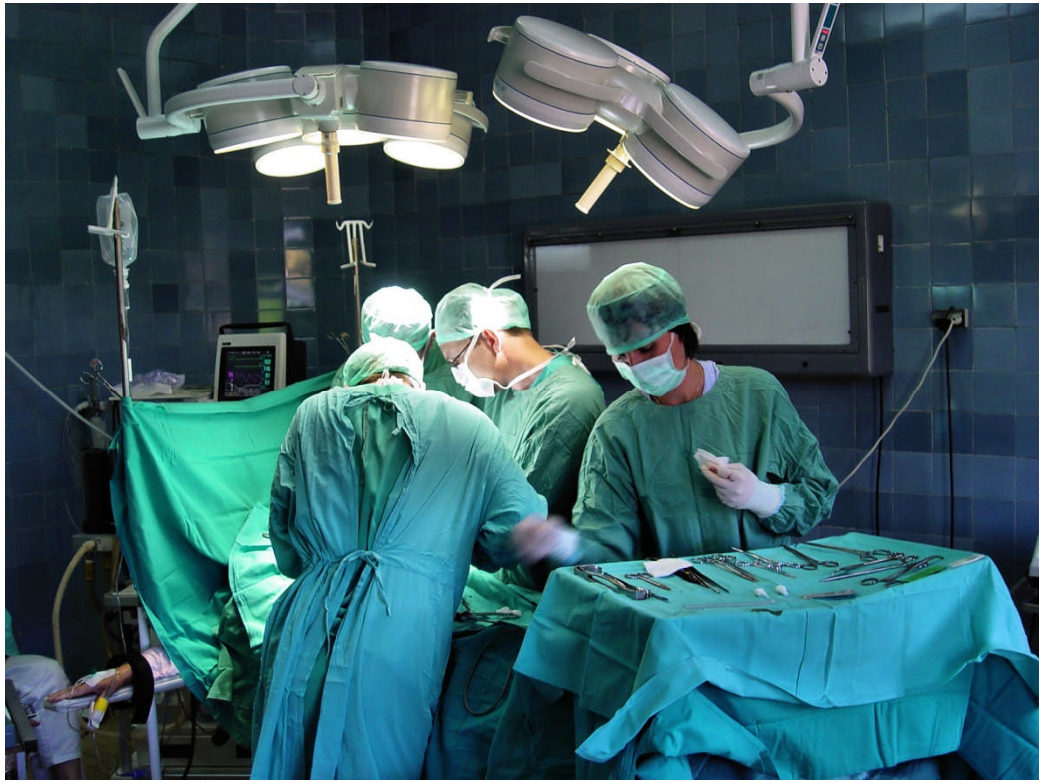
KCE REPORT 200

Federaal Kenniscentrum voor de Gezondheidszorg
Centre Fédéral d'Expertise des Soins de Santé
Belgian Health Care Knowledge Centre

QUALITY INDICATORS FOR THE MANAGEMENT OF UPPER GASTROINTESTINAL CANCER



KCE REPORT 200
GOOD CLINICAL PRACTICE

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QUALITY INDICATORS FOR THE MANAGEMENT OF UPPER GASTROINTESTINAL CANCER

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2013 www.kce.fgov.be

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Conflict of interest:	All consulted external experts are working in a hospital where patients with esophageal and gastric cancer are treated A grant, fees or funds for a member of staff or another form of compensation for the execution of research: Johan De Mey (research projects MRI, CT-scan (GE, Philips)). Payments to speak, training remuneration, subsidised travel or payment for participation at a conference: Yves Van Molhem (workshops life surgery + lectures at the request of J&J) Any other direct or indirect relationship with a producer, distributor or healthcare institution that could be interpreted as a conflict of interests: Jean-Marie Collard (chairman of the section surgery of the upper gastrointestinal tract of the Société Royale Belge de Chirurgie)
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Publication date:	29 april 2013 (2nd print ; 1st print : 16 april 2013)
Domain:	Good Clinical Practice (GCP)
MeSH:	Esophageal Neoplasms ; Stomach Neoplasms ; Quality of Health Care ; Quality Indicators, Health Care ; Quality Assurance, Health Care ; Physician's Practice Patterns
NLM Classification:	WI 149
Language:	English
Format:	Adobe® PDF™ (A4)
Legal depot:	D/2013/10.273/15

How to refer to this document? Vlayen J, De Gendt C, Stordeur S, Schillemans V, Camberlin C, Vrijens F, Van Eycken E, Lerut T. Quality indicators for the management of upper gastrointestinal cancer. Good Clinical Practice (GCP) Brussels: Belgian Health Care Knowledge Centre (KCE). 2013. KCE Reports 200. D/2013/10.273/15.

This document is available on the website of the Belgian Health Care Knowledge Centre.

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LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
95%CI	95% confidence interval
95%LL	95% lower limit
95%UL	95% upper limit
AC	Adenocarcinoma
AHRQ	Agency for Healthcare Research and Quality
BCR	Belgian Cancer Registry
combStage	Combined stage
CPG	Clinical practice guideline
CRT	Chemoradiotherapy
cStage	Clinical stage
CT	Computed tomography
DICA	Dutch Institute for Clinical Auditing
EMR	Endoscopic mucosal resection
ESD	Endoscopic submucosal dissection
EUS	Endoscopic ultrasonography
FNAC	Fine needle aspiration cytology
GC	Gastric cancer
GOJ	Gastro-oesophageal junction
GRADE	Grades of Recommendation Assessment, Development and Evaluation
HR	Hazard Ratio
ICD	International Classification of Diseases
IKNL	Integraal Kankercentrum Nederland
IMA	InterMutualistic Agency
KCE	Belgian Health Care Knowledge Centre

MDT	Multidisciplinary Team
MRI	Magnetic Resonance Imaging
NACRT	Neoadjuvant chemoradiotherapy
NACT	Neoadjuvant chemotherapy
OC	Oesophageal cancer
OR	Odds ratio
PET	Positron Emission Tomography
pStage	Pathological stage
QI	Quality indicator(s)
RER	Relative Excess Risks
SCC	Squamous Cell Carcinoma
TNM	Tumour – Node – Metastasis

SCIENTIFIC REPORT

1. INTRODUCTION

Previously, the KCE recommended to set up an integrative quality system in oncology, covering the development and implementation of clinical practice guidelines, the monitoring of the quality of care with quality indicators, feedback to health care providers and organisations and targeted actions to improve the quality if needed [1]. Quality indicator sets were already developed for rectal cancer [2, 3], breast cancer [4] and testicular cancer [5]. Building on these experiences, it was decided to set up a quality project for upper gastrointestinal cancer (comprising both oesophageal and gastric cancer) for the following reasons:

- **Upper gastrointestinal cancer has an important burden.**

  In Belgium, 680 men and 242 women were diagnosed with oesophageal cancer (ICD-10 15.0-15.9) in 2010, compared with 854 men and 547 women for gastric cancer (ICD-10 16.0-16.9) (www.kankerregister.org). Both cancer types are responsible for a substantial number of cancer deaths [6]. In 2008, 3.4% and 3.2% of all cancer deaths in men and 1.4% and 2.6% in women were caused by oesophageal cancer and gastric cancer, respectively. According to the most recent data (2004-2008) from the Belgian Cancer Registry, the global relative 5-year survival for oesophageal cancer was 21.7% and 21.6% for men and women, respectively, and for gastric cancer 28.4% and 31.4% for men and women, respectively.

- **The care for oesophageal and gastric cancer requires high specialisation, but is very dispersed in Belgium.**

  In 2008, the first national guidelines for the treatment of upper gastrointestinal cancer were developed by the College of Oncology in collaboration with the KCE [7]. These guidelines were updated in 2012 [8]. These guidelines highlight the clinical challenges when dealing with a patient with upper gastrointestinal cancer.

  In both versions, centralisation of care was recommended based on the available scientific literature. We found that in the period 2004-2008, 111 and 114 out of 115 acute Belgian hospitals delivered a medico-surgical treatment for patients with oesophageal and gastric cancer, respectively.

The primary objectives of this report were to develop a set of quality indicators for upper gastrointestinal cancer and to evaluate their measurability with the available cancer registry and administrative data. A secondary objective was to calculate these quality indicators in order to evaluate the quality of care on a national and hospital-level using Belgian data covering a period of 5 years. An additional objective is to use risk-adjustment in the calculation of outcome indicators on a hospital level. The ultimate goal of this project is to improve the quality of care of upper gastrointestinal cancer.

2. SELECTION PROCESS OF QUALITY INDICATORS

2.1. Methodology

2.1.1. Literature search

Both OVID Medline (see Appendix 1 for search strategy) and the grey literature were searched to identify published and validated quality indicators for upper gastrointestinal cancer. The following sources were considered to identify grey literature:

- Agency for Healthcare Research and Quality: http://www.ahrq.gov/
- Joint Commission: http://www.jointcommission.org/
- Clinical Indicators Support Team: http://www.indicators.scot.nhs.uk/
- National Health Service: http://www.nhs.uk/

Furthermore, the CPGs identified during the development of the upper gastrointestinal cancer guideline [8] were evaluated for included quality indicators. The main searches were conducted in February 2012.

2.1.2. Addition of guideline-based quality indicators

The list of quality indicators resulting from the literature search was complemented by quality indicators derived from the recommendations of the KCE upper gastro-intestinal cancer guideline [8]. To this end, most individual recommendations were translated in at least one quality indicator. Quality indicators were only searched for ‘strong’ recommendations according to the GRADE scoring system (Table1).

Table 1 – Strength of recommendations according to the GRADE system [9]

Grade	Definition
Strong	The desirable effects of an intervention clearly outweigh the undesirable effects (the intervention is to be put into practice), or the undesirable effects of an intervention clearly outweigh the desirable effects (the intervention is not to be put into practice)
Weak	The desirable effects of an intervention probably outweigh the undesirable effects (the intervention probably is to be put into practice), or the undesirable effects of an intervention probably outweigh the desirable effects (the intervention probably is not to be put into practice)

2.1.3. Selection process and results

The long list of indicators resulting from the literature search and identification in the guidelines was subject to a formal assessment in April 2012. These indicators were first evaluated on their relevance (the extent to which important health conditions accounting for a major share of the burden of disease, the cost of care, or policymakers' priorities are reflected). A panel of 14 experts used a scale from 1 (strongly disagree) to 5 (strongly agree) to score the relevance of each quality indicator. One vote was given for each clinical expert (N=9), one vote for the representatives of the Belgian Cancer Registry (N=1) and one vote for the KCE experts (N=1). For each indicator, the scores were summarized in a mean score, median score, minimum score, maximum score and the percentage of '4' and '5' scores. Quality indicators were retained when the percentage of '4' and '5' scores was superior or equal to 60%.

The retained quality indicators were then evaluated by a smaller working panel with representatives of each group (clinical experts, Belgian Cancer Registry and KCE), on the basis of 3 other criteria:

- Reliability: the extent to which the measure provides stable results across various populations and circumstances;
- Interpretability: the extent to which clear conclusions are possible;
- Actionability: the extent to which action can be taken by individuals, organised groups and public and private agencies to meaningfully address this issue.

The aim of this exercise was to strongly reduce the list of potential indicators to a final short list that could be proposed to the Belgian Cancer Registry for measurement.

2.2. Results

The Medline search yielded 130 original references. From these 130 papers, 114 were not selected since their focus was out-of-scope (quality indicators for other pathology than upper gastro-intestinal cancer, other scope than quality indicators). Sixteen relevant articles were retrieved (8 for gastric cancer [10-17] and 8 for oesophageal cancer [18-25]) that were evaluated based on their full text. Globally, 28 quality indicators were retrieved from these published sources. The search in the grey literature identified 2 additional indicators proposed by AHRQ.

Based on the upper gastrointestinal cancer guideline, 54 additional quality indicators were proposed resulting in a long list of 84 indicators covering most aspects of the care for patients with an oesophageal (55 quality indicators) and/or a gastric cancer (29 quality indicators) (Appendix 2). The first evaluation step reduced this list to 33 quality indicators (19 QI for oesophageal cancer and 14 QI for gastric cancer).

After the second assessment step, a final list of 29 quality indicators included 15 quality indicators for oesophageal cancer (Table 2) and 14 quality indicators for gastric cancer (Table 3). The final lists for both cancer types were very similar. The list for oesophageal cancer contained one extra indicator on surgery (OC7), while the indicator on primary chemoradiotherapy (OC10) was replaced by an indicator on palliative chemotherapy for gastric cancer (GC9).

According to Donabedian's classification, quality indicators were categorized in process (what is actually done in giving and receiving care), outcome (states of health or events that follow care, and that may be affected by health care) and structure (characteristics of providers and the health care system that affect the system's ability to meet the health care needs of individual patients or a community) indicators [26]. The large majority of the selected indicators were process and outcome indicators, whereas no indicator was selected to measure the structure.

The following quality dimensions were covered: effectiveness, appropriateness, continuity, safety, timeliness and patient-centeredness. No indicator addressed efficiency or equity.

Table 2 – Final selection of quality indicators for oesophageal cancer

	Staging	Type of indicator
OC1	Proportion of patients diagnosed with oesophageal cancer discussed at the multidisciplinary team meeting (MDT)	Process
OC2	Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen	Process
	Treatment of mucosal cancer	
OC3	Proportion of patients diagnosed with cT1a oesophageal cancer undergoing endoscopic mucosal resection (EMR) who had an *en bloc* resection	Outcome
	Neoadjuvant treatment	
OC4	Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{Any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention	Process
	Surgery	
OC5	Proportion of surgically treated patients who had a R0 resection	Process
OC6	Oesophageal resection mortality rate within 30 days	Outcome
OC7	Proportion of patients with oesophageal cancer or cancer of the gastro-oesophageal junction (GOJ) who were treated by a radical transthoracic oesophagectomy and two-field lymphadenectomy of abdominal and thoracic lymph nodes	Process
OC8	Mean number of resected/evaluated lymph nodes during oesophagectomy	Outcome
OC9	Proportion of patients who experienced an anastomotic leakage after their oesophagectomy	Outcome
	Primary chemoradiotherapy	
OC10	Proportion of patients with any stage of oesophageal cancer treated with primary chemoradiotherapy	Process
	Metastatic disease	
OC11	Proportion of patients with metastatic oesophageal cancer who received palliative support	Process
	Recurrent disease	
OC12	Proportion of patients diagnosed with recurrent oesophageal cancer discussed at the MDT meeting before any treatment	Process
	Generic indicators	
OC13	Five-year relative survival rates by stage	Outcome
OC14	Five-year overall survival rates	Outcome
OC15	Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals in a given year	Process

Table 3 – Final selection of quality indicators for gastric cancer

	Staging	Type of indicator
GC1	Proportion of patients diagnosed with gastric cancer discussed at the MDT	Process
GC2	Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen	Process
	Treatment of mucosal cancer	
GC3	Proportion of patients diagnosed with cT1a gastric cancer undergoing EMR/endoscopic submucosal dissection (ESD) who had an *en bloc* resection	Outcome
	Neoadjuvant treatment	
GC4	Proportion of patients with a gastric cancer beyond the mucosa ($T_{2\text{-}4}$ N_{Any} M_0) who received neoadjuvant treatment before their surgical intervention	Process
	Surgery	
GC5	Proportion of surgically treated patients who had a R0 resection	Process
GC6	Gastric resection mortality rate within 30 days	Outcome
GC7	Mean number of resected/evaluated lymph nodes during gastrectomy	Outcome
GC8	Proportion of patients who experienced an anastomotic leakage after their gastrectomy	Outcome
	Metastatic disease	
GC9	Proportion of patients with metastatic gastric cancer who received combination chemotherapy	Process
GC10	Proportion of patients with metastatic gastric cancer who received palliative support	Process
	Recurrent disease	
GC11	Proportion of patients diagnosed with recurrent gastric cancer discussed at the MDT meeting before any treatment	Process
	Generic indicators	
GC12	Five-year relative survival rates by stage	Outcome
GC13	Five-year overall survival rates	Outcome
GC14	Proportion of patients with gastric cancer surgically treated in high-volume hospitals in a given year	Process

3. METHODOLOGY FOR PILOT TEST

3.1. Data selection and linkage

For the calculation of the selected quality indicators for oesophageal and gastric cancer care, cancer registry data in combination with health insurance data were used.

3.1.1. Primary selection

From the Belgian Cancer Registry (BCR) database the following records were selected:

- All invasive oesophageal and gastric cancers that were diagnosed between January 1, 2004 and December 31, 2008 for patients living in Belgium at time of diagnosis. To be included, patients needed to be registered in the BCR database with their unique National Number (NISS/INSZ). The following ICD-10 codes were used:
  - Oesophageal cancer, including gastro-oesophageal junction (GOJ): ICD-10 = C15.0-C16.0
  - Gastric cancer: ICD-10 = C16.1-C16.9

  This resulted in the selection of 11 210 cancers from 11 201 unique patients.
- For each selected patient, records related to other invasive tumours (excluding non-melanoma of the skin) were added.

Fifteen percent (N=1 657) of the selected patients were diagnosed with multiple tumours. For these patients, 1 796 records from other invasive tumours were added to the database.

3.1.2. Linkage of cancer registry data with health insurance data

Since 2009, the Belgian Cancer Registry is authorised [a] to link data from the BCR database with data on cancer-related diagnostic and therapeutic procedures and pharmaceuticals, which are obtained from all seven Belgian health insurance companies via the Intermutualistic Agency (IMA/AIM). Via this linkage procedure, the Cancer Registry receives for each registered patient, health insurance data starting from January 1 of the year preceding the incidence year, until December 31 of the third year after the incidence year (further mentioned as IMA data). At the start of this study, IMA data until 2009 were available to the Cancer Registry. Because at least one year of follow-up could be guaranteed for each individual patient, it was decided that the available IMA data were sufficient to calculate the selected process indicators.

Figure 1 shows the data transfer procedure as authorised by the privacy commission [b].

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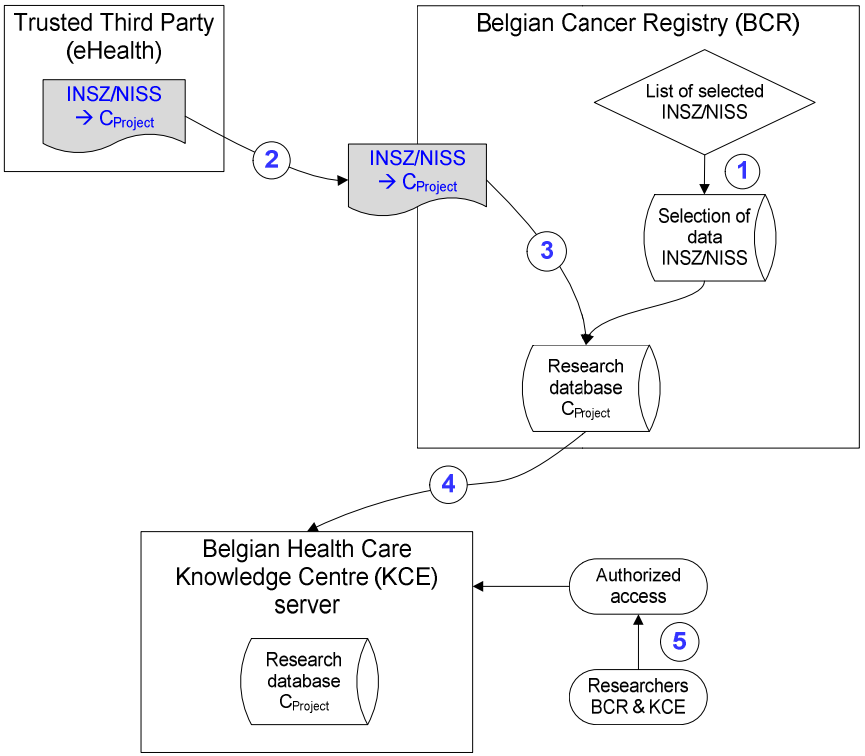
[a] Beraadslaging nr 09/071 van 15 september 2009 met betrekking tot de mededeling van persoonsgegevens door de verzekeringsinstellingen aan de Stichting Kankerregister in het kader van artikel 45 quinquies van het KB nr. 78 van 10 november 1967 betreffende de uitoefening van de gezondheidsberoepen / Délibération n°09/071 du 15 septembre 2009 relative à la communication de données à caractère personnel par les organismes assureurs à la Fondation Registre du Cancer dans le cadre de l'article 45quinquies de l'AR n° 78 du 10 novembre 1967 relatif è l'exercice des professions des soins de santé.

[b] Beraadslaging nr 11/065 van 20 september 2011 betreffende de mededeling van gecodeerde persoonsgegevens door de Stichting Kankerregister aan het Federaal Kenniscentrum voor de Gezondheidszorg voor het verrichten van de studie "Zorgkwaliteit voor slokdarm- en maagkanker" (KCE 2009-02-GCP) / Délibération n°11/065 du 20 septembre 2011 relative à la communication de données à caractère personnel codées de la Fondation Registre du Cancer au Centre Fédéral d'Expertise des soins de santé en vue de la réalisation de l'étude "Qualité des soins pour le cancer de l'oesophage er de l'estomac" (KCE 2009-02-GCP).

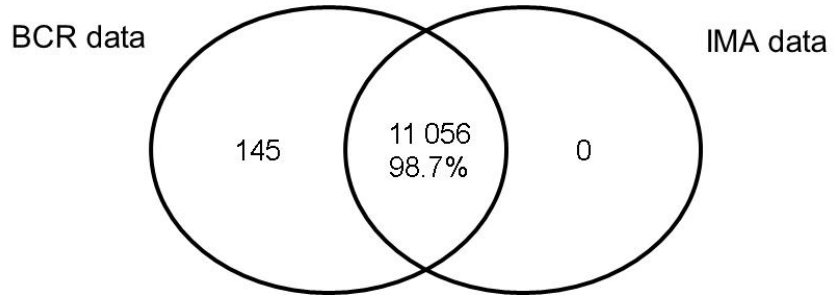
Figure 1 – Data transfer procedure



1.The BCR selected the National Numbers (INSZ/NISS) and corresponding tumour records of oesophageal and gastric cancer patients. The list of selected INSZ/NISS was send to the Trusted Third Party.
2.The Trusted Third Party made a conversion list INSZ/NISS versus coded patient ID (Cproject) and sent it to the BCR.
3.An authorised data manager of the BCR linked the research data to the Cproject
4.The research database (with Cproject) was placed on the dataserver of the KCE.
5.A secured access to the research database was provided to BCR and KCE researchers.

From the originally selected 11 201 patients, 11 056 (98.7%) could be linked to the IMA database (Figure 2). Patients for whom no information was available in the IMA database were probably not affiliated to one of the Belgian health insurance companies or had an invalid National Number (NISS/INSZ).

Figure 2 – Linkage between BCR data and IMA data: number of unique patients



3.1.3. Vital status

The vital status was retrieved from the Kruispuntbank van de Sociale Zekerheid / Banque Carrefour de la Sécurité Sociale based on the patients' unique social security number (NISS/INSZ). Using this active follow-up method, patients were followed up until January 1st 2010.

3.1.4. Data preparation

From the 11 210 oesophageal and gastric tumour records that were originally selected from the BCR database, 550 tumours were excluded from further analysis:

- 145 records were excluded because there was no information on these patients available in the health insurance database (Figure).
- 23 records were excluded because they concerned patients with more than one oesophageal and/or gastric tumour diagnosed until 2008. This exclusion was necessary because these diagnoses could not unambiguously be linked to administrative health insurance data.

- 23 records were excluded because the incidence date and the date of death were the same. Such cases would hinder the calculation of the process indicators and may induce a bias.
- 3 records were excluded because the patients were lost to follow up since the day of diagnosis.
- 347 records were excluded because of the histological type (e.g. sarcoma and small-cell tumours). These tumours are managed differently than recommended in the clinical practice guidelines [8].
- 9 records were finally because the primary tumour localisation was questionable and might be wrongfully included at the start.

This resulted in a final selection of 10 660 tumour records (one per individual patient) of which 5 813 concerned oesophageal cancer (including gastro-oesophageal junction) and 4 847 gastric cancer.

Information on the occurrence of multiple tumours was then added to the remaining selection of oesophageal and gastric cancers. Specific information was provided about the number and localisation of synchronous tumours (i.e. incidence date of the multiple tumours within three months of the incidence date of the oesophageal/gastric tumour), pre-tumours (i.e. incidence date of the multiple tumours more than three months before the incidence date of the oesophageal/gastric tumour) and metachronous tumours (i.e. incidence date of the multiple tumours more than three months after the incidence date of the oesophageal/gastric tumour).

3.2. Assigning a patient to one centre

Patients in general, and for this study more specifically patients with oesophageal/gastric cancer, often visit multiple centres during their care pathway. Because an important aim of this study was to describe the variability in results for quality indicators by centre, it was necessary to construct an algorithm to assign each individual patient with oesophageal/gastric cancer to one centre, namely the centre with the highest impact on the quality of care for that specific patient. The methodology is further detailed in Appendix 3.

3.3. Methods of analysis

For each selected quality indicator, a technical fiche was constructed detailing the rationale behind the indicator and its definition (type of indicator, description, numerator and denominator). Each indicator was translated in an algorithm including all in- and exclusion steps. For each variable, relevant nomenclature codes were searched if available (see Appendix 8). Furthermore, the need for subgroup analyses, risk adjustment and sensitivity analyses was evaluated. More details on the methods of analysis can be found in Appendix 4.

3.4. Validation by six hospitals

Because it remains impossible to unambiguously link diagnoses to health insurance data, a subproject was initiated to validate the indicator results. The main research question of the validation project was: "*Do quality indicator results differ when they are calculated using cancer registry data linked to health insurance data compared to when they are calculated using data that are available at the hospital (e.g. medical file, financial data,…), and can the possible difference in results be considered as acceptable?*". During a first phase of the validation, it was tested whether it is possible (based on BCR and IMA data) to identify for each hospital a complete list of patients diagnosed with a specific cancer. Both completeness and validity of the BCR and IMA data, as well as the algorithm to assign patients to a centre (chapter 3.2) itself were evaluated during this phase. In the second phase, which was only started when the involved hospitals had finished the first phase, it was evaluated whether quality of care indicators can correctly be calculated using BCR and IMA data. A detailed manual to help hospitals perform this task was developed for each phase.

Six hospitals were asked to participate in the validation of indicator results for oesophageal cancer. It was supposed that the results of a validation for oesophageal cancer would be similar for gastric cancer. Selection of the hospitals was based on the distribution of university versus non-university hospitals, low-medium-high volume hospitals and geographical location. To have a comparable workload, a subselection of patients was made (based on incidence years) for the higher volume hospitals. A small fee was provided to the participating hospitals: CH de l'Ardenne, CHU Liège,

Institut Jules Bordet, OLV Aalst, Sint-Augustinus Antwerpen and UZ Leuven.

More details on the methods and results of this validation phase can be found in Appendix 5.

4. DESCRIPTIVE STATISTICS

4.1. Oesophageal cancer

4.1.1. Patient and tumour characteristics

From 2004 until 2008, 5 963 patients with cancer of the oesophagus (ICD-10: C15.0) or gastro-oesophageal junction (ICD-10: C16.0) were selected from the BCR database.

From this selection, 150 patients were excluded, resulting in 5 813 patients (4 397 men and 1 416 women) for analysis. The reasons for exclusion were: (1) patients were not found in the health insurance database (N=60), (2) patients had more than 1 oesophageal or gastric tumour (N=18), which might cause confusion about diagnostic or therapeutic procedures in the health insurance data, (3) patients who died at the incidence date (N=10), and (4) sarcoma (N=31), small-cell tumours (N=26) and other non-stageable oesophageal tumours (N=5) because of differences in the management of these tumours.

4.1.1.1. Demographic information

Oesophageal cancer (C15.0-C16.0) was most frequently diagnosed in men and women from 70 to 79 years old (Figure 3). The mean age at diagnosis was 65 years for men (range 23-99 years) and 70 years for women (range 36-101 years).

In all age groups, oesophageal cancer was more frequently diagnosed in men than in women (Figure 3). The difference between both sexes remained stable throughout the entire study period (2004-2008) (Figure 4).

Figure 3 – Oesophageal cancer (C15.0-C16.0): distribution of sex, by age

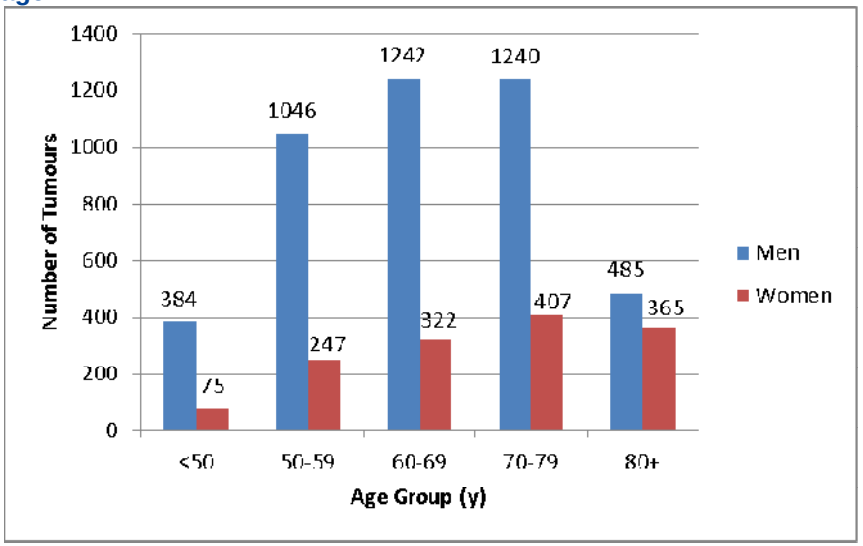
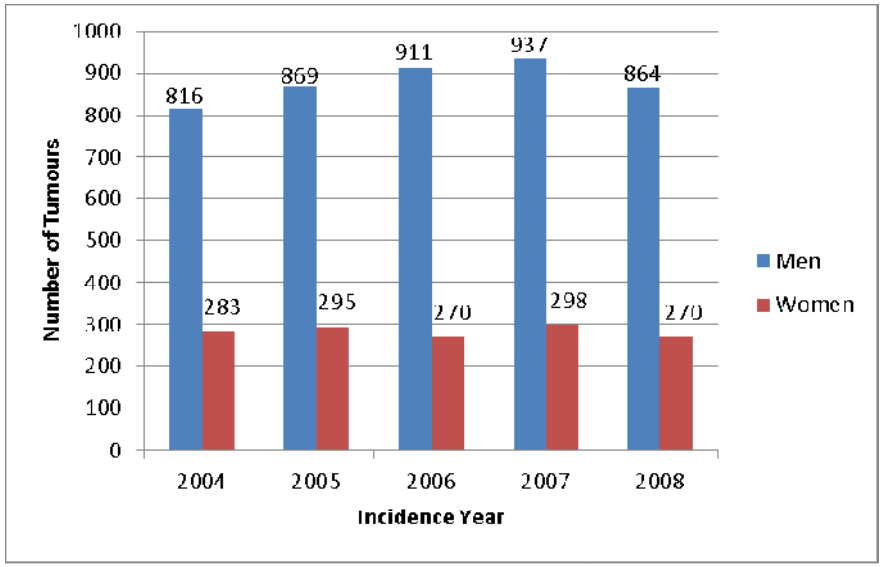


Figure 4 – Oesophageal cancer (C15.0-C16.0): distribution of sex, by incidence year



4.1.1.2. Tumour characteristics

Localization

Most of the specified oesophageal tumours were located in the gastro-oesophageal junction (C16.0; 25.0%) and in the lower third of the oesophagus (C15.5; 20.3%) (Table 4). For a substantial proportion of the tumours (41.1%) the sublocalization was not specified.

Table 4 – Oesophageal cancer (C15.0-C16.0): distribution of localization

ICD-10	Localization	N	%
C15.0	Cervical part of oesophagus	49	0.8
C15.1	Thoracic part of oesophagus	30	0.5
C15.2	Abdominal part of oesophagus	12	0.2
C15.3	Upper third of oesophagus	245	4.2
C15.4	Middle third of oesophagus	446	7.7
C15.5	Lower third of oesophagus	1 179	20.3
C15.8	Overlapping lesion of oesophagus	10	0.2
C15.9	Oesophagus, unspecified	2 390	41.1
C16.0	Gastro-oesophageal junction	1 452	25.0
C15.0-C16.0	**Total**	**5 813**	**100.0**

Morphology

The selection included carcinoma (99.2%) and “unspecified malignant neoplasms” (0.8%). In the group of carcinoma, the adenocarcinoma (56.2%) and squamous cell carcinoma (39.7%) were most frequently diagnosed (Table 5).

Adenocarcinoma were most frequently found in the gastro-oesophageal junction (C16.0) or in the abdominal part/lower third of the oesophagus (C15.2+C15.5). For the other parts of the oesophagus, squamous cell carcinoma was the most frequent type of morphology (Table 5).

Table 5 – Oesophageal cancer (C15.0-C16.0): distribution of morphology, by localization

			Histological Group											
			Carcinoma		*Squamous cell carcinoma*		*Adenocarcinoma*		*Other specified carcinoma*		*Unspecified carcinoma*		Unspecified malignant neoplasm	
ICD-10	Localization	Total N	N	%	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	N	%
C150 + C153	Cervical part / Upper third	294	289	98.3	*255*	*86.7*	*29*	*9.9*	*3*	*1.0*	*2*	*0.7*	5	1.7
C151 + C154	Thoracic part / Middle third	476	474	99.6	*414*	*87.0*	*54*	*11.3*	*4*	*0.8*	*2*	*0.4*	2	0.4
C152 + C155	Abdominal part / Lower third	1 191	1 180	99.1	*351*	*29.5*	*791*	*66.4*	*23*	*1.9*	*15*	*1.3*	11	0.9
C158	Overlapping lesion of oesophagus	10	9	90.0	*6*	*60.0*	*3*	*30.0*	*0*	*0.0*	*0*	*0.0*	1	9.1
C159	Oesophagus, unspecified	2 390	2 369	99.1	*1 262*	*52.8*	*1 017*	*42.6*	*34*	*1.4*	*56*	*2.3*	21	0.9
C160	Gastro-oesophageal junction	1 452	1 445	99.5	*21*	*1.4*	*1 374*	*94.6*	*41*	*2.8*	*9*	*0.6*	7	0.5
Total		**5 813**	**5 766**	**99.2**	***2 309***	***39.7***	***3 268***	***56.2***	***105***	***1.8***	***84***	***1.4***	**47**	**0.8**

TNM stage

For a substantial number of patients, the TNM classification was not reported to the BCR (see also Appendix 6.9.4 and Appendix 7). Clinical stage (cStage) was unknown for 2 388 patients (41.1%) (Table 6), while the pathological stage (pStage) was not available for 3 882 patients (66.8%) (Table 6). In the majority of patients with an unknown cStage or pStage, the T-stage, N-stage and M-stage were unknown (Appendix 7). Most patients with a reported cStage had cStage IV (34.5%) or cStage III (29.0%) (Table 6). Most patients who underwent surgery and with a reported pStage had pStage II (34.7%) or pStage I (28.9%) (Table 6).

Because the cStage and/or pStage is lacking for many patients, a combined stage (combStage) is calculated for each patient. To determine this combined stage, known pStage prevails over known cStage, except when there is clinical proof of distant metastasis. When only pStage or cStage is known, this is considered as the combined stage. Otherwise, when pStage and cStage are unknown, the combined stage also remains unknown. For oesophageal cancer the combined stage (combStage) was unknown for 1 679 (28.9%) patients. Between 2004 and 2008, the evolution of unknown combStage was almost stable (27.4-30.6%) (Figure 5). Most patients with a known combStage are diagnosed with combStage IV (32.3%) or combStage III (26.7%) (Table 6).

For all known cStages and pStages for oesophageal cancer (C15), a good correspondence was found (Table 7). A similar relationship was found for cancer of the gastro-oesophageal junction (C16.0) (Table 8). In some cases, a higher pStage than cStage was reported based on additional information that became available during surgery. In cases where the pStage is lower than the cStage, it is possible that neoadjuvant treatment succeeded in downstaging the initial tumour.

Of all known clinical stages, stage IV occurred most frequently for almost all age groups. Only for the age group 80+, cStage II occurred more frequently. In all age groups the proportion of the lowest pathological stages (I and II) was higher than for the clinical stage, because smaller tumours are more eligible for surgical intervention (Figure 6 and Figure 7). Patients in the oldest age group more often had an unknown cStage (56.0%), and since they are less often surgically treated, the proportion of unknown combined stage also was high (48.6%). For most age groups, combined stage IV occurred more frequently than the other stages. Only in the oldest age group (i.e. 80+), combined stage II occurred more frequently (Figure 8). Both in men and women, cStage IV was the most frequent cStage, followed by cStage III and II (Figure 9). Both in men and women, pStage I and II were the most frequent pStages (Figure 10). The proportion of unknown pStage was higher in women. In men, combined stage IV (33.8%) occurred more frequently, while in women, stage III (28.0%) and II (27.7%) occurred more frequently, followed by stage IV (27.1%) (Figure 11).

Table 6 – Oesophageal cancer (C15.0-C16.0): distribution of stage

	cStage			pStage			combStage		
	N	% of total	% of known	N	% of total	% of known	N	% of total	% of known
Known stages	3 425	58.9	100.0	1 525	77.1	100.0	4 134	71.1	100.0
In situ	7	0.1	0.2	-	-	-	-	-	-
I	401	6.9	11.7	441	22.3	28.9	688	11.8	16.6
II	843	14.5	24.6	529	26.8	34.7	1 008	17.3	24.4
III	993	17.1	29.0	420	21.2	27.5	1 104	19.0	26.7
IV	1 181	20.3	34.5	135	6.8	8.9	1 334	22.9	32.3
Unknown stage	2 388	41.1	NA	452	22.9	NA	1 679	28.9	NA

Figure 5 – Oesophageal cancer (C15.0-C16.0): proportion of tumours with unknown combined stage

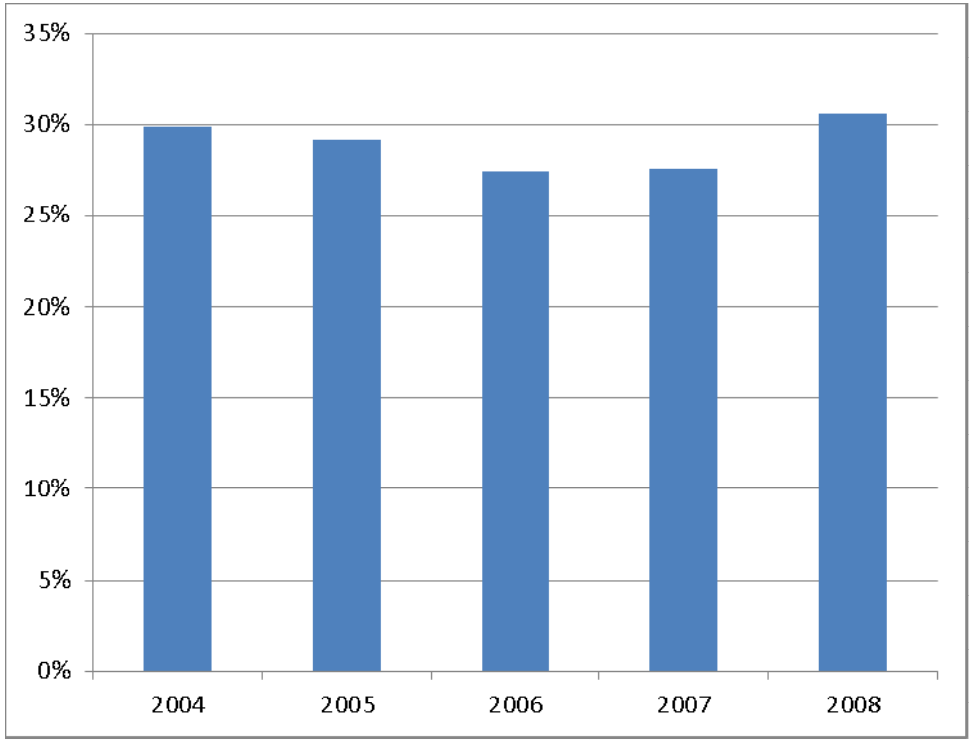


Table 7 – Oesophageal cancer (C15.0-C15.9): distribution of pathological stage (pStage) by clinical stage (cStage)

cStage	Total N	pStage									
		I		II		III		IV		X	
		N	%	N	%	N	%	N	%	N	%
In situ	7	5	71.4	0	0.0	0	0.0	0	0.0	2	28.6
I	243	124	51.0	22	9.1	2	0.8	4	1.6	91	37.4
II	709	69	9.7	151	21.3	63	8.9	15	2.1	411	58.0
III	777	8	1.0	86	11.1	113	14.5	18	2.3	552	71.0
IV	855	7	0.8	23	2.7	16	1.9	76	8.9	733	85.7
X	1 770	142	8.0	138	7.8	100	5.6	39	2.2	1 351	76.3
Total	**4 361**	**355**	**8.1**	**420**	**9.6**	**294**	**6.7**	**152**	**3.5**	**3 140**	**72.0**

Table 8 – Oesophageal cancer (C16.0): distribution of pathological stage (pStage) by clinical stage (cStage)

		pStage									
		I		II		III		IV		X	
cStage	Total N	N	%	N	%	N	%	N	%	N	%
I	158	75	47.5	17	10.8	18	11.4	6	3.8	42	26.6
II	134	16	11.9	42	31.3	37	27.6	12	9.0	27	20.1
III	216	18	8.3	40	18.5	46	21.3	23	10.6	89	41.2
IV	326	1	0.3	11	3.4	13	4.0	43	13.2	258	79.1
X	618	98	15.9	70	11.3	83	13.4	41	6.6	326	52.8
Total	**1 452**	**208**	**14.3**	**180**	**12.4**	**197**	**13.6**	**125**	**8.6**	**742**	**51.1**

Figure 6 – Oesophageal cancer (C15.0-C16.0): distribution of clinical stage (cStage), by age group

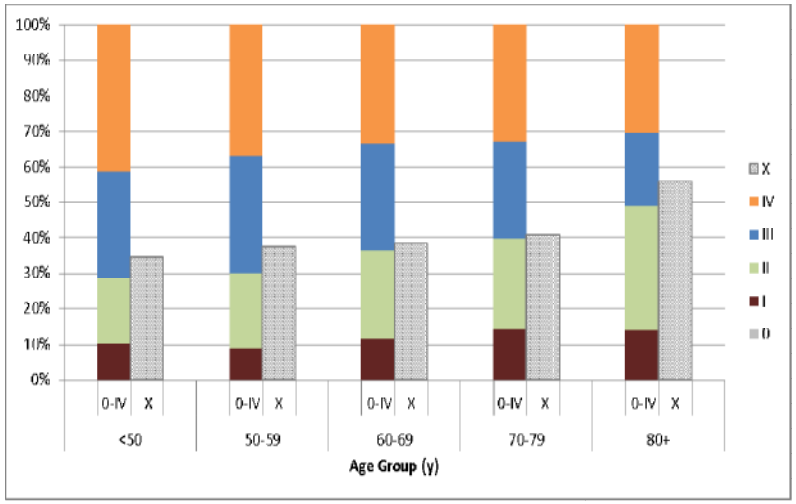


Figure 7 – Oesophageal cancer (C15.0-C16.0): distribution of pathological stage (pStage), by age group

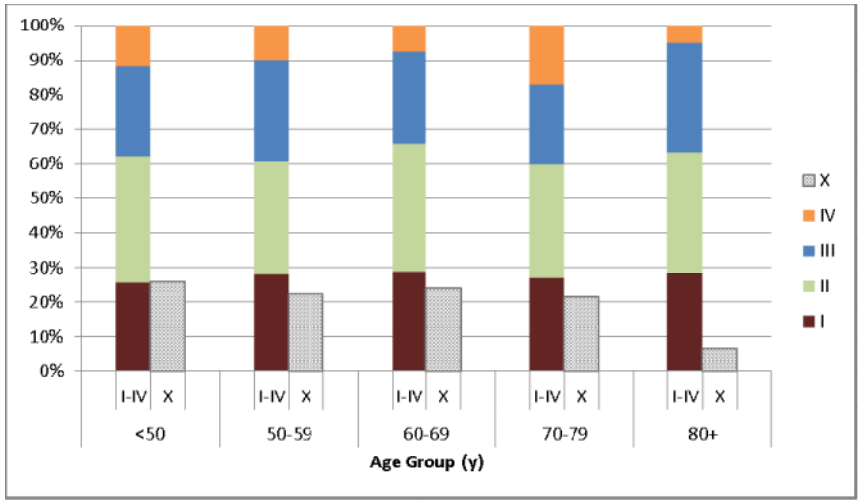


Figure 8 – Oesophageal cancer (C15.0-C16.0): distribution of combined stage (combStage), by age group

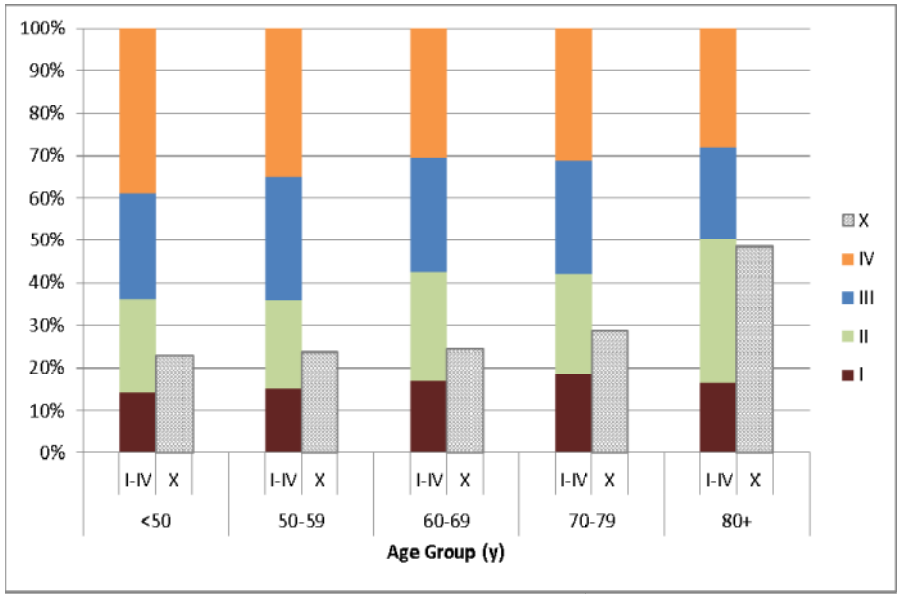


Figure 9 – Oesophageal cancer (C15.0-C16.0): distribution of clinical stage (cStage), by sex

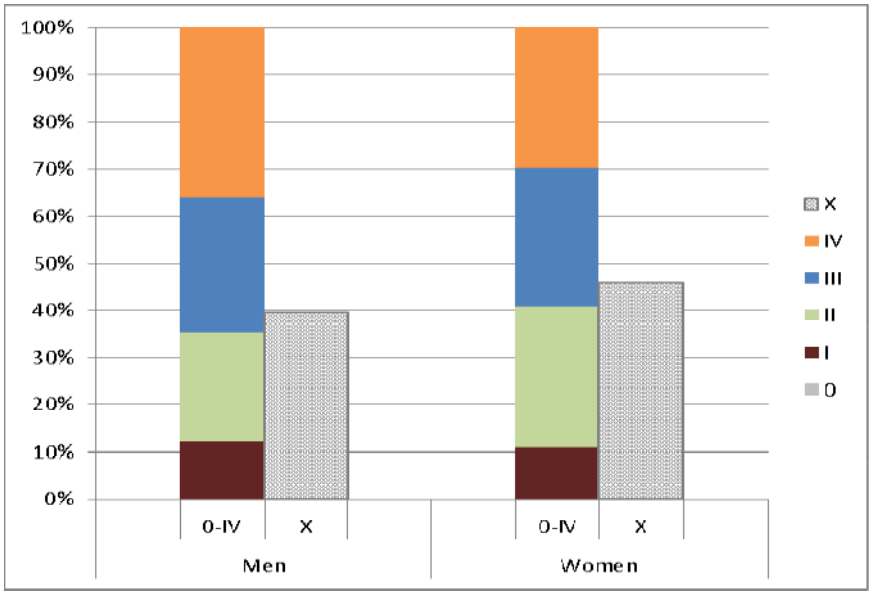


Figure 10 – Oesophageal cancer (C15.0-C16.0): distribution of pathological stage (pStage), by sex

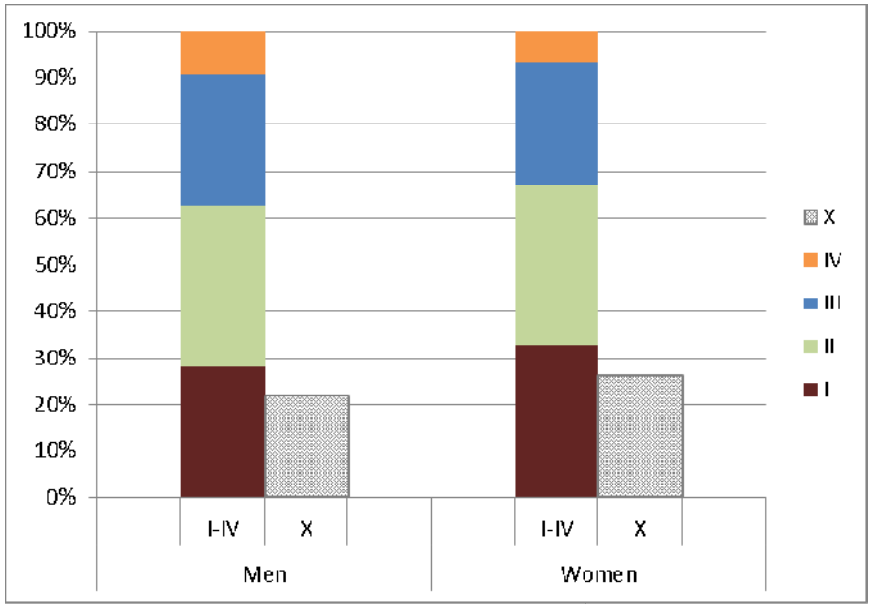
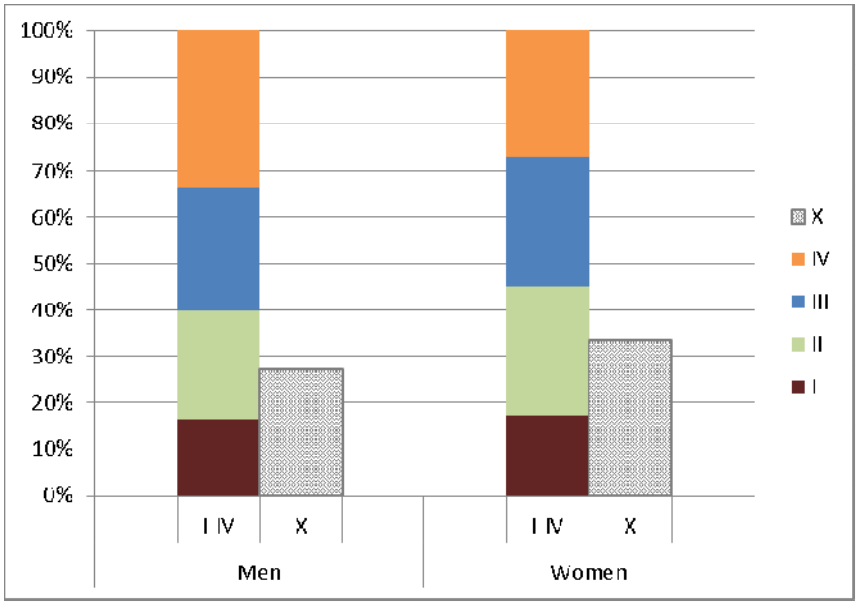


Figure 11 – Oesophageal cancer (C15.0-C16.0): distribution of combined stage (combStage), by sex



Multiple tumours

For 254 patients (4.4%), a synchronous tumour (i.e. incidence date of the second tumour within three months of the incidence date of the first tumour) was diagnosed. For 610 patients (10.5%), a pre-tumour (i.e. incidence date of the first tumour more than three months before the incidence date of the second tumour) was found. For 109 patients (1.9%), a metachronous tumour (i.e. incidence date of the second tumour more than three months after the incidence date of the first tumour) was found.

4.1.2. Diagnosis and staging

An overview of the most important techniques used in the diagnostic work-up of oesophageal cancer (C15.0-C16.0), within 3 months before and after the incidence date, is reported in Table 9.

Almost all patients had a biopsy (97.8%). Cytology (of primary tumour and/or lymph nodes) was more frequently done in patients with cancer of the oesophagus (30.6%) than in patients with cancer of the gastro-oesophageal junction (24.7%).

Most of the patients had a CT (93.4%), while half of them had a PET-scan (49.9%). The number of patients that had a PET-scan increased from 43.9% in 2004 to 53.7% in 2008. A PET-scan was more often performed in patients with cancer of the oesophagus (52.1%) than in patients with cancer of the gastro-oesophageal junction (43.3%). Patients with clinical stage II (61.2%) and III (66.7%) more often underwent a PET-scan than other patients. Only 5.5% of the patients underwent a MRI.

Half of the patients underwent endoscopic ultrasound (EUS). EUS with fine needle aspiration cytology (FNAC) was more often performed in 2008 (9.5%) than in 2004 (4.8%). Patients with cancer of the oesophagus (48.1%) less often had an EUS than patients with cancer of the gastro-oesophageal junction (54.1%). Most of the patients (96.1%) had an oesophago-, gastro- or duodenoscopy. For 4.9% of all patients it was indicated that a therapeutic intervention (i.e. resection of the tumour and/or coagulation) was performed during this procedure.

Twenty-seven percent of the patients underwent a bronchoscopy. Bronchoscopy was more often performed in patients with cancer of the oesophagus (31.9%) than in patients with cancer of the gastro-oesophageal junction (14.3%). One percent of the patients had a mediastinoscopy and 3.1% had a laparoscopy. Bronchoscopy was more often performed for patients with squamous cell carcinoma (44.5%).

Explorative thoracotomy was performed in 0.4% of the patients. Since this is a quite invasive procedure to use as a diagnostic procedure (e.g. to define the staging), it is possible that for some patients a therapeutic procedure was started but then aborted because of the extent of the disease.

The results concerning CT are discussed in more detail in chapter 5.2.1.1 and Appendix 6.2.

Table 9 – Oesophageal cancer (C15.0-C16.0): diagnostic procedures (-3m<inc<+3m)

Diagnostic procedure (-3m<inc<+3m)	C15.0-C16.0 Oesophagus and gastro-oesophageal junction (GOJ)							Oesophagus (N=4 361)		GOJ (N=1 452)	
	Total (N=5 813)		2004 (N=1 099)	2005 (N=1 164)	2006 (N=1 181)	2007 (N=1 235)	2008 (N=1 134)				
	N	%	%	%	%	%	%	N	%	N	%
Tissue/Cell examination	**5 700**	**98.1**	**98.3**	**97.6**	**97.7**	**98.0**	**98.8**	**4 278**	**98.1**	**1 422**	**97.9**
Biopsy	5 687	97.8	98.0	97.2	97.6	97.8	98.6	4 268	97.9	1 419	97.7
Cytology	1 693	29.1	30.0	29.2	26.6	30.8	29.0	1 335	30.6	358	24.7
Global imaging	**5 452**	**93.8**	**93.8**	**92.7**	**93.6**	**94.6**	**94.4**	**4 082**	**93.6**	**1 370**	**94.4**
CT	5 431	93.4	93.4	92.3	93.2	94.2	94.0	4 066	93.2	1 365	94.0
PET	2 902	49.9	43.9	48.3	50.6	52.7	53.7	2 274	52.1	628	43.3
MRI	317	5.5	6.6	3.9	6.2	4.7	6.1	233	5.3	84	5.8
Local imaging (EUS)	**2 884**	**49.6**	**43.4**	**49.6**	**49.9**	**52.7**	**52.0**	**2 099**	**48.1**	**785**	**54.1**
EUS (upper GI tractus)	2 505	43.1	39.2	44.9	43.8	43.8	43.5	1 820	41.7	685	47.2
EUS (+ FNAC)	429	7.4	4.8	5.6	7.1	9.6	9.5	314	7.2	115	7.9
Endoscopic examination	**5 625**	**96.8**	**96.8**	**96.5**	**96.5**	**96.7**	**97.4**	**4 227**	**96.9**	**1 398**	**96.3**
Oesophago-/gastro-/duodenoscopy	5 585	96.1	95.9	95.7	96.2	96.0	96.6	4 192	96.1	1 393	95.9
Oesophago-/gastro-/duodenoscopy (without resection of the tumour and/or coagulation)	5 563	95.7	95.3	95.4	95.9	95.5	96.4	4 176	95.8	1 387	95.5
Oesophago-/gastro-/duodenoscopy (with resection of the tumour and/or coagulation)	284	4.9	4.5	4.9	4.7	5.5	4.7	232	5.3	52	3.6
Bronchoscopy	1 596	27.5	29.7	27.7	27.0	27.0	26.1	1 389	31.9	207	14.3

Diagnostic procedure (-3m<inc<+3m)	C15.0-C16.0 Oesophagus and gastro-oesophageal junction (GOJ)							Oesophagus (N=4 361)		GOJ (N=1 452)	
	Total (N=5 813)		2004 (N=1 099)	2005 (N=1 164)	2006 (N=1 181)	2007 (N=1 235)	2008 (N=1 134)				
	N	%	%	%	%	%	%	N	%	N	%
Explorative surgery	**231**	**4.0**	**4.3**	**4.0**	**4.6**	**4.2**	**2.7**	**120**	**2.8**	**111**	**7.6**
Mediastinoscopy	59	1.0	1.0	1.3	1.2	1.0	0.6	47	1.1	12	0.8
Laparoscopy	182	3.1	3.6	3.1	3.5	3.3	2.1	79	1.8	103	7.1
Explorative thoracotomy	23	0.4	0.5	0.5	0.2	0.6	0.2	20	0.5	3	0.2

4.1.3. Multidisciplinary oncological consult

Sixty percent of all patients with oesophageal cancer were discussed at the multidisciplinary oncological consultation within 3 months after the incidence date. There was an evolution over time from 54.0% in 2004 to 68.0% in 2008. There was almost no difference between patients with cancer of the oesophagus (C15, 59.5%) and patients with cancer of the gastro-oesophageal junction (C16.0, 62.0%) (Table 10).

These results are discussed in more detail in chapter 5.2.1.2 and Appendix 6.1.

Table 10 – Oesophageal cancer (C15.0-C16.0): MDT (-1m<inc<+3m)

	C15.0-C16.0 Oesophagus and gastro-oesophageal junction(GOJ)							Oesophagus (N=4 361)		GOJ (N=1 452)	
	Total (N=5 813)		2004 (N=1 099)	2005 (N=1 164)	2006 (N=1 181)	2007 (N=1 235)	2008 (N=1 134)				
	N	%	%	%	%	%	%	N	%	N	%
MDT (-1m<inc<+3m)	3 495	60.1	54.0	56.9	57.3	64.1	68.0	2 595	59.5	900	62.0

4.1.4. Treatment

Major surgery (i.e. oesophagectomy and/or gastrectomy) was performed within 9 months after the incidence date in 1 977 patients (34.0% of 5 813 patients) (Table 11). The majority of these patients (52.9%) received primary surgery (without neoadjuvant and/or adjuvant treatment). Neoadjuvant treatment (chemotherapy, radiotherapy or both) was given in 19.9% of these patients, adjuvant treatment in 16.2% of patients, and both neoadjuvant and adjuvant treatment in 11.0% of patients. More detailed information on the exact combination of treatments can be found in Appendix 9.

Of the patients who were not treated with major surgery (N = 3 836), 64.0% received chemotherapy, radiotherapy or both, either as primary treatment, palliative treatment or both (Table 11). Local treatment (i.e. coagulation, cryotherapy, lasertherapy, stenting or dilatation) as sole treatment was given to 674 patients. For 708 patients, none of these treatments were registered at all.

The results concerning neoadjuvant treatment and primary chemoradiotherapy are discussed in more detail in chapter 5.2.2.1 and 5.2.2.2 and in Appendix 6.3 and Appendix 6.5.

Table 11 – Oesophageal cancer (C15.0-C16.0): overview of general treatment schemes

Treatment scheme	Frequency	Percent
Primary surgery	1 046	18.0
Neoadjuvant treatment < surgery	393	6.8
Surgery < adjuvant treatment	320	5.5
Neoadjuvant treatment < surgery < adjuvant treatment	218	3.8
Primary chemoradiotherapy, chemotherapy or radiotherapy	2 454	42.2
Local treatment	674	11.6
No major treatment registered	708	12.2

4.1.5. Palliative care

Of all patients who deceased (from all causes) before January 1st, 2010 43.6% received palliative care. Over time, an increase was seen in palliative care from 38.7% in 2004 to 44.9% in 2008. There is a small difference between patients with cancer of the oesophagus (C15) (42.4%) and patients with cancer of the gastro-oesophageal junction (C16.0) (47.3%) (Table 12).

These results are discussed in more detail in chapter 5.2.2.3 and Appendix 6.6.

Table 12 – Oesophageal cancer (C15.0-C16.0): palliative care (no timeframe)

	C15.0-C16.0 Oesophagus and gastro-oesophageal junction (GOJ)							Oesophagus (N=3 227)		GOJ (N=1 081)	
	Total (N=4 308)		2004 (N=954)	2005 (N=899)	2006 (N=898)	2007 (N=902)	2008 (N=655)				
	N	%	%	%	%	%	%	N	%	N	%
Palliative care (no timeframe)*	1 879	43.6	38.7	44.2	44.7	46.3	44.9	1 368	42.4	511	47.3

* Only patients deceased before 1/01/2010.

4.2. Gastric cancer

4.2.1. Patient and tumour characteristics

From 2004 until 2008, 5 247 patients with gastric cancer (C16.1-C16.9) were selected from the BCR database.

From this selection, 400 patients were excluded, resulting in 4 847 patients (2 814 men and 2 033 women) for analysis. The reasons for exclusion were: (1) patients were not found in the health insurance database (N=85), (2) patients with more than 1 oesophageal or gastric tumour (N=5), (3) patients who died at the incidence date (N=13), (4) patients who were lost to follow-up at the incidence date (N=3), (5) sarcoma (N=268), (6) small-cell tumours (N=13), (7) other non-stageable tumours (N=4) and (8) tumours for which the localization is questionable (N=9).

4.2.1.1. Demographic information

Gastric cancer was most frequently diagnosed in men and women aged 70 years and older. In women, most patients were diagnosed at the age of 80 years and older (Figure 12). The youngest patients were 8 and 15 years for men and women, respectively. The oldest patients were 99 years and 103 years for men and women, respectively. The mean age at diagnosis was 71 years among men and 73 years among women.

In most age groups, gastric cancer was more frequently diagnosed in men than in women (Figure 13).

Figure 12 – Gastric cancer (C16.1-C16.9): distribution of sex, by age

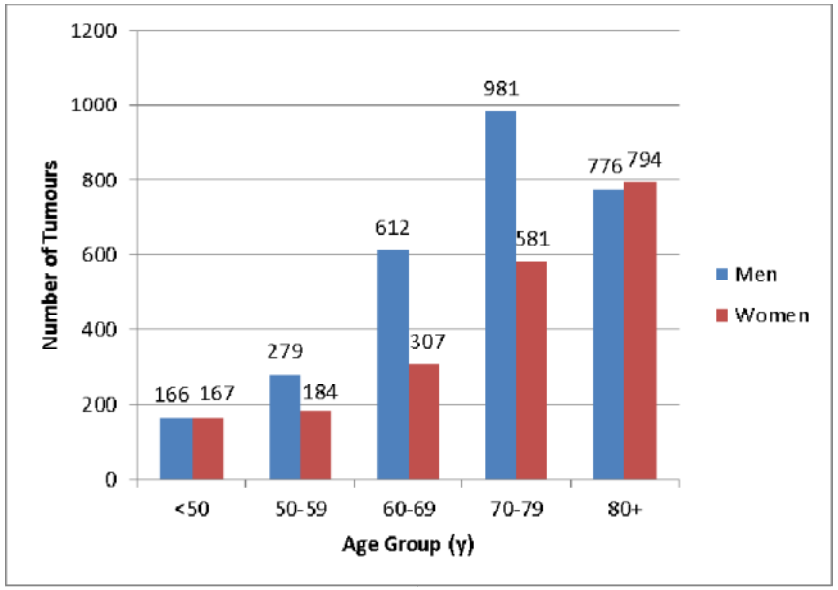
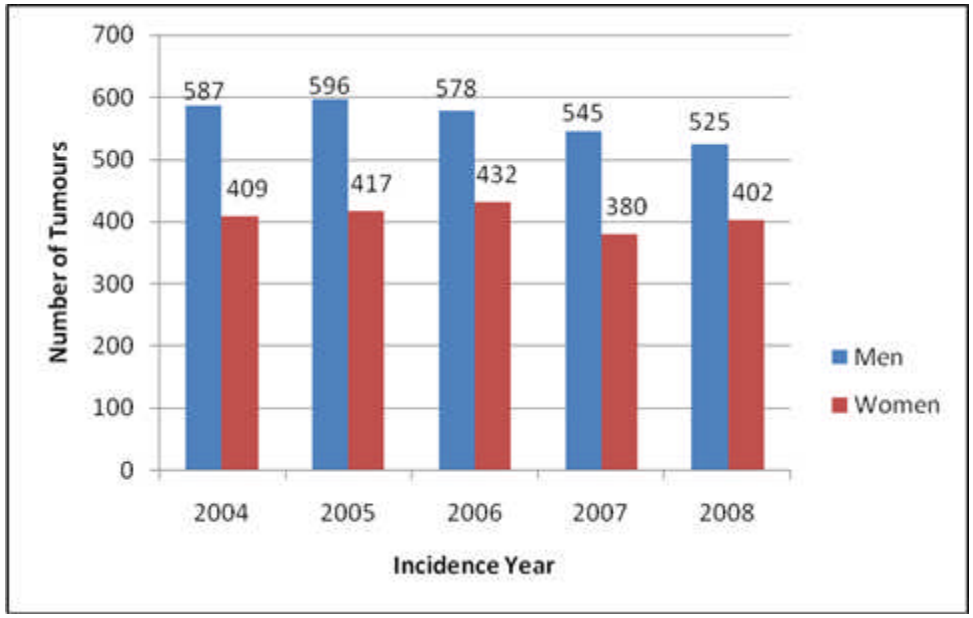


Figure 13 – Gastric cancer (C16.1-C16.9): distribution of sex, by incidence year



4.2.1.2. Tumour characteristics

Localization

For a substantial proportion of patients with gastric cancer (71.6%) the sublocalization was not reported to the BCR. Most of the specified gastric tumours were located in the pyloric antrum (C16.3; 14.7%) (Table 13).

Table 13 – Gastric cancer (C16.1-C16.9): distribution of localization

ICD-10	Localization	N	%
C16.1	Fundus of stomach	200	4.1
C16.2	Body of stomach	193	4.0
C16.3	Pyloric antrum	714	14.7
C16.4	Pylorus	64	1.3
C16.5	Lesser curvature of stomach, unspecified	138	2.8
C16.6	Greater curvature of stomach, unspecified	58	1.2
C16.8	Overlapping lesion of stomach	9	0.2
C16.9	Stomach, unspecified	3 471	71.6
C16.1-C16.9	**Total**	**4 847**	**100.0**

Morphology

The selection consisted of carcinoma (99.0%) and “unspecified malignant neoplasms” (1.0%). In the group of carcinoma, the adenocarcinoma (91.8%) are most frequently found (Table 14).

For all localisations of the stomach, adenocarcinoma was the most frequently found morpholgy. Other specified carcinoma were also found in the fundus of the stomach (C16.1) and in the overlapping lesion of the stomach (C16.8) (Table 15).

Table 14 – Gastric cancer (C16.1-C16.9): distribution of morphology

Histological Group	N	%
Carcinoma	4 800	99.0
Squamous cell carcinoma	4	0.1
Adenocarcinoma	4 449	91.8
Other specified carcinoma	298	6.1
Unspecified carcinoma	49	1.0
Unspecified malignant neoplasm	47	1.0

Table 15 – Gastric cancer (C16.1-C16.9): distribution of morphology, by localization

ICD-10	Localization	Total N	Histological Group: Carcinoma N	Carcinoma %	Squamous cell carcinoma N	Squamous cell carcinoma %	Adenocarcinoma N	Adenocarcinoma %	Other specified carcinoma N	Other specified carcinoma %	Unspecified carcinoma N	Unspecified carcinoma %	Unspecified malignant neoplasm N	Unspecified malignant neoplasm %
C16.1	**Fundus of stomach**	200	199	99.5	1	0.5	165	82.5	30	15.0	3	1.5	1	0.5
C16.2	**Body of stomach**	193	191	99.0	-	0.0	176	91.2	14	7.3	1	0.5	2	1.0
C16.3	**Pyloric antrum**	714	710	99.4	1	0.1	678	95.0	28	3.9	3	0.4	4	0.6
C16.4	**Pylorus**	64	63	98.4	-	0.0	60	93.8	3	4.7	-	0.0	1	1.6
C16.5	**Lesser curvature of stomach, unspecified**	138	137	99.3	-	0.0	130	94.2	5	3.6	2	1.4	1	0.7
C16.6	**Greater curvature of stomach, unspecified**	58	58	100.0	-	0.0	57	98.3	1	1.7	-	0.0	-	0.0
C16.8	**Overlapping lesion of stomach**	9	9	100.0	-	0.0	8	88.9	1	11.1	-	0.0	-	0.0
C16.9	**Stomach, unspecified**	3 471	3 433	98.9	2	0.1	3 175	91.5	216	6.2	40	1.2	38	1.1
C16.1-C16.9	**Total**	**4 847**	**4 800**	**99.0**	**4**	**0.1**	**4 449**	**91.8**	**298**	**6.1**	**49**	**1.0**	**47**	**1.0**

TNM stage

For a substantial number of patients the TNM classification was lacking in the BCR database (see Appendiix 6.18.4 and Appendix 7). Clinical stage (cStage) was unknown for 3 060 patients (63.1%) (Table 16), while the pathological stage (pStage) was not available for 2 533 patients (52.3%) (Table 16). In the majority of patients with an unknown cStage or pStage, the T-stage, N-stage and M-stage were unknown (Appendix 7). Most patients with a reported cStage had cStage IV (43.1%) or cStage I (25.5%) (Table 16). Most patients who underwent surgery and with a reported pStage had pStage I (36.4%) or pStage III (24.3%) (Table 16).

Because the cStage and/or pStage is lacking for many patients, a combined stage (combStage) is calculated for each patient. To determine this combined stage, known pStage prevails over known cStage, except when there is clinical proof of distant metastasis. When only pStage or only cStage is known, this is kept as the combined stage. Otherwise, when pStage and cStage are unknown, the combined stage remains also unknown. For gastric cancer the combined stage (combStage) was unknown for 1 692 patients (34.9%). Between 2004 and 2008, the proportion of tumours with an unknown combined stage fluctuated between 31.7% and 37.7% (Figure 14). Most patients with a known combined stage are diagnosed with stage IV (36.2%) or stage I (28.9%) (Table 16).

For all known cStages and pStages for gastric cancer, a good correspondence was found (Table 17). In some cases, a higher pStage than cStage was reported, based on additional information that became available during surgery. In other cases, where the pStage is lower than the cStage, it is possible that neoadjuvant treatment succeeded in downstaging the initial tumour.

Of all known clinical stages, stage IV occurred most frequently in all age groups. In the oldest age group, cStage I occurred more frequently than in younger patients (Figure 15). For all age groups, pStage I occurred most frequently, possibly because this type of tumours are most eligible for surgery (Figure 16). CombStage IV was more frequently present in the younger age groups, while combStage I more frequently occurred in elder patients (Figure 17).

Both in men and women, cStage IV was the most frequent cStage, followed by cStage I (Figure 18). Both in men and women, pStage I was the most frequent pStage, followed by pStage III (Figure 19). In both men and women, combStage IV occurred most frequently. In men, combStage III (62.8%) occurred more frequently than in women. In women, combStage I (42.4%) and II (40.9) occurred more frequently than in men (Figure 20).

Table 16 – Gastric cancer (C16.1-C16.9): distribution of stage

	cStage			pStage			combStage		
	N	% of total	% of known	N	% of total	% of known	N	% of total	% of known
Known stages	1 787	36.9	100.0	2 013	83.6	100.0	3 155	65.1	100.0
In situ	4	0.1	0.2	-	-	-	-	-	-
I	456	9.4	25.5	732	30.4	36.4	911	18.8	28.9
II	269	5.5	15.1	418	17.4	20.8	506	10.4	16.0
III	288	5.9	16.1	490	20.3	24.3	597	12.3	18.9
IV	770	15.9	43.1	373	15.5	18.5	1 141	23.5	36.2
Unknown stage	3 060	63.1	NA	396	16.4	NA	1 692	34.9	NA

Figure 14 – Gastric cancer (C16.1-C16.9): proportion of tumours with unknown combStage

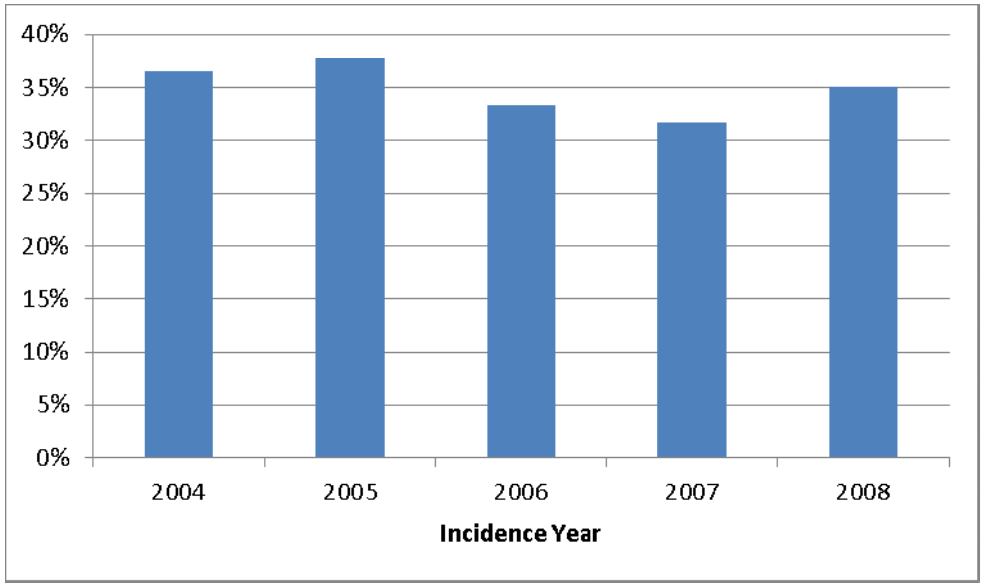


Table 17 – Gastric Cancer (C16.1-C16.9): distribution of pathological stage, by clinical stage

		pStage									
		I		II		III		IV		X	
cStage	Total N	N	%	N	%	N	%	N	%	N	%
In situ	4	2	50.0	1	25.0	0	0.0	0	0.0	1	25.0
I	456	208	45.6	59	12.9	40	8.8	33	7.2	116	25.4
II	269	51	19.0	63	23.4	48	17.8	33	12.3	74	27.5
III	288	22	7.6	34	11.8	88	30.6	46	16.0	98	34.0
IV	770	14	1.8	14	1.8	32	4.2	157	20.4	553	71.8
X	3 060	510	16.7	271	8.9	309	10.1	279	9.1	1 691	55.3
Total	4 847	807	16.6	442	9.1	517	10.7	548	11.3	2 533	52.3

Figure 15 – Gastric cancer (C16.1-C16.9): distribution of clinical stage (cStage), by age group

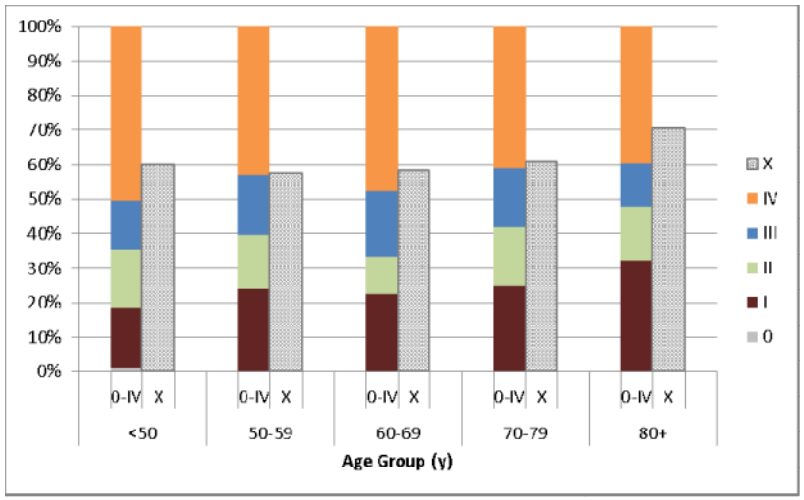


Figure 16 – Gastric cancer (C16.1-C16.9): distribution of pathological stage (pStage), by age group

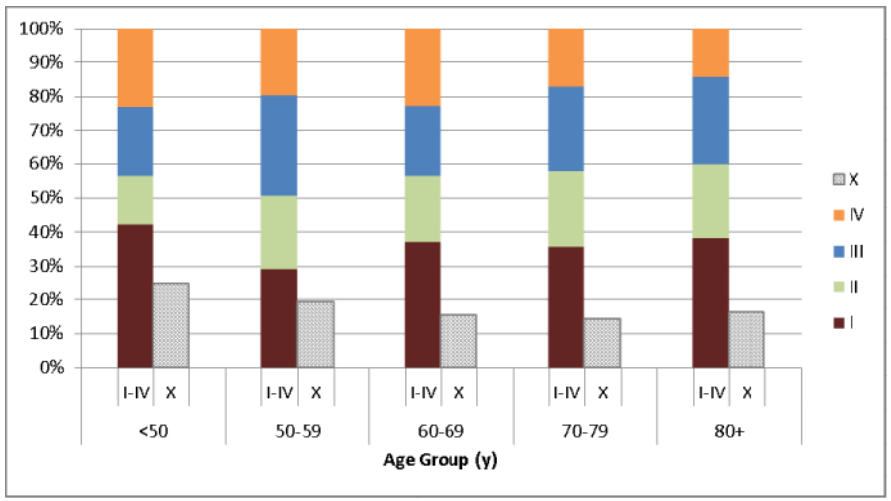


Figure 17 – Gastric cancer (C16.1-C16.9): distribution of combined stage (combStage), by age group

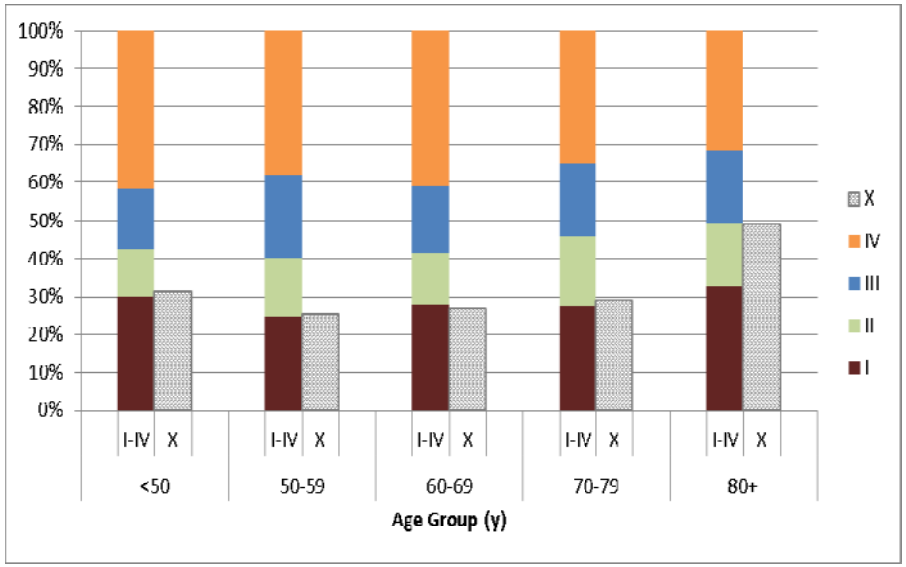


Figure 18 – Gastric cancer (C16.1-C16.9): distribution of clinical stage (cStage), by sex

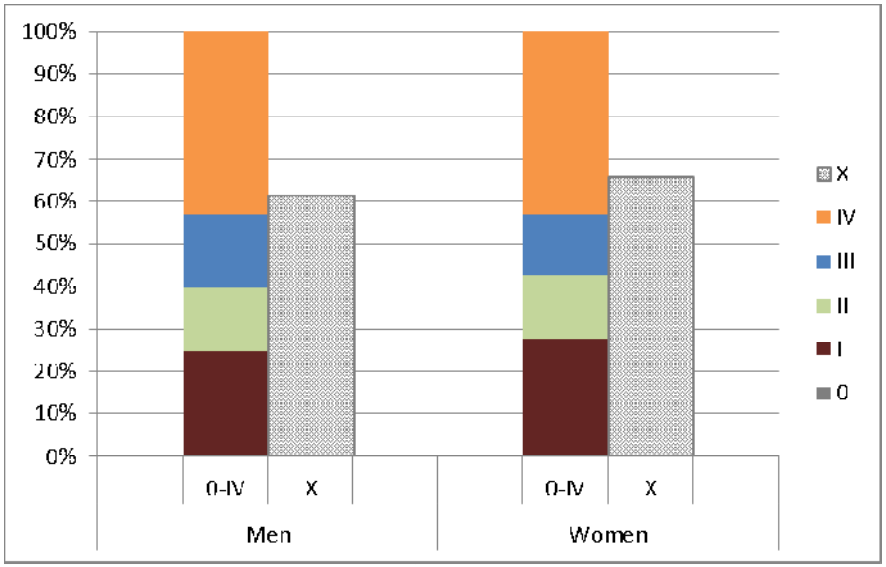


Figure 19 – Gastric cancer (C16.1-C16.9): distribution of pathological stage (pStage), by sex

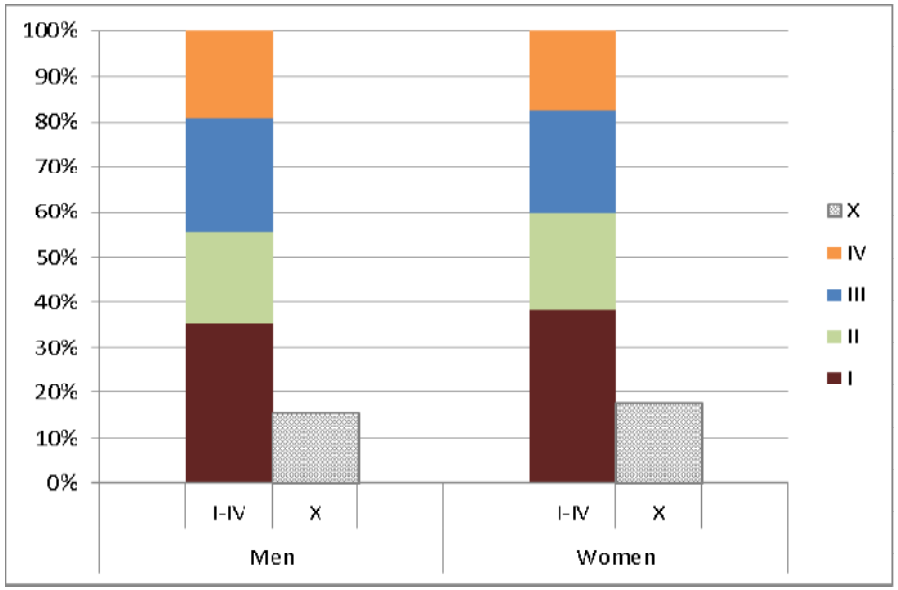
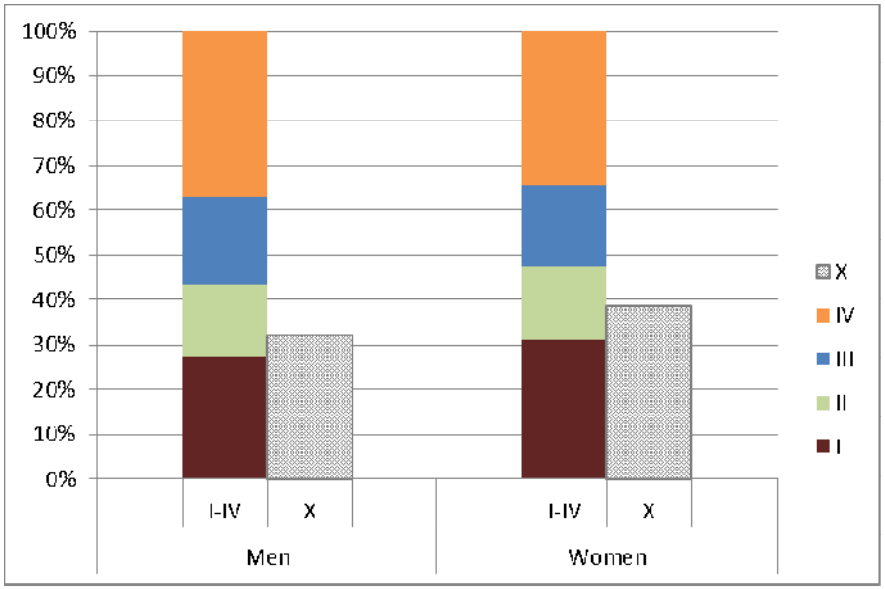


Figure 20 – Gastric cancer (C16.1-C16.9): distribution of combined stage (combStage), by sex



4.2.2. Diagnosis and staging

An overview of the most important techniques used in the diagnostic work up of gastric cancer (C16.1- C16.9), within 3 months before and after the incidence date, is given in Table 18.

Almost all patients had a biopsy (98.0%) while only for 18.4% of the patients cytology was done. Most of the patients had a CT (90.0%), while only 13.1% had a PET-scan. The number of patients with a PET-scan increased from 10.3% in 2004 to 17.2% in 2008. Only 5.0% of the patients had a MRI. Twenty-five percent of the patients underwent an EUS. For this diagnostic technique, an increase over time was found, from 19.7% in 2004 to 28.1% in 2008. EUS with FNAC was performed in 2.8% of the patients. Most of the patients (94.2%) had an oesophago-, gastro- or duodenoscopy. For 2.9% of all patients it was indicated that a therapeutic intervention (i.e. resection of the tumour and/or coagulation) was performed during this procedure.

Only 0.2% of the patients had a mediastinoscopy, 4.4% a laparoscopy and 0.2% had an explorative thoracotomy. Since a thoracotomy is a quite invasive procedure to use as a diagnostic procedure (e.g. to define the staging), it is possible that for some patients a therapeutic procedure was started but then aborted because of the extent of the disease.

The results concerning CT are discussed in more detail in chapter 5.3.1.1 and Appendix 6.11.

Table 18 – Gastric cancer (16.1-C16.9): diagnostic procedures (-3m<inc<+3m)

Diagnostic procedure (-3m<inc<+3m)	Total (N=4 847)		2004 (N=988)	2005 (N=1 009)	2006 (N=1 006)	2007 (N=921)	2008 (N=923)
	N	%	%	%	%	%	%
Tissue/Cell examination							
Biopsy	4 749	98.0	96.8	97.5	99.1	97.8	98.7
Cytology	894	18.4	17.8	19.3	19.7	18.0	17.2
Global imaging							
CT	4 377	90.3	89.0	89.9	91.9	89.7	91.0
PET	633	13.1	10.3	9.7	12.7	15.9	17.2
MRI	240	5.0	4.5	4.9	5.6	4.6	5.3
Local imaging (EUS)	**1 227**	**25.3**	**19.7**	**24.1**	**26.2**	**28.9**	**28.1**
EUS (upper GI tractus)	1 101	22.7	18.5	21.8	23.0	25.8	24.8
EUS (+ FNAC)	135	2.8	1.2	2.5	3.5	3.3	3.6
Endoscopic examination	**4 567**	**94.2**	**93.7**	**93.3**	**94.8**	**93.7**	**95.7**
Oesophago-/gastro-/duodenoscopy (without resection of the tumour and/or coagulation)	4 552	93.9	93.2	93.2	94.5	93.4	95.3
Oesophago-/gastro-/duodenoscopy (with resection of the tumour and/or coagulation)	140	2.9	2.4	3.1	2.9	2.6	3.5
Explorative surgery	**223**	**4.6**	**4.4**	**4.5**	**5.4**	**4.1**	**4.7**
Mediastinoscopy	9	0.2	0.0	0.5	0.2	0.1	0.1
Laparoscopy	214	4.4	4.4	4.0	5.2	4.0	4.6
Explorative thoracotomy	8	0.2	0.0	0.2	0.0	0.2	0.4

4.2.3. Multidisciplinary oncological consult

Fifty-three percent of all patients were discussed at the multidisciplinary consult within 3 months after incidence date. There was an evolution over time in the proportion of patients who were discussed at an MDT from 46.7% in 2004 to 58.2% in 2008 (Table 19).

These results are discussed in more detail in chapter 5.3.1.2 and Appendix 6.10.

Table 19 – Gastric cancer (16.1-C19.9): MDT (-1m<inc<+3m)

	Total (N=4 847)		2004 (N=988)	2005 (N=1 009)	2006 (N=1 006)	2007 (N=921)	2008 (N=923)
	N	%	%	%	%	%	%
MDT (-1m<inc<+3m)	2 554	52.7	46.7	48.3	53.2	58.0	58.2

4.2.4. Treatment

Major surgery (i.e. gastrectomy) was performed within 9 months after the incidence date in 2 409 patients (49.7% of 4 847 patients) (Table 20). One third of these patients (33.2%) received primary surgery (without neoadjuvant and/or adjuvant treatment). Neoadjuvant treatment (chemotherapy, radiotherapy or both) was given in only 1.7% of these patients, adjuvant treatment in 11.1% of patients, and both neoadjuvant and adjuvant treatment in 3.7% of patients. More detailed information on the exact combination of treatments can be found in Appendix 9.

Of the patients who were not treated with major surgery (N = 2 438), 32.6% received chemotherapy, radiotherapy or both, either as primary treatment, palliative treatment or both (Table 20). Local treatment (i.e. coagulation, cryotherapy, lasertherapy, stenting or dilatation) as sole treatment was given to 154 patients. For 1 490 patients, none of these treatments were registered at all.

The results concerning neoadjuvant treatment and palliative chemotherapy are discussed in more detail in chapter 5.3.2.1 and 5.3.2.2 and Appendix 6.12 and Appendix 6.14.

Table 20 – Gastric cancer (C16.1-C16.9): overview of general treatment schemes

Treatment scheme	Frequency	Percent
Primary surgery	1 611	33.2
Neoadjuvant treatment < surgery	81	1.7
Surgery < adjuvant treatment	538	11.1
Neoadjuvant treatment < surgery < adjuvant treatment	179	3.7
Primary chemoradiotherapy, chemotherapy or radiotherapy	794	16.4
Local treatment	154	3.2
No major treatment registered	1 490	30.7

* Multiple other treatments for one patient possible

4.2.5. Palliative care

Of the patients who deceased before January 1st 2010 42.8% received palliative care. Over time an increase was seen in palliative care from 42.0% in 2004 to 45.4% in 2007, but it dropped to 40.9% in 2008 (Table 21). Such statistics probably underestimated the real use of palliative care since all nomenclature codes for this procedure were unavailable in the administrative database.

These results are discussed in more detail in chapter 5.3.2.3 and Appendix 6.15.

Table 21 – Gastric cancer: palliative care (no timeframe)

	Total (N=3 446)		2004 (N=807)	2005 (N=760)	2006 (N=743)	2007 (N=588)	2008 (N=548)
	N	%	%	%	%	%	%
Palliative care (no timeframe)*	1 474	42.8	42.0	41.4	44.3	45.4	40.9

* Only patients deceased before 1/01/2010

5. INDICATOR RESULTS

5.1. Measurability of indicators

Of the 15 selected quality indicators for oesophageal cancer, 6 were found to be not measurable (Table 22). For gastric cancer, 5 out of 14 selected quality indicators were found to be not measurable (Table 23). The main reasons for not being measurable were the absence of an administrative code for specific interventions or clinical information. Concrete propositions to render these 11 indicators measurable are provided in the synthesis of this report.

Table 22 – Not measurable quality indicators for oesophageal cancer

	Definition of indicator	Type of indicator	Reason for not being measurable
OC3	Proportion of patients diagnosed with cT1a oesophageal cancer undergoing EMR who had an *en bloc* resection	Outcome	• Data related to oesophageal cancer were registered according to the 6th version of the TNM classification until 2010. Superficial cancer (T1a cancer) was introduced in the 7th version and registered since 2010 • No specific nomenclature code to distinguish *en bloc* from piecemeal resection
OC5	Proportion of surgically treated patients who had a R0 resection	Process	• Absence of administrative code for R0 resection
OC7	Proportion of patients with oesophageal cancer or cancer of the GOJ who were treated by a radical transthoracic oesophagectomy and two-field lymphadenectomy of abdominal and thoracic lymph nodes	Process	• No specific nomenclature code for transthoracic oesophagectomy and 2-field lymphadenectomy
OC8	Mean number of resected/evaluated lymph nodes during oesophagectomy	Outcome	• Absence of information on the number of resected/evaluated lymph nodes in administrative databases
OC9	Proportion of patients who experienced an anastomotic leakage after their oesophagectomy	Outcome	• Anastomotic leakage is currently not registered
OC12	Proportion of patients diagnosed with recurrent oesophageal cancer discussed at the MDT meeting before any treatment	Process	• Recurrence is currently not registered at the Cancer Registry at a population level

Table 23 – Not measurable quality indicators for gastric cancer

	Definition of indicator	Type of indicator	Reason for not being measurable
GC3	Proportion of patients diagnosed with cT1a gastric cancer undergoing EMR/ESD who had an *en bloc* resection	Outcome	• Data related to gastric cancer were registered according to the 6th version of the TNM classification until 2010. Superficial cancer (T1a cancer) was introduced in the 7th version and registered since 2010 • No specific nomenclature code to distinguish *en bloc* from piecemeal resection
GC5	Proportion of surgically treated patients who had a R0 resection	Process	• Absence of administrative code for R0 resection
GC7	Mean number of resected/evaluated lymph nodes during gastrectomy	Outcome	• Absence of an administrative code for the number of resected/evaluated lymph nodes
GC8	Proportion of patients who experienced an anastomotic leakage after their gastrectomy	Outcome	• Anastomotic leakage is currently not registered
GC11	Proportion of patients diagnosed with recurrent gastric cancer discussed at the MDT meeting before any treatment	Process	• Recurrence is currently not registered at the Cancer Registry at a population level

In total, 18 quality indicators were found to be measurable and are discussed below by tumour type.

5.2. Oesophageal cancer

5.2.1. Diagnostic work-up

5.2.1.1. Staging CT

National results

Overall, between 2004 and 2008, 88.3% of the patients with oesophageal cancer received a CT neck/thorax/abdomen within 1 month before and 1 month after incidence date (Appendix 6.2, Table 51). The proportion remained quite stable between 2004 (88.2%) and 2008 (89.4%). Patients in the age category 50-59 years most frequently received a CT neck/thorax/abdomen (91.8%). Patients aged 80 years and above were least likely to receive a CT neck/thorax/abdomen (80+ vs. 80-: OR = 0.46, 95%CI 0.38 to 0.56) (Appendix 6.2, Table 52). The proportion was slightly higher in men than in women (Appendix 6.2, Table 53: 88.9 vs. 86.4%; OR = 1.27, 95%CI 1.06 to 1.52). However, this gender difference disappeared when stratified by age (Appendix 6.2, Table 54).

The proportion appeared to increase with cStage (Appendix 6.2, Table 55). Patients with an unknown cStage were less likely to receive a staging CT neck/thorax/abdomen (cStage X vs. cStage 0-IV: OR = 0.45, 95%CI 0.38 to 0.53).

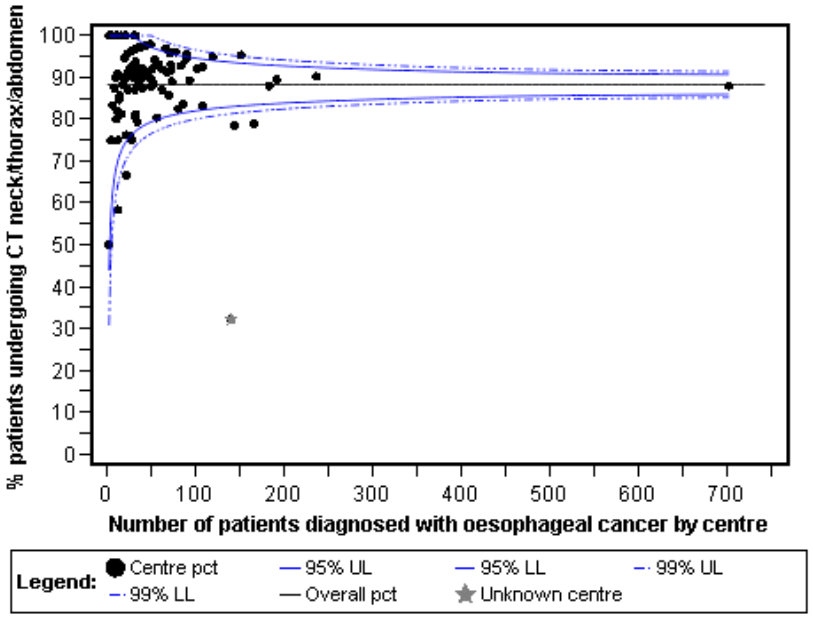
Patients receiving no major treatment were significantly less likely to receive a staging CT neck/thorax/abdomen (Appendix 6.2, Table 56: OR = 0.19, 95%CI 0.16 to 0.22). Patients treated with multimodality treatment or primary (chemo)radiotherapy had the highest proportions. Patients only treated with surgery had a proportion of 88.8%.

If the time period was extended until 3 months after incidence date, 92.4% of patients with oesophageal cancer received a CT neck/thorax/abdomen (Appendix 6.2, Table 57).

Comparison between centres

The variability between the 112 centres was limited (Figure 21). Only 6 centres had a proportion below the 95%LL (Appendix 6.2, Table 58). In only 13 centres, less than 80% of patients with oesophageal cancer received a CT neck/thorax/abdomen. In 15 centres, all patients with oesophageal cancer received a CT neck/thorax/abdomen.

Figure 21 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen within 1 month before and one month after incidence, by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.2.1.2. Multidisciplinary discussion

National results

Overall, between 2004 and 2008, 44% of patients with oesophageal cancer were discussed at the MDT meeting within one month after incidence date (Appendix 6.1, Table 41). The proportion slightly increased from 40.9% in 2004 to 49.2% in 2008. The proportion appeared to increase with cStage (Appendix 6.1, Table 42). Patients with cStage III and IV oesophageal cancer were most often discussed at the MDT (61.0% and 62.4%, respectively). Of the patients without a registered cStage, only 23.7% were discussed at the MDT meeting.

No clear differences were found in the proportion of patients discussed at the MDT meeting across the different age categories below 80 years, but the proportion was significantly lower in the 80+ category (80+ vs. 80-: OR = 0.80, 95%CI 0.69 to 0.93) (Appendix 6.1, Table 43). The proportion was higher in men than in women (Appendix 6.1, Table 44: 45.0 vs. 40.9%; OR = 1.18, 95%CI 1.05 to 1.34). When stratified by age, this gender difference only remained for the 80+ category (Appendix 6.1, Table 45).

When the proportion was calculated according to the treatment type, patients receiving no major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were less likely to be discussed at a multidisciplinary team meeting (Appendix 6.1, Table 46: OR = 0.53, 95%CI 0.47 to 0.61). On the contrary, patients that received primary chemo- and/or radiotherapy were more likely to be discussed at a multidisciplinary team meeting than patients receiving no or other treatment (OR = 1.68, 95%CI 1.51 to 1.86).

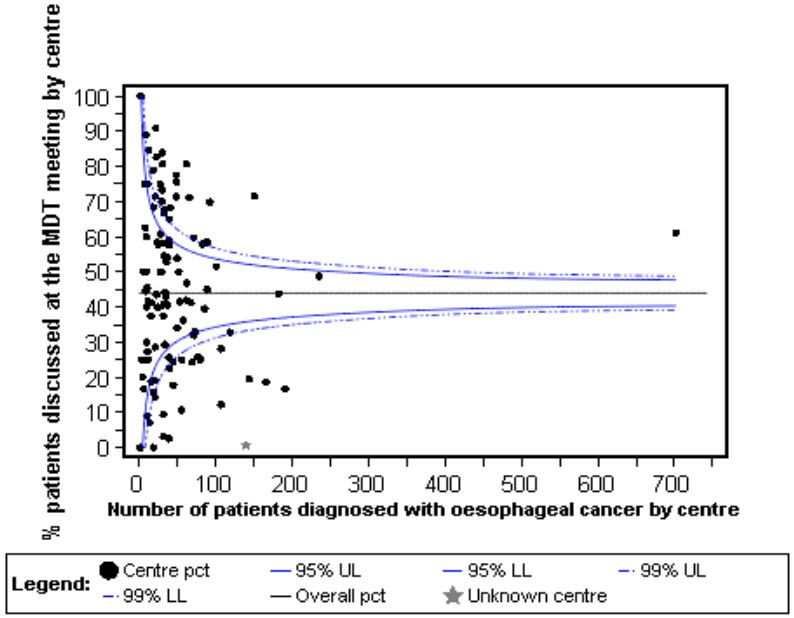
If the time period was extended until 3 months after incidence date, 60% of patients with oesophageal cancer were discussed at the MDT meeting (Appendix 6.1, Table 47). The proportion only slightly increased further to 64.5% if the time period was extended until 6 months after incidence date. However, specifically looking at the data for 2008, approximately 75% of patients with oesophageal cancer were discussed at a multidisciplinary team meeting within 6 months after incidence date.

Comparison between centres

An important variability was found across the 112 centres (Figure 22). Twenty-nine centres had a proportion below the 95%LL (Appendix 6.1, Table 48). Only 9 centres discussed at least 80% of their patients with oesophageal cancer in a multidisciplinary meeting, only 3 centres at least 90% of their patients.

When the timeframe was extended to 3 months after incidence date, the variability remained unchanged (Appendix 6.1, Figure 52). Twenty-seven centres had a proportion below the 95%LL (Appendix 6.1, Table 50).

Figure 22 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting within 1 month after incidence date, by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.2.2. Treatment

5.2.2.1. Neoadjuvant treatment

National results

Only patients with a *known* stage oesophageal cancer beyond the mucosa (T_{2-4} N_{any} $M_{0-1a;}$ N=1 623) who underwent surgical resection were included in this analysis. Overall, between 2004 and 2008, 43.3% of these patients received neoadjuvant treatment (Appendix 5.3., Table 59). This proportion clearly increased annually, from 34.2% in 2004 to 50.3% in 2008 (Appendix 6.3, Table 59). When patients with T_4 or T_4M_{1a} were excluded, the proportion of patients who received neoadjuvant treatment did not change (43.3%) (Appendix 6.3, Table 60).

The proportion of operated patients who received neoadjuvant treatment was clearly higher in SCC group than in AC group (Appendix 6.3, Table 61: 54.2% vs. 38.9%, OR = 1.85, 95%CI 1.34 to 2.56). For both types, more patients with stage IV (100% and 85.2%, respectively) or III (71.9% and 54.8%, respectively) received neoadjuvant treatment (Appendix 6.3, Table 61), probably to downstage the cancer to a resectable or potentially curable stage. Only 23.7% of all patients with stage II cancer received neoadjuvant therapy and the proportion was even lower for stage I cancer patients (6.8% in the AC group) (cStage III-IV vs. I-II: OR = 6.11, 95%CI 4.41 to 8.47).

Clear differences were found in the proportion of patients with T_{2-4} N_{any} M_{0-1a} oesophageal cancer treated with neoadjuvant treatment according to age. The proportion of patients receiving preoperative treatment decreased from 49.3% before 70 years to 33.3% after 70 years (OR = 3.41, 95%CI 2.46 to 4.74). None of the 34 patients older than 80 years received neoadjuvant treatment (Appendix 6.3, Table 62).

No statistical differences were observed according to sex (OR 1.10 [95%CI 0.77 – 1.58]) (Appendix 6.3, Table 63 and Table 64).

A higher proportion of patients with nodal involvement (cN_{any} OR cM_{1a}) received neoadjuvant treatment (55.3% vs. 18.4% in cN_0M_0, OR = 5.49, 95%CI 3.76 to 8.03]) (Appendix 6.3, Table 65).

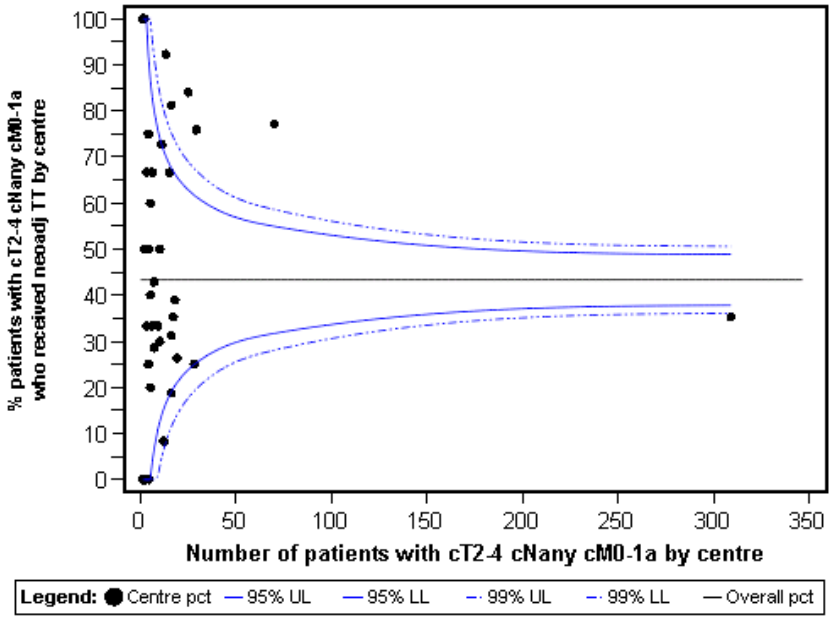
When comparing the main types of neoadjuvant treatment, a higher proportion of patients received chemoradiotherapy than chemotherapy only (29% vs. 14.3%) (Appendix 6.3, Table 66).

Comparison between centres

The funnel plot (Figure 23) depicts the variability between the 72 centres that were included in this analysis, based on the 2004-2008 data (the 40 other centres did not have eligible patients for this analysis). The majority of the very low volume centres were situated within the 99% limits. An important variability was observed between centres that treated more than 50 patients with oesophageal cancer beyond the mucosa during the 5 years period. In the highest volume centre (> 300 patients with T_{2-4} N_{any} M_{0-1a} cancer), 35.3% received a neoadjuvant treatment versus 77.1% of patients in a centre having treated 70 patients (Appendix 6.3, Table 67). Restricting the analyses to the two last available years (2007 and 2008) did not change the global picture (Appendix 6.3, Figure 55).

When the population was restricted to patients with nodal involvement (cT_{2-4} $_cN_+$ $_cM_{0-1a}$ or cT_{2-4} $_cN_0$ $_cM_{1a}$), the mean estimated value for all centres increased to 55%. Four centres clearly differentiated from the other low- and medium-volume centres, giving neoadjuvant treatment to at least 85% of patients.

Figure 23 – Funnel plot of the proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by centre (2004-2008)



5.2.2.2. Primary chemoradiotherapy

National results

Globally, in Belgium, during the period 2004-2008, 1 977 patients with oesophageal cancer underwent surgical resection (34%) whereas 3 836 patients (66%) received medical treatment (curative or palliative) (Appendix 6.5, Table 82). Whereas 70-80% of patients with tumours located in the upper and middle third of the oesophagus were treated with definitive chemoradiotherapy, half of the patients with tumours located in the lower third of the oesophagus and the GOJ benefited from surgery (Appendix 6.5, Table 83). Most cancers of the upper two thirds of the oesophagus were squamous cell tumours (>86%), whereas cancers of the lower oesophagus were most often adenocarcinomas (66% for the lower third and 94.6% for the GOJ) (Appendix 6.5, Table 84).

Overall, 21.1% of patients with oesophageal cancer received primary chemoradiotherapy. Patients who were in cStage III or IV were most likely to receive primary chemoradiotherapy compared to patients with lower cStages (30.6% vs. 18.6%; OR 1.93 [95%CI 1.62 – 2.29]). However, 4.6% of patients who had a cancer in situ or a cStage I cancer were not surgically treated and received primary CRT (Appendix 6.5, Table 85). In the Belgian cohort, 45.3% of patients with a SCC in cStage III-IV were treated with primary chemoradiotherapy, whereas only 19.8% of patients with adenocarcinoma in cStage III-IV received this therapy (Appendix 6.5, Table 86). Globally, patients with SCC were most likely treated with primary chemoradiotherapy than patients with adenocarcinoma (35.4% vs. 11.2%; OR=4.33 [95%CI 3.76 – 4.98]).

Clear differences were found in the proportion of patients with oesophageal cancer treated by primary chemoradiotherapy across age categories. The proportion of patients receiving such treatment decreased from 26.3% before 70 years to 14% after 70 years (OR 2.18 [95%CI 1.90 – 2.51]). Among patients older than 80 years, 7.3% received a primary chemoradiotherapy (Appendix 6.5, Table 87).

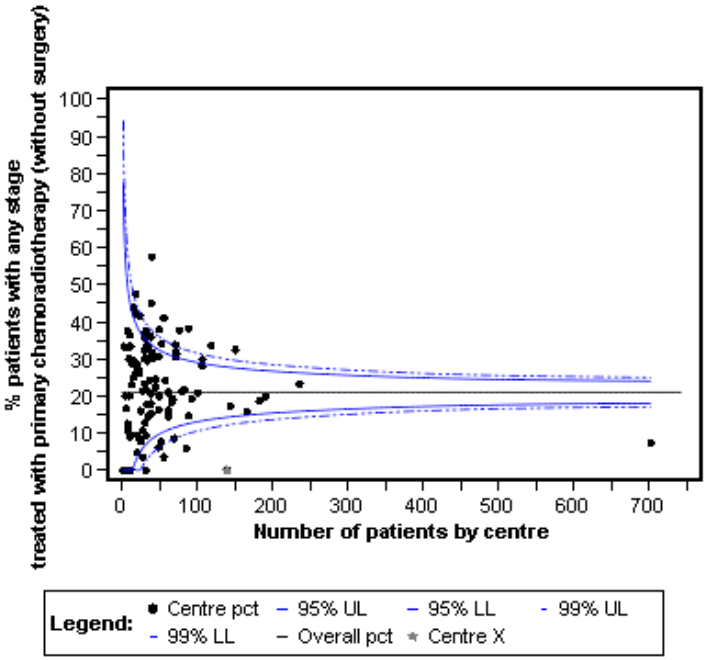
Slight differences were observed according to sex, with a higher proportion reported for men than for women (21.8% vs. 18.6%; OR 1.22 [95%CI 1.04 – 1.42]) (Appendix 6.5, Table 88). However, this difference disappeared when stratified by age category (Appendix 6.5, Table 89).

The proportion of patients who received primary chemoradiotherapy remained stable over time, around 20% (Appendix 6.5, Table 90).

Comparison between centres

Figure 24 presents the variability between the centres for the use of primary chemoradiotherapy, based on the 2004-2008 data. The differences between individual centres are fairly large, but the funnel plots reveal that this may be due to random fluctuations alone.

Figure 24 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.2.2.3. *Palliative support*

National results

Overall, of all patients diagnosed with metastatic oesophageal cancer between 2004 and 2008 that died before January 1st 2010, 44% received palliative support within 3 months before death (Appendix 6.6, Table 92). No clear time trend was found, although the highest rate was found for 2009 (49.3%).

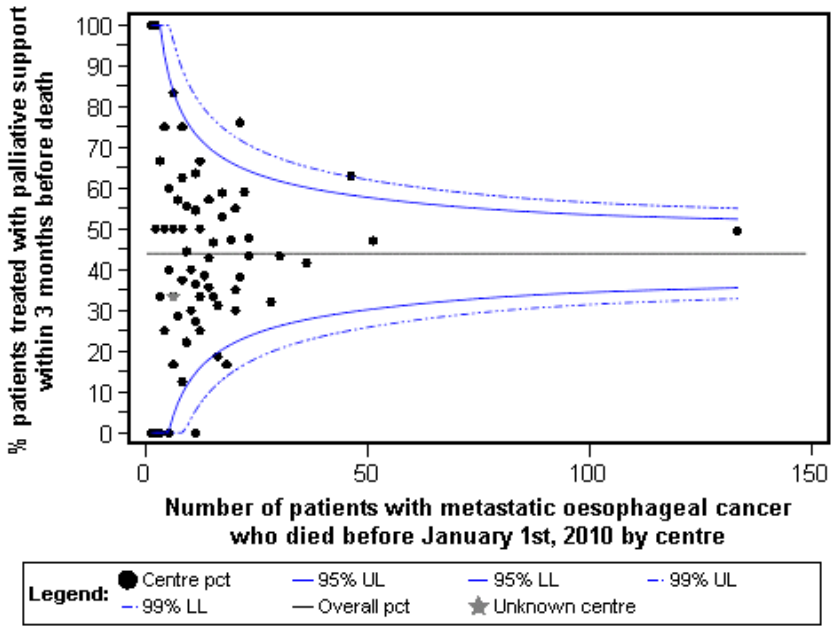
Important differences were found across the Belgian provinces, with the highest rates found in Luxembourg (59.3%) and the lowest in Hainaut (29.0%) (Appendix 6.6, Table 93). Older patients were more likely to receive palliative support than younger patients (80+ vs. 80-: OR = 1.56, 95%CI 1.04 to 2.34) (Appendix 6.6, Table 94). No important difference was found between men and women (men vs. women: OR = 0.94, 95%CI 0.69 to 1.27) (Appendix 6.6, Table 95). However, when stratified by age group, men aged 80 years and above were more likely to receive palliative support than women aged 80 years and above (Appendix 6.6, Table 96: OR = 1.56, 95%CI 1.17-2.09).

These calculations probably underestimate the real use of palliative care since not all nomenclature codes for this procedure were available in the administrative database.

Comparison between centres

The variability between the 108 centres included in the analysis was limited (Figure 25). Four centres had a proportion below the 95%LL (Appendix 6.6, Table 97). In 27 centres, more than 50% of the patients received palliative support within 3 months before death. In contrast, in 12 centres no patient received palliative support. Similar results were found when only considering the period 2007-2008 (Appendix 6.6, Figure 61).

Figure 25 – Funnel plot of the proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.2.3. Outcomes

5.2.3.1. Postoperative mortality

National results

Overall, between 2004 and 2008, 4.8% of the 1 723 patients with oesophageal cancer that underwent oesophageal resection and for whom the vital status was known died within 30 days after surgery (green horizontal line in Figure 26; Appendix 6.4, Table 70). The proportion varied between 2004 and 2008, and was the lowest in 2004 (3.5%) and 2008 (3.7%), and the highest in 2005 (6.7%). Women had a slightly higher 30-day mortality than men, although the difference was not statistically significant (Appendix 6.4, Table 71: men vs. women, OR = 0.76, 95%CI 0.44 to 1.30). The 30-day mortality clearly increased with age (Appendix 6.4, Table 72: 80+ vs. 80-, OR = 5.11, 95%CI 2.40 to 10.67). No significant sex differences were found when stratified by age (Appendix 6.4, Table 73).

Oesophageal tumours tended to have a higher 30-day postoperative mortality than junction tumours, although the difference was not statistically significant (5.4% vs. 3.4%, OR = 1.65, 95%CI 0.93 to 2.95) (Appendix 6.4, Table 74).

Patients receiving neoadjuvant treatment tended to have a better short-term outcome than patients not receiving neoadjuvant treatment, although the difference was not statistically significant (4.2% vs. 5.1%, OR = 0.81, 95%CI 0.81 to 1.35) (Appendix 6.4, Table 75 and Table 76).

When the period was extended to 60 and 90 days, the mortality rose to 8.2% and 9.9%, respectively (Appendix 6.4, Table 77).

Comparison between centres

The adjusted funnel plot shows variability between the 88 centres that were included in this analysis (Figure 27). Adjusted for age and combined stage, 25 centres had a 30-day mortality above 10%, and 9 centres even had a 30-day mortality above 20%. Nine centres had a 30-day mortality above the 95%UL. In contrast, 46 centres had a 30-day mortality below 1%.

Multivariate analysis showed that centres performing at least 20 oesophagectomies per year had a significantly lower 30-day mortality (Table 27:adjusted OR 0.226, 95%CI 0.113 to 0.454) and 90-day mortality (Table 27: adjusted OR 0.367, 95%CI 0.235 to 0.573) than those performing less than 6 oesophagectomies per year. This is further discussed in chapter 5.2.4.3.

Figure 26 – Funnel plot of the unadjusted 30-day mortality rate after an oesophagectomy, by centre

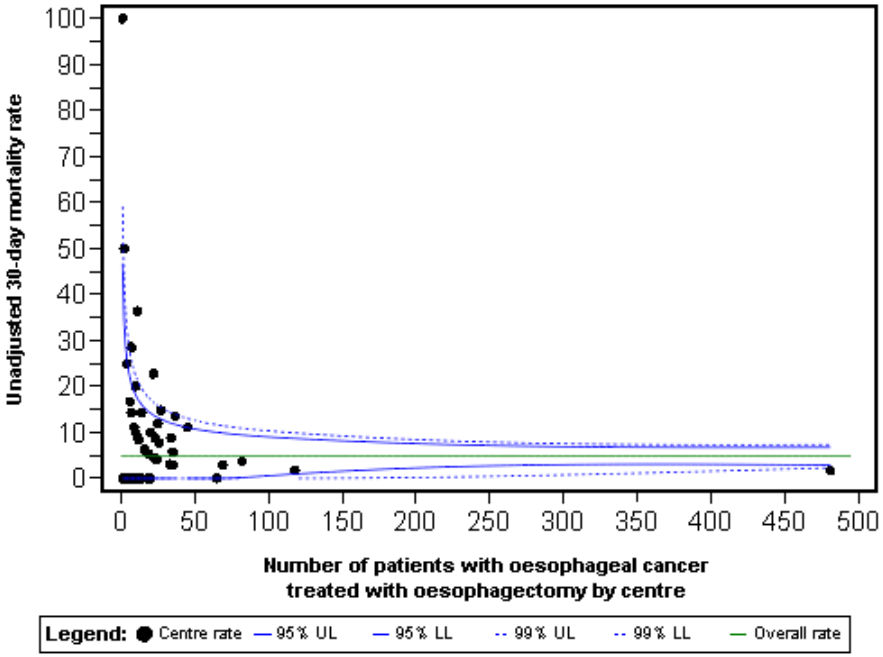
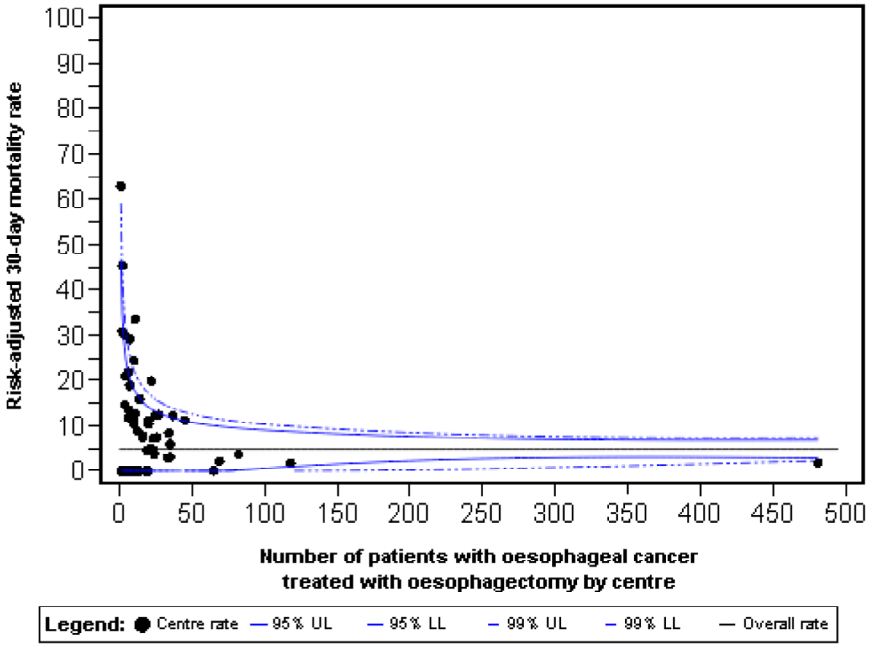


Figure 27 – Funnel plot of the 30-day mortality rate after an oesophagectomy, by centre, adjusted for age and combined stage



Note: Due to a low sample size for most centres and low percentages of deaths, one should be careful with the interpretation of adjusted rates; small changes might have a significant impact on the adjusted rate (observed rate / expected rate).

5.2.3.2. Survival

National results

Overall survival

Oesophageal cancer mostly affects men, with a ratio 3:1. Whereas the mean age at diagnosis was 65 years for men, it was as high as 70 years for women. This unequal distribution of mean age at diagnosis led however to obtain a similarly very low overall survival at 5 years (18.9% both in women and men) (Appendix 6.8, Table 106). The lethality of oesophageal cancer is due to the high proportion of patients who were diagnosed with an advanced disease (≥ stage III) at an older age. Considering the age groups, younger patients were more likely to be alive at 5 years after diagnosis than older patients (Appendix 6.8, Table 107; Figure 72 and Figure 73). In each age group, survival rates were not significantly different between women and men, except for the category 60-69 years ($p<0.0001$) (Appendix 6.8, Table 108). In stage I, observed survival declined from 84.8% (1 year) to 56.3% (5 years) in men and from 84% to 62% in women. In stage II, the decline is more pronounced reaching 27% in men and 25% in women after 5 years. For stage IV, 5-year overall survival is low both for men (4.6%) and for women (3.8%). Women were more likely to have an undocumented combined stage (33.7% vs. 27.3%). Patients with undocumented cancer stages (N=1 679) had a 5-year overall survival that was between survival rates reported for stages III and IV (Appendix 6.8, Table 108, Figure 74 and Figure 75).

Relative survival

Five-year relative survival, i.e. survival corrected for age- and gender-specific background mortality, was slightly higher than 5-year overall survival in both sexes (21.7% for men and 21.6% for women). This was particularly true for stages I and II where the differences were the largest, indicating that other causes of mortality may play a role during a 5-year period after the incidence date. In stages III and IV, the majority of deaths were caused by the presence of oesophageal cancer, since 5-year relative and overall survival cancer were very close (Appendix 6.7, Table 101 and Table 107).

Most cancers of the upper two thirds of the oesophagus were squamous cell tumours (>86%), whereas cancers of the lower oesophagus were most

often adenocarcinomas (66% for the lower third and 94.6% for the GOJ) (Appendix 6.7, Table 84).

In men, tumours located in the abdominal part of the oesophagus had a better prognosis at 5-year (29.2%) than tumours located in the thoracic part (17.3%) or in the cervical part (16.8%) (Appendix 6.7, Table 102 and Figure 66). A higher proportion of men were diagnosed with an adenocarcinoma than with a SCC (59.9% vs. 36.1%). The 5-year relative survival was clearly higher for adenocarcinomas than for SCC (25.5% vs. 16.0% of survivors; p<0.0001) (Appendix 6.7, Table 103 and Figure 68).

In women, such differences were not so large, and tumours located in the thoracic part were associated with the highest proportion of survivors at 5 years (25.8%) followed by tumours located in the abdominal part (23.9%) (Appendix 6.7, Table 102 and Figure 67). In women, a lower proportion of adenocarcinomas was diagnosed (44.6% vs. 50.8%). The 5-year relative survival of women with an adenocarcinoma was similar to survival for women with SCC (22.1% vs. 20.9%; p=0.55) (Appendix 6.7, Table 103 and Figure 69), and similar to survival for men with the same histological type (22.1% vs. 25.5%; p=0.08). On the contrary, women with a SCC were more likely to be alive at 5 years than men with a SCC (20.9% vs. 16%; p<0.05) (Appendix 6.7, Table 103, Figure 68, Figure 69).

Comparison between centres

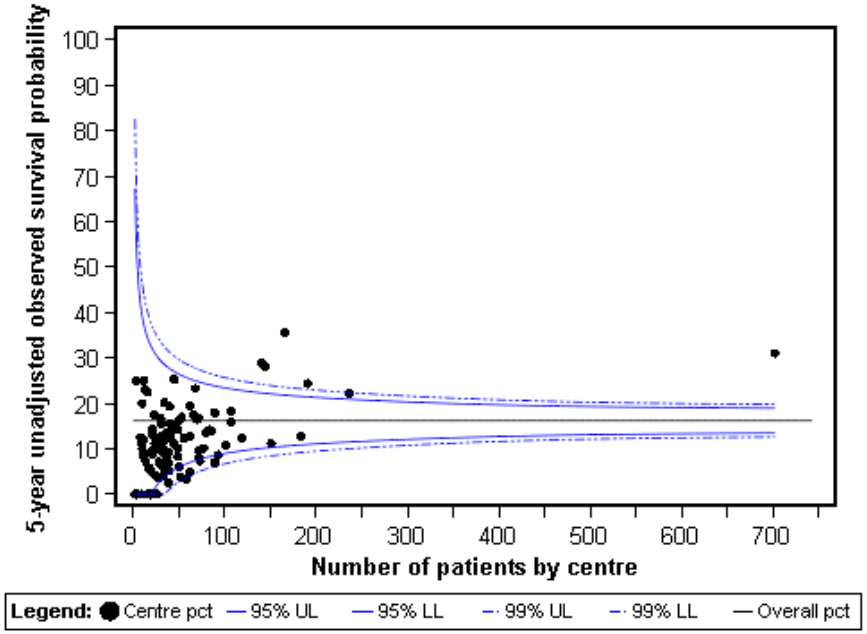
Overall survival

Most centres treating less than 150 patients within 5 years (around 30 patients who received a medical or surgical treatment yearly) obtained very similar results, falling within the 95% limits of the funnel plot, i.e. a 5-year observed survival below 30%. Variability was observed between medium-volume centres (around 30-50 patients per year) and the high-volume centre (around 140 patients per year) that reported slightly higher survival rates above the upper limits of the funnel plot (Figure 28 and Figure 29). Restricting the population to those who underwent a surgical resection increased the mean value of observed survival at the national level (38%) (Figure 30). Only one centre fell above the 99% upper limit, reaching a 45% survival rate for operated patients. Both figures that adjusted observed survival rates for age, sex and combined stage illustrated the relationship between the volume of patients (surgically treated) and their 5-year survival (Figure 30 and Figure 31). Only the highest volume centres fell above the upper limits of the plots.

Striking is the high overall (and relative) 5-year survival of the patients with an unknown centre (N=140 for oesophageal cancer). A possible explanation is that many of these patients had T1a cancer that was treated with endoscopic mucosal resection, a treatment that had no nomenclature code before June 2009.

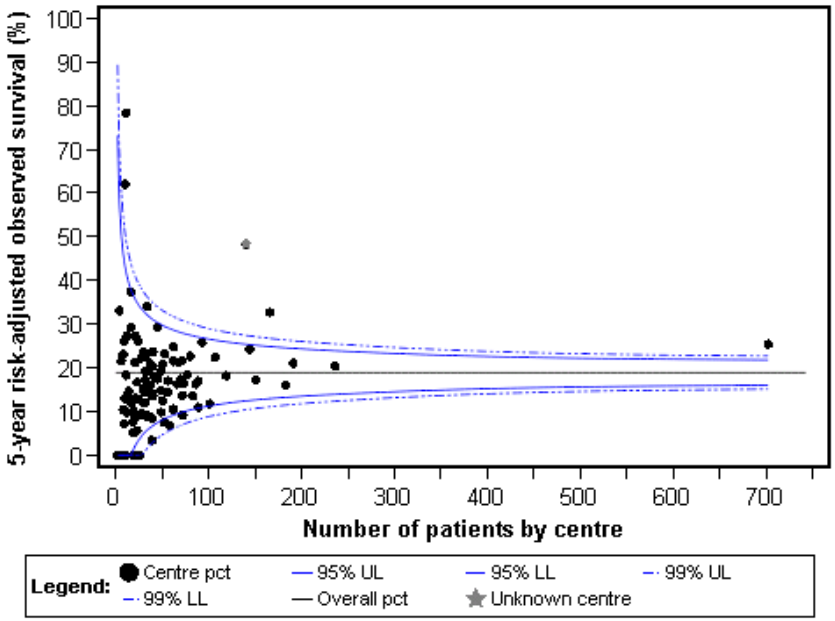
Finally, demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of oesophagectomies (<6, 6-19, ≥20 per year) were included in a multivariate analysis to predict 5-year observed mortality (Table 24). Multivariate Cox regression analysis showed that older age, advanced stage, squamous cell histological type and hospital volume of oesophagectomies were independently and significantly correlated with 5-year observed mortality of all patients with an oesophageal cancer. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Both patients in high-volume and medium-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.65; 95%CI 0.59–0.71 and HR 0.83; 95%CI 0.77–0.89, respectively).

Figure 28 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer, by centre



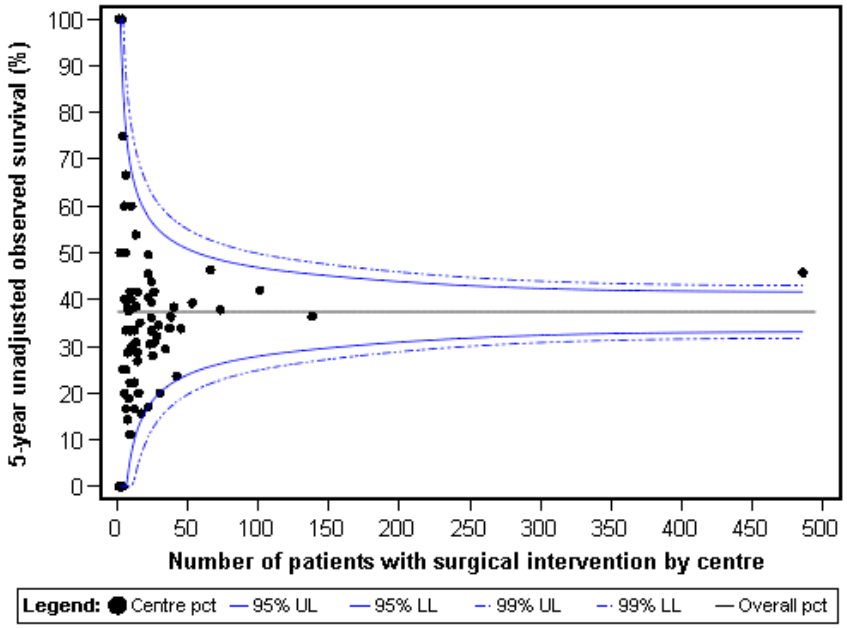
Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Figure 29 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer, by centre, adjusted for sex, age and combined stage



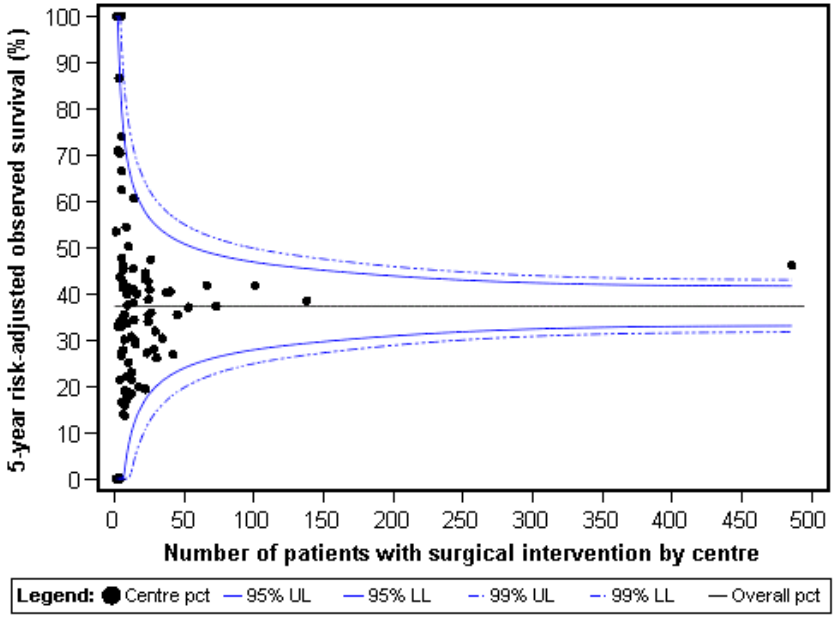
Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot. All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

Figure 30 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer who underwent surgical intervention, by centre



Note: For five centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Figure 31 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer who underwent surgical intervention, by centre, adjusted for sex, age and combined stage



Note: For five centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 24 – Oesophageal cancer: Multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality

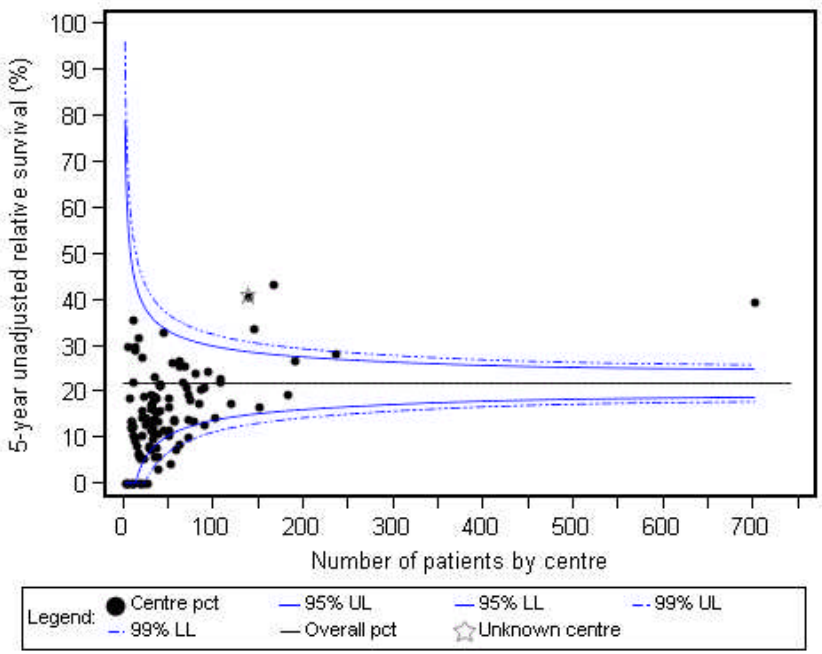
Variable	5-year overall mortality		
	Adjusted HR	95%CI	p-value
Sex			0.8879
Women (vs. men)	0.995	[0.926-1.069]	
Age			0.004
50-59y (vs. <50y)	1.200	[1.053-1.367]	
60-69y (vs. <50y)	1.251	[1.102-1.421]	
70+ (vs. <50y)	2.020	[1.787-2.283]	
Histological type			<0.001
AC (vs. SCC)	0.865	[0.811-0.922]	
Other (vs. SCC)	0.960	[0.822-1.122]	
Combined stage			0.001
II (vs. I)	2.319	[2.013-2.673]	
III (vs. I)	3.325	[2.895-3.818]	
IV (vs. I)	5.584	[4.877-6.394]	
X (vs. I)	4.409	[3.854-5.044]	
Hospital volume			<0.001
Medium (6-19 per year) (vs. ≤5 per year)	0.834	[0.774-0.899]	
High (20+ per year) (vs. ≤5 per year)	0.646	[0.591-0.707]	

* One patient was lost to follow up since the day of incidence and is excluded for survival analyses.

Relative survival

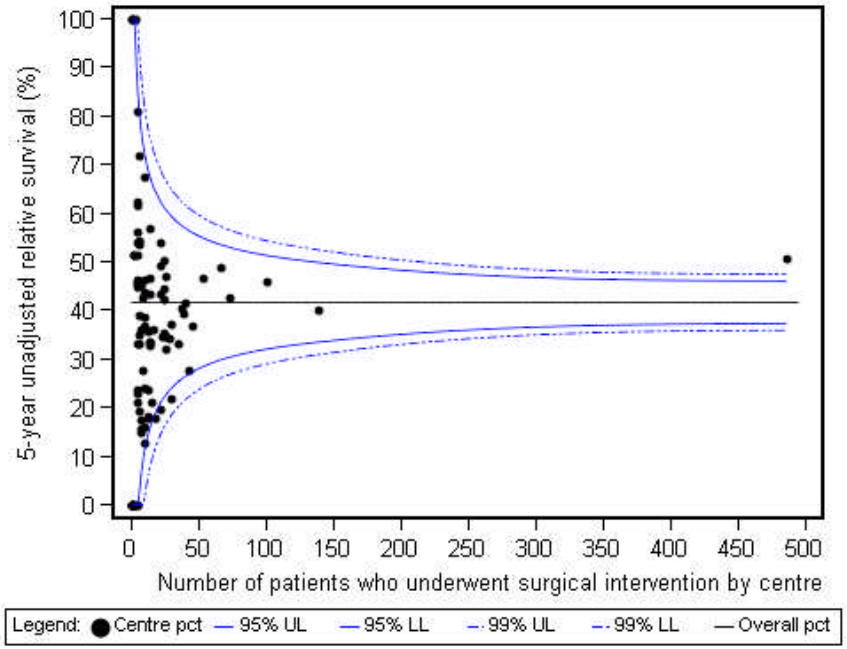
Figure 32 presents 5-year relative survival rates for the centres in which patients with oesophageal cancer were treated. While four centres reported lower survival than the 99% lower limit, nine additional centres reported lower rates than the 95% lower limit. These centres had a low volume of oesophageal cancer patients (maximum 30 patients who received a medical or surgical treatment yearly). Three centres fell above the 99% upper limit and reported higher survival rates than the nationwide value. Two of them treated 30-40 patients per year while the third recorded the highest volume of patients in the period 2004-2008 (around 140 patients per year). Restricting the patients' population to only those who underwent a surgical intervention increased the mean 5-year relative survival from 21.6% to beyond 40% (Figure 33). In that scenario, 92% of the centres fell between the 95% limits, revealing no high variability. The highest volume hospital fell beyond the 99% upper limit, indicating a significant higher 5-year relative survival compared with the other centres where surgical interventions were underwent.

Figure 32 – Funnel plot of the 5-year relative survival for patients diagnosed with oesophageal cancer, by centre



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

Figure 33 – Funnel plot of the 5-year relative survival for patients diagnosed with oesophageal cancer who underwent surgical intervention, by centre



Note: Three centres are not reported in the funnel plot because none of their patients have a theoretical follow up time of 5 years.

5.2.4. Volume

Various definitions of hospital volume were found in the literature [19]. The US Agency for Healthcare Research and Quality (AHRQ) defined high-volume as 6 oesophagectomies/year, whereas the US Leapfrog Group (a large coalition of private and public purchasers of health insurance in the USA, referring their patients to high-volume providers of oesophagectomies since 2000) used 13/year as threshold. Dikken et al. proposed the following categories [27]: very low (1–5/year), low (6–10/year), medium (11–20/year), and high (≥21/year).

According to the distribution of volumes per centre in Belgium, we decided to adopt three categories, low (<6/year), medium (6-19/year), and high (≥20/year), to fit as much as possible with international classifications and allow further comparisons.

5.2.4.1. High-volume care for oesophageal cancer

Using the criterion of at least 20 patients per year, only 2 Belgian hospitals could be considered high-volume hospitals. Between 2004 and 2008, 34.7% of the patients with oesophageal cancer were surgically treated in 1 of these 2 centres (Appendix 6.9, Table 119). This proportion remained quite stable, although it was somewhat lower in 2008 (29.8%). Older patients were less likely to be surgically treated in a high-volume hospital, although the difference was not statistically significant (Appendix 6.9, Table 120: 70+ vs. 70-, OR = 0.88, 95%CI 0.71-1.09). No statistically significant difference was found between men and women (Appendix 6.9, Tale 121: OR = 1.12, 95%CI 0.87-1.45), or between squamous cell carcinoma and adenocarcinoma (Appendix 6.9, Table 122).

5.2.4.2. Patient and tumour characteristics according to volume

Table 25 presents the distribution of patient characteristics (age, sex, ...) within each volume category. The proportion of women was slightly higher in low-volume centres than in high-volume centres (25.7% vs. 20.4%) and the proportion of older patients (70+) was also higher in low-volume centres (46.7% vs. 32.2%). High-volume centres also treated more adenocarcinomas (64.7% vs. 54.4%). All these factors have been accounted for in the volume-outcome analyses presented in the other sections.

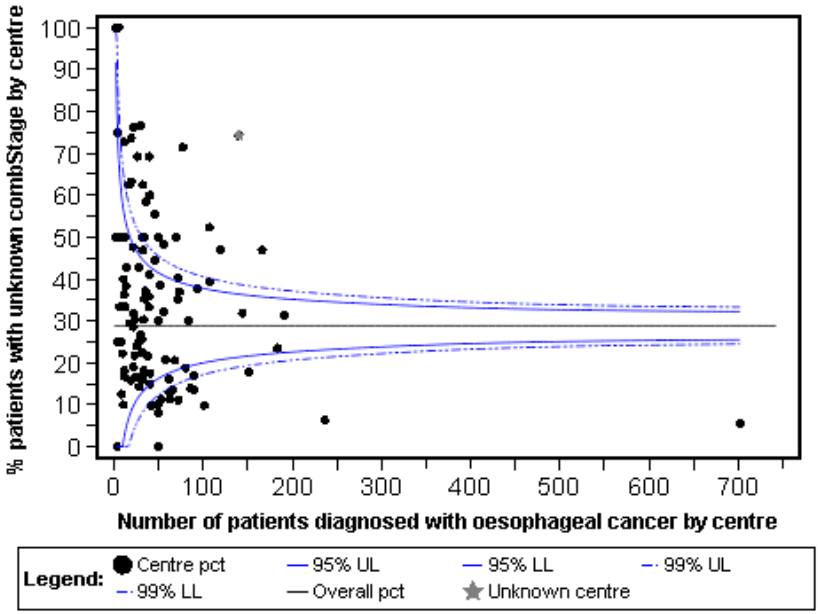
Striking are the differences in the reporting of the stage to the BCR: while in high-volume centres the percentage of missing stage was only 5.8%, these percentages attained 35.2% and 27.7% in low- and medium-volume centres, respectively. Figure 34 depicts the variability between centres to report the (combined) stage to the BCR.

Table 25 – Oesophageal cancer: Differences in case mix between

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (≥20 per year)	Total
N of hospitals	101	9	2	**112**
N of patients	3 675	1 200	938	**5 813**
Sex (%)				
Men	74.3	76.7	79.6	**75.6**
Women	25.7	23.3	20.4	**24.4**
Age (mean)	67.6	65.9	63.2	**66.6**
<50y (%)	6.6	8.6	12.3	**7.9**
50-59y (%)	20.9	23.7	25.7	**22.2**
60-69y (%)	25.9	27.8	29.9	**26.9**
70+ (%)	46.7	40.0	32.2	**43.0**
Type of tumour (%)				
Oesophageal	74.9	76.1	74.0	**75.0**
Junction	25.1	23.9	26.0	**25.0**
Histological type (%)				
AC	54.4	35.3	64.7	**56.2**
SCC	41.3	41.3	31.5	**39.7**
Other	4.3	3.5	3.8	**4.1**
Combined stage (%)				
I*	13.5	19.6	22.3	**16.6**
II*	23.4	27.7	23.9	**24.4**
III*	26.6	25.7	28.1	**26.7**
IV*	36.6	27.1	25.8	**32.3**
X	35.2	27.7	5.8	**28.9**

* Unknown stage (X) is excluded to calculate the percentages

Figure 34 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer with unknown combined stage (combStage), by centre



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.2.4.3. Outcome indicator results according to volume

Univariate analysis showed that age and hospital volume (<6, 6-19, ≥20 per year) were significantly predictive for the 30-day mortality (Appendix 6.4, Table 78), while age, histological type and hospital volume were predictive for the 90-day mortality (Appendix 6.4, Table 79). Type of tumour was also predictive for the 30-day and 90-day mortality, although not statistically significant. In a multivariate analysis with adjustment for sex, age, histological type, combined stage and hospital volume, both age and hospital volume remained significantly predictive for 30-day mortality, while age, histological type, combined stage and hospital volume were predictive for 90-day mortality (Table 26).

Demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of oesophagectomies (<6, 6-19, ≥20 per year) were also included in a multivariate analysis to predict 5-year observed mortality of patients who underwent an oesophagectomy. Multivariate Cox regression analysis showed that older age, advanced stage, squamous cell histological type and hospital volume of oesophagectomies were independently and significantly correlated with 5-year observed mortality. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.66; 95%CI 0.57–0.75).

Table 26 – Multivariate analysis using logistic regression model to predict the risk of 30-day and 90-day mortality after an oesophagectomy (N=1 723)

Variable	30-day mortality				90-day mortality			
	Observed %	Adjusted OR	95%CI	p-value	Observed %	Adjusted OR	95%CI	p-value
Sex				0.798				0.563
Women (vs. men)	5.9% vs. 4.5%	1.073	[0.624-1.846]		11.3% vs. 9.6%	0.888	[0.592-1.330]	
Age				0.004				<0.001
<50y (vs. ≥70y)	1.6% vs. 7.6%	0.187	[0.056-0.624]		3.7% vs. 16.1%	0.157	[0.070-0.354]	
50-59y (vs. ≥70y)	4.1% vs. 7.6%	0.487	[0.270-0.879]		8.5% vs. 16.1%	0.375	[0.244-0.577]	
60-69y (vs. ≥70y)	4.0% vs. 7.6%	0.479	[0.277-0.828]		7.7% vs. 16.1%	0.360	[0.240-0.541]	
Histological type				0.055				<0.001
SCC (vs. AC)	6.3% vs. 4.2%	1.825	[1.107-3.011]		14.8% vs. 7.8%	2.711	[1.886-3.897]	
Other (vs. AC)	4.0% vs. 4.2%	0.851	[0.195-3.717]		10.0% vs. 7.8%	1.214	[0.452-3.259]	
Combined stage				0.240				0.039
I (vs. IV)	3.6% vs. 6.4%	0.452	[0.202-1.010]		7.3% vs. 13.4%	0.422	[0.234-0.759]	
II (vs. IV)	4.9% vs. 6.4%	0.544	[0.261-1.137]		9.5% vs. 13.4%	0.477	[0.276-0.822]	
III (vs. IV)	4.0% vs. 6.4%	0.500	[0.233-1.075]		10.1% vs. 13.4%	0.601	[0.350-1.033]	
X (vs. IV)	8.4% vs. 6.4%	0.797	[0.336-1.890]		14.0% vs. 13.4%	0.634	[0.325-1.238]	
Hospital volume				<0.001				<0.001
Medium (6-19 per year) (vs. <6 per year)	5.1% vs. 7.4%	0.669	[0.397-1.128]		12.4% vs. 12.6%	0.994	[0.683-1.447]	
High (≥20 per year) (vs. <6 per year)	1.7% vs. 7.4%	0.226	[0.113-0.454]		5.0% vs. 12.6%	0.367	[0.235-0.573]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Table 27 – Multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality for patients with oesophageal cancer who underwent a surgical intervention

	5-year overall mortality		
Variable	**Adjusted HR**	**95%CI**	**p-value**
Sex			0.534
Women (vs. men)	0.956	[0.828-1.103]	
Age			<0.001
50-59y (vs. <50y)	1.326	[1.056-1.661]	
60-69y (vs. <50y)	1.367	[1.098-1.702]	
70+ (vs. <50y)	2.354	[1.895-2.923]	
Histological type			0.074
AC (vs. SCC)	0.930	[0.-11-1.067]	
Other (vs. SCC)	1.288	[0.942-1.762]	
Combined stage			<0.001
II (vs. I)	2.372	[1.966-2.863]	
III (vs. I)	3.613	[3.000-4.351]	
IV (vs. I)	5.702	[4.607-7.058]	
X (vs. I)	2.136	[1.659-2.751]	
Hospital volume			<0.001
Medium (6-19 per year) (vs. <6 per year)	0.928	[0.806-1.068]	
High (≥20 per year) (vs. <6 per year)	0.655	[0.571-0.751]	

5.2.4.4. Process indicator results according to volume

To explore the reasons for the volume-outcome relationship, the results for the process indicators were stratified by volume category (Table 28). High-volume centres had a higher proportion of patients discussed at the multidisciplinary team meeting and palliatively supported, but a lower proportion of patients treated with primary chemoradiotherapy. The differences in the proportion of patients staged with CT or treated with neoadjuvant treatment were less clear.

Table 28 – Process indicators for oesophageal cancer care by volume of centres

	Volume of centres (2004-2008)			
	Low (<6 per year)	**Medium (6-<20 per year)**	**High (≥20 per year)**	**Total**
N of hospitals	101	9	2	**112**
N of patients	3 675	1 200	938	**5 813**
Multidisciplinary discussion (%)	43.3	35.3	58.0	**44.0**
Staging CT neck/thorax/abdomen (%)	88.5	87.4	88.6	**88.3**
Neoadjuvant treatment (%)	38.9	51.9	43.0	**43.3**
Primary chemoradiotherapy (%)	23.6	20.8	11.4	**21.1**
Palliative support (%)	43.8	40.0	48.9	**44.0**

5.3. Gastric cancer

5.3.1. Diagnostic work-up

5.3.1.1. Staging CT

National results

Overall, between 2004 and 2008, 84.5% of the patients with gastric cancer received a CT thorax/abdomen within 1 month before and 1 month after incidence date (Appendix 6.11, Table 138). The proportion slightly increased between 2004 (83.3%) and 2008 (86.6%). Patients in the age category 60-69 years most frequently received a CT thorax/abdomen (88.7%). Patients younger than 50 years (78.1%; 50- vs. 50+: OR = 0.63; 95%CI 0.47 to 0.83) or aged 80 years and above (79.6%; 80+ vs. 80-: OR = 0.59, 95%CI 0.50 to 0.69) were least likely to receive a CT thorax/abdomen (Appendix 6.11, Table 139). The proportion was higher in men than in women (Appendix 6.11, Table 140: 87.0% vs. 81.2%; OR = 1.54, 95%CI 1.32 to 1.81). However, after stratification by age group, this

difference only remained statistically significant for the age categories 60-69 years (OR = 1.92, 95%CI 1.25 to 2.96) and 80 years and above (OR = 1.31, 95%CI 1.02 to 1.69) (Appendix 6.11, Table 141).

The proportion appeared to increase with cStage (Appendix 6.11, Table 142). Patients with an unknown cStage were less likely to receive a staging CT thorax/abdomen (cStage X vs. cStage 0-IV: OR = 0.46, 95%CI 0.38 to 0.56).

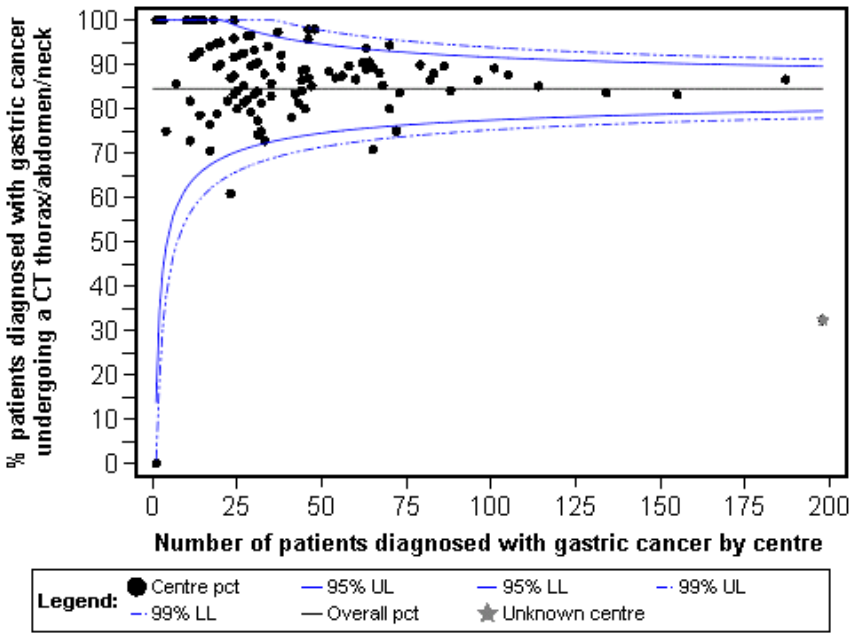
Patients receiving no major treatment (i.e. surgery, chemotherapy and/or radiotherapy) were less likely to receive a staging CT thorax/abdomen (Appendix 6.11, Table 143: OR = 0.25, 95%CI 0.21 to 0.29).

If the time period was extended until 3 months after incidence date, 88.3% of patients with gastric cancer received a CT thorax/abdomen (Appendix 6.11, Table 144).

Comparison between centres

The variability between the 115 centres included in the analysis was limited (Figure 35). Only 6 centres had a proportion below the 95%LL (Appendix 6.11, Table 145). In 18 centres, less than 80% of patients with gastric cancer received a CT thorax/abdomen. In 11 centres, all patients with gastric cancer received a CT thorax/abdomen.

Figure 35 – Funnel plot of the proportion of patients diagnosed with gastric cancer undergoing a CT neck/thorax/abdomen within 1 month before and one month after incidence, by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.3.1.2. Multidisciplinary discussion

National results

Overall, between 2004 and 2008, 37% of patients with gastric cancer were discussed at the MDT meeting within one month after incidence date (Appendix 6.10.1, Table 128). The proportion slightly increased from 33.0% in 2004 to 41.3% in 2008. No clear increase was found in relation with the cStage. Patients with cStage II gastric cancer were most often discussed at the MDT (61.3%) (Appendix 6.10.1, Table 129). Of the

patients without a registered cStage, only 25.8% were discussed at the MDT meeting.

No clear differences were found in the proportion of patients discussed at the MDT meeting across the different age categories, although the proportion tended to be lower in the 50- category (34.2%; 50- vs. 50+: OR = 0.87, 95%CI 0.69 to 1.11) and was significantly lower in the 80+ category (33.9%; 80+ vs. 80-: OR = 0.81; 95%CI 0.71 to 0.92) (Appendix 6.10.1, Table 130). The proportion tended to be higher in men than in women, without reaching statistical significance (Table 131: 38 vs. 36%; OR = 1.09, 95%CI 0.96 to 1.23). However, this difference disappeared with stratification by age group (Appendix 6.10.1, Table 132).

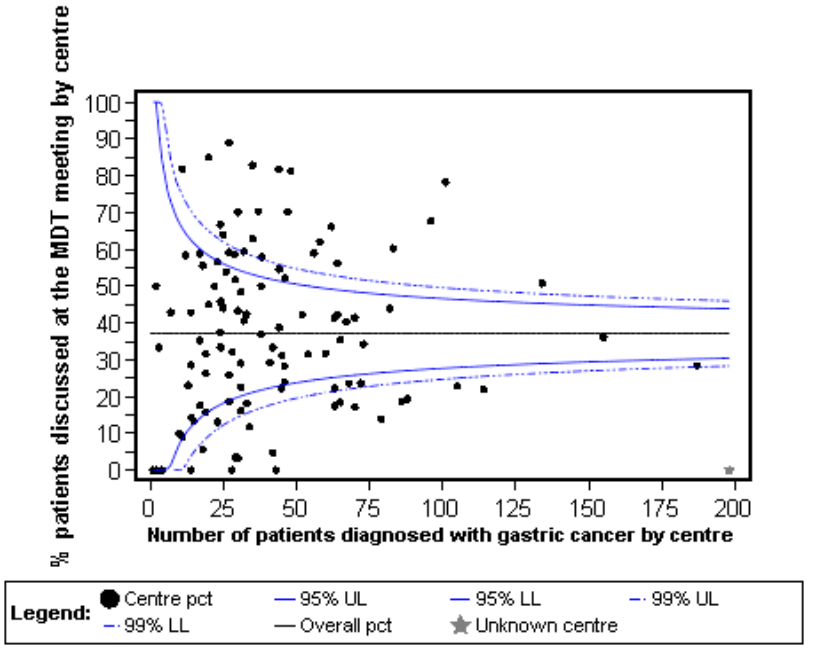
When the proportion was calculated according to the treatment type, patients receiving no major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were less likely to be discussed at a multidisciplinary team meeting (Appendix 6.10.1, Table 133: OR = 0.56, 95%CI 0.49 to 0.64).

If the time period was extended until 3 months after incidence date, 52.7% of patients with gastric cancer were discussed at the MDT meeting (Appendix 6.10.1, Table 134). The proportion only slightly increased further to 56.1% if the time period was extended until 6 months after incidence date. However, specifically looking at the data for 2008, approximately 62% of patients with gastric cancer were discussed at a multidisciplinary team meeting within 6 months after incidence date.

Comparison between centres

An important variability was found across the 115 centres included in the analysis (Figure 36). Twenty-six centres had a proportion below the 95%LL (Appendix 6.10.1, Table 135). Only 6 centres discussed at least 80% of their patients with gastric cancer in a multidisciplinary meeting, none of the centres discussed at least 90% of their patients. If only the two most recent years were considered (2007-2008), the variability slightly improved, although this may have been due to lower sample sizes (Appendix 6.10.1, Figure 88 and Table 136). Extending the time period until 3 months after the incidence date also had a minor impact on variability (Appendix 6.10.1, Figure 89 and Table 137).

Figure 36 – Funnel plot of the proportion of patients diagnosed with gastric cancer discussed at the MDT meeting, by centre (2004-2008)



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.3.2. Treatment

5.3.2.1. Neoadjuvant treatment

National results

Overall, between 2004 and 2008, of all patients with gastric cancer beyond the mucosa (known cStage T_{2-4} N_{any} M_0) who underwent surgical resection, 20.7% received neoadjuvant treatment (Appendix 6.12, Table 146). This proportion increased over time, from 8.4% in 2004 to 37.8% in 2008 (Appendix 6.12, Table 146). When patients with T_4 tumours were excluded, the proportion only slightly decreased (from 20.7% to 19.6%) (Appendix 6.12, Table 147).

The proportion of patients who received neoadjuvant treatment was clearly higher among patients with more advanced stages (stage III-IV vs. I-II: 34.9% vs. 11.6%; OR = 4.08, 95%CI 2.55 to 6.56) (Appendix 6.12, Table 148).

As the majority of patients had adenocarcinoma, no subgroup analysis could be done by histological type (Appendix 6.12, Table 149).

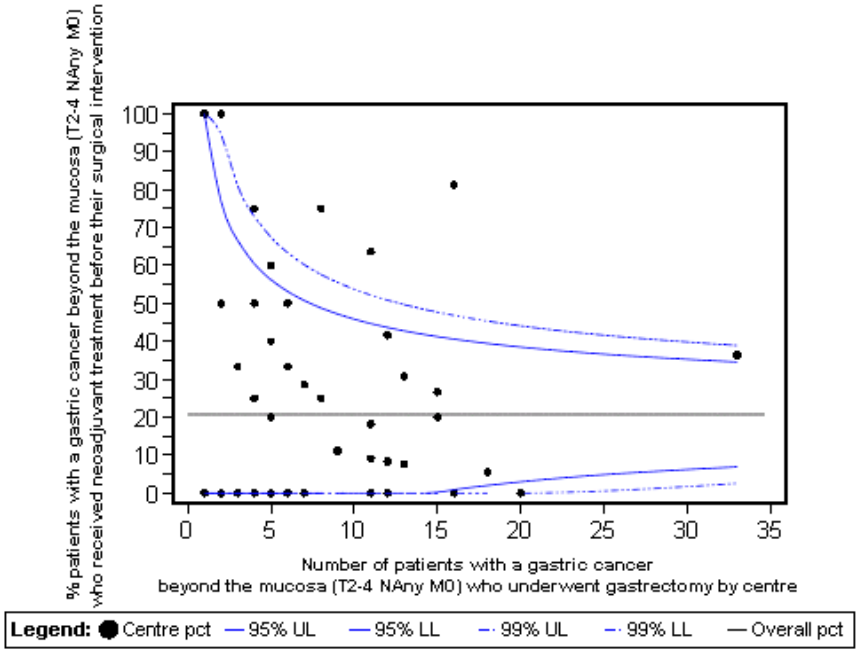
Clear differences were also found in the proportion of patients with T_{2-4} N_{any} M_0 gastric cancer treated with neoadjuvant treatment according to age. The proportion decreased from 31.7% before 70 years to 12.4% after 70 years (OR = 3.26, 95%CI 2.04 to 5.22). Only two of the 98 patients older than 80 years received neoadjuvant treatment (Appendix 6.12, Table 150).

No significant differences were observed in the proportion of patients receiving neoadjuvant treatment according to sex (OR = 0.99, 95%CI 0.63 to 1.57) (Appendix 6.12, Table 151 and Table 152).

Comparison between centres

Figure 37 shows the variability between centres for the use of neoadjuvant treatment, based on the 2004-2008 data. The highest volume centre surgically treated a total of 33 patients with a known cStage (T_{2-4} N_{any} M_0) between 2004 and 2008. As the majority of the very small volume centers contributed very few data, 89.3% of them fell within the expected limits of the funnel plot. Only 6 centres (6.45%) were above the 99% upper limit (Appendix 6.12, Table 153). Restricting the analyses to the two last available years (2007 and 2008) did not change the global picture (Appendix 6.12, Figure 92).

Figure 37 – Funnel plot of the proportion of patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant chemotherapy before their gastrectomy, by centre (2004-2008)



5.3.2.2. Palliative chemotherapy

National results

Overall, of all patients diagnosed with metastatic gastric cancer between 2004 and 2008, 42% received combination chemotherapy within 1 month before and 3 months after incidence date (Appendix 6.14, Table 166). The proportion slightly increased between 2004 (40.4%) and 2008 (47.9%).

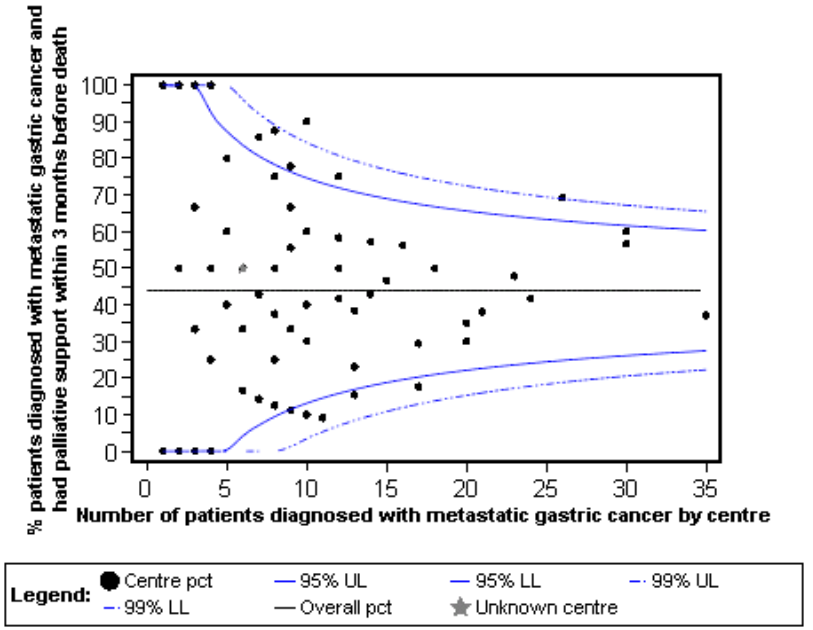
A clear decrease with age was found (Appendix 6.14, Table 167). Patients aged 70 years and above were significantly less likely to receive combination chemotherapy (OR = 0.17, 95%CI 0.13 to 0.23). In addition, Appendix 6.14, Table 168: OR = 0.75, 95%CI 0.57-1.00). However, after stratification by age category this gender difference only remained significant for the age category 70-79 years (Appendix 6.14, Table 169).

When the time period was extended until 6 months after incidence date, the proportion slightly increased to 45.1% (Appendix 6.14, Table 170).

Comparison between centres

The variability between the 105 centres included in the analysis is limited (Figure 38). Only 3 centres had a proportion below the 95%LL (Appendix 6.14, Table 171). In 14 centres, no patient received combination chemotherapy. On the contrary, in 9 centres all patients received combination chemotherapy.

Figure 38 – Funnel plot of the proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 months after incidence date), by centre



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.3.2.3. Palliative support

National results

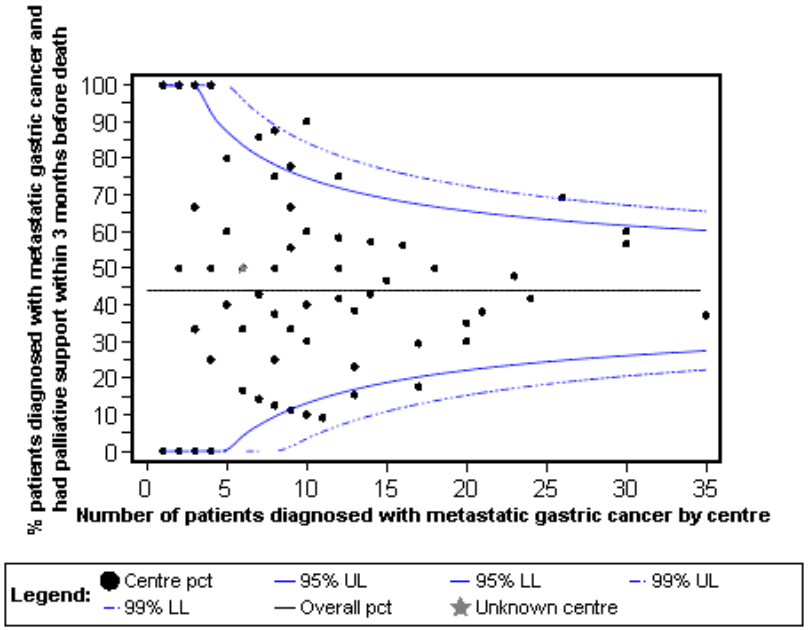
Overall, of all patients diagnosed with metastatic gastric cancer between 2004 and 2008 that died before January 1st 2010, 43.9% received palliative support within 3 months before death (Appendix 6.15, Table 172). No clear time trend was found, although the highest rate was clearly found for 2009 (55.3%).

Important differences were found across the Belgian provinces, with the highest rates found in Namur (63.2%) and the lowest in Brussels (27.3%) and Liège (27.5%) (Appendix 6.15, Table 173). Younger patients were more likely to receive palliative support than older patients (60- vs. 60+: OR = 1.58, 95%CI 1.11 to 2.25) (Appendix 6.15, Table 174). No important difference was found between men and women (men vs. women: OR = 0.92, 95%CI 0.69 to 1.23) (Appendix 6.15, Table 175 and Table 176).

Comparison between centres

The variability between the 105 centres included in the analysis was limited (Figure 39 and Appendix 6.15, Figure 97). Six centres had a proportion below the 95%LL (Appendix 6.15, Table 177). In 28 centres, more than 50% of the patients received palliative support within 3 months before death. In contrast, in 14 centres no patient received palliative support.

Figure 39 – Funnel plot of the proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death), by centre (2004-2008)



All patients that could not be attributed to a centre were regrouped and marked with an asterix on the funnel plot.

5.3.3. Outcomes

5.3.3.1. Postoperative mortality

National results

Overall, between 2004 and 2008, 5.6% of the 2 408 patients with gastric cancer that underwent gastric resection and for whom the vital status was known died within 30 days after surgery (Appendix 6.13, Table 155). The proportion varied between 2004 and 2008, and was the lowest in 2006 (4.1%) and exceptionally high in 2005 (8.3%). No clear difference was found according to sex (Appendix 6.13, Table 156 and Table 158). However, the 30-day mortality clearly increased with age (Appendix 6.13, Table 157Table 157: 80+ vs. 80-, OR = 2.89, 95%CI 1.99 to 4.18).

Patients treated with neoadjuvant therapy in general tended to have a lower 30-day mortality, although the difference did not reach statistical significance (Appendix 6.13, Table 159: OR = 0.66, 95%CI 0.32 to 1.31). Similar trends were found for patients treated with neoadjuvant chemotherapy (Appendix 6.13, Table 160: OR = 0.59, 95%CI 0.29 to 1.16).

When the period was extended to 60 and 90 days, the postoperative mortality rose to 8.7% and 12.0%, respectively (Appendix 6.13, Table 161).

Comparison between centres

The unadjusted funnel plot shows little variability between the 111 centres that were included in the analysis (Figure 40). However, after adjustment for age and combined stage, the variability becomes more pronounced (Figure 41). Adjusted for age and combined stage, 26 centres had a 30-day mortality above 10%, and 6 centres even had a 30-day mortality above 20%. Eight centres had an adjusted 30-day mortality above the 95%UL (Appendix 6.13, Table 165). In contrast, 42 centres had an adjusted 30-day mortality below 1%.

Multivariate analysis showed that centres performing at least 20 gastrectomies per year had a lower 30-day mortality than those performing less than 6 gastrectomies per year, although the effect was not statistically significant (adjusted OR = 0.33, 95%CI 0.08 to 1.37) (Appendix 6.13, Table 162). This is further discussed in chapter 5.3.4.3.

Figure 40 – Funnel plot of the 30-day mortality rate after a gastrectomy, by centre

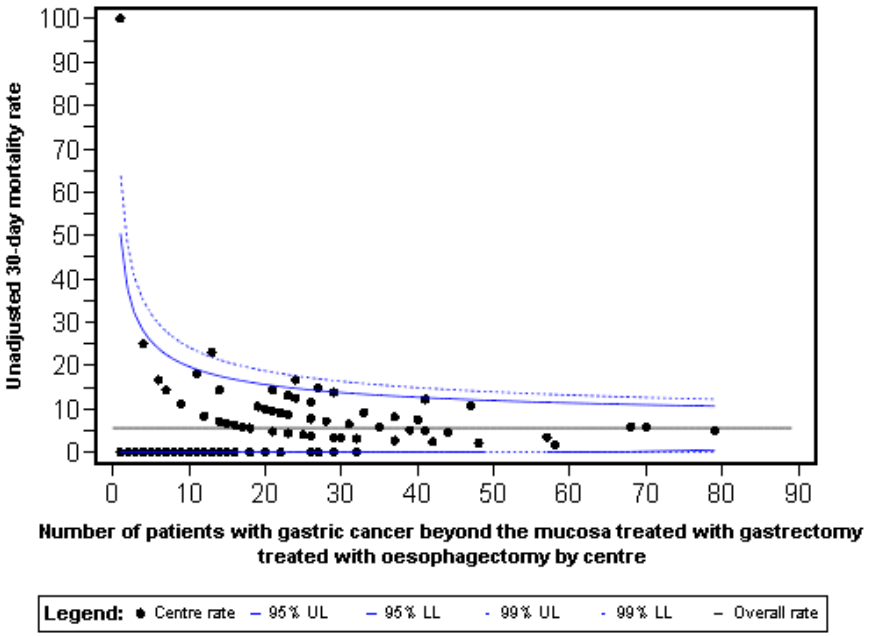
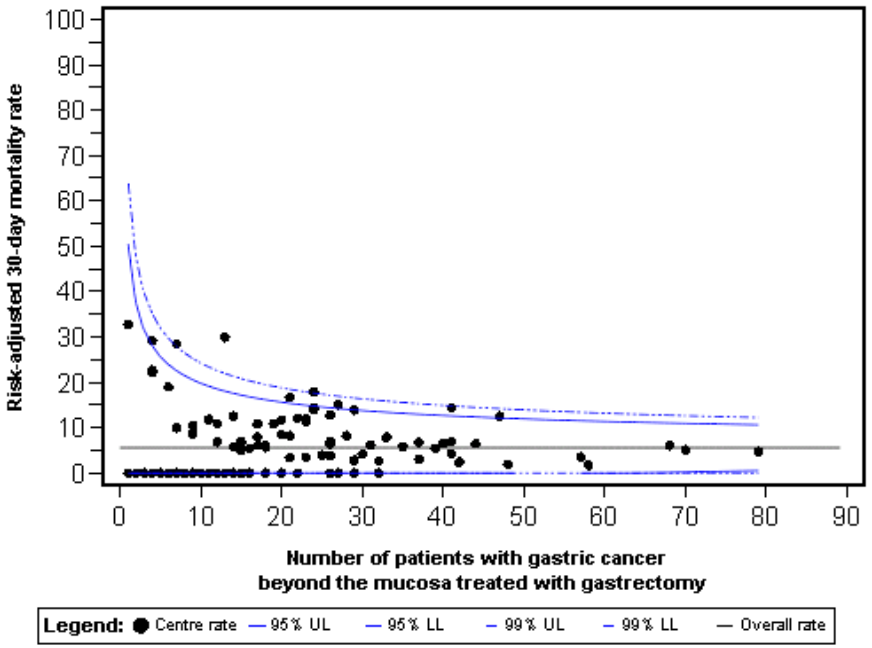


Figure 41 – Funnel plot of the 30-day mortality rate after a gastrectomy, by centre, adjusted for age and combined stage



Note: Due to a low sample size for most centres and low percentages of deaths, one should be careful with the interpretation of adjusted rates; small changes might have a significant impact on the adjusted rate (observed rate / expected rate).

5.3.3.2. Survival

National results

Overall survival

Gastric cancer affects slightly more men than women (Appendix 6.17, Table 187). Gastric cancer is most frequently diagnosed in men and women of 70 years or older. The mean age at diagnosis was 71 years in men and 73 years in women. This distribution of mean age at diagnosis led to obtain a similarly very low overall survival at 5 years, although women had a little survival advantage on their male counterparts (Appendix 6.17, Table 187). Gastric cancer remains difficult to cure, primarily because most patients present with advanced disease. Considering the age groups, younger patients were more likely to be alive 5 years after their diagnosis than older patients (Appendix 6.17, Table 188; Figure 108 and Figure 109). In all age groups, survival rates were higher in women than in men, whatever the follow-up period, even for the oldest ones (≥80 years) (Appendix 6.17, Table 188).

In stage I, observed survival declined from 81.9% (1 year) to 57.9% (5 years) in men and from 79.5% to 58.3% in women. In stage III, the decline was more pronounced to reach 17.6% in men and 17.1% in women after 5 years. For stage IV, 5-year overall survival is low both for men (3.7%) and women (2.8%).

Relative survival

Five-year relative survival, i.e. survival corrected for age- and gender-specific background mortality, was slightly higher than 5-year overall survival in both sex groups (22.3% in men and 25.3% in women, respectively). This is particularly true for stages I and II where the differences are the largest, indicating that other causes of mortality play a role during a 5-year period after incidence date. In stages III and IV, the majority of deaths were caused by the presence of the gastric cancer, since 5-year relative and overall survival cancer were very close (Appendix 6.16, Table 181 and Table 189).

Women were more likely to have an undocumented combined stage (38.7% vs. 32.2%). Men with undocumented cancer stages had a 5-year relative survival that was between the survival rates reported for stages III and IV, whereas for women, the picture is less clear.

After two years, the relative survival for all those with undocumented stages was between survival rates reported for stages II and III (Appendix 6.16, Table 181, Figure 100 and Figure 101).

In 72% of all gastric cancers, the anatomical localization was not specified (Appendix 6.16, Table 182). Around 15% of gastric tumours were located in the pyloric antrum. In men, tumours located in the pyloric antrum had a better prognosis at 5-year (37.7%) than tumours located in the body of stomach (31.9%) or in the fundus (32.7%) (Appendix 6.16, Table 182 and Figure 102). A higher proportion of men were diagnosed with an adenocarcinoma than with another histological type (93.9% vs. 6.9%). The 5-year relative survival was close for both types (28.2% vs. 30.6% of survivors; p<0.44) (Appendix 6.16, Table 183 and Figure 104). In women also, tumours located in the pyloric antrum had a better prognosis at 5-year (38.4%) than tumours located in the body of stomach (18.1%) or in the fundus (32.6%) (Appendix 6.16, Table 182 and Figure 103). A high proportion of adenocarcinoma was diagnosed (90.0% vs. 10%). The 5-year relative survival of women with an adenocarcinoma was significantly lower than survival for women with another histological type (28.9% vs. 53.3%; p<0.0001) (Appendix 6.16, Table 183 and Figure 105), and similar to survival of men with adenocarcinoma (28.9% vs. 28.2%; p=0.60). On the contrary, women with another histological type were more likely to be alive at 5 years than men with another histological type (53.3% vs. 30.6%; p<0.0001) (Appendix 6.16, Table 183, Figure 104 and Figure 105).

In Belgium, 5-year relative survival was higher than rates reported in Europe, both for resected cancers (47.2%) and for non-resected cancers (16.4% in women and 7.9% in men) (Appendix 6.16, Table 184).

Comparison between centres

Overall survival

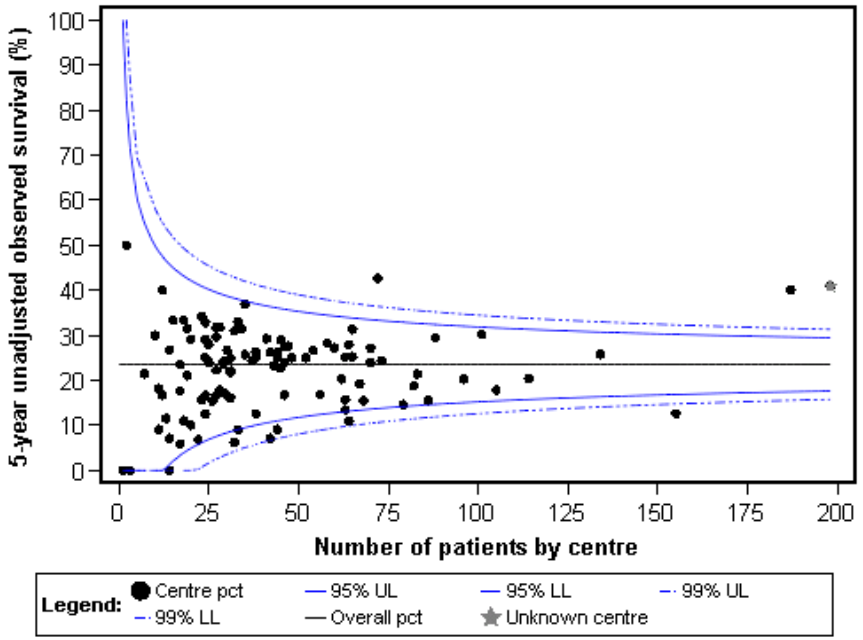
Most centres treating (medically or surgically) less than 150 patients within 5 years obtained very similar results, falling within the 95% limits of the funnel plot (Figure 42). Restricting the population to those who underwent a surgical resection increased the observed survival at the level of the country (from 24% to 38%). Only one centre fell above the 99% upper limit, reaching a 55% survival rate for operated patients. This centre reported the highest volume of operated patients (110 patients operated within 5 years) (Figure 44).

However, when adjusted for age, sex and combined stage a less clear relationship was found between volume of patients and 5-year survival (Appendix 6.17, Figure 113 and Figure 117), particularly when only operated patients were considered (Appendix 6.17, Figure 117).

Striking is the high overall (and relative) 5-year survival of the patients with an unknown centre. A plausible explanation is that many of these patients had T1a cancer that was treated with endoscopic mucosal resection or endoscopic submucosal dissection, a treatment that had no nomenclature code before June 2009.

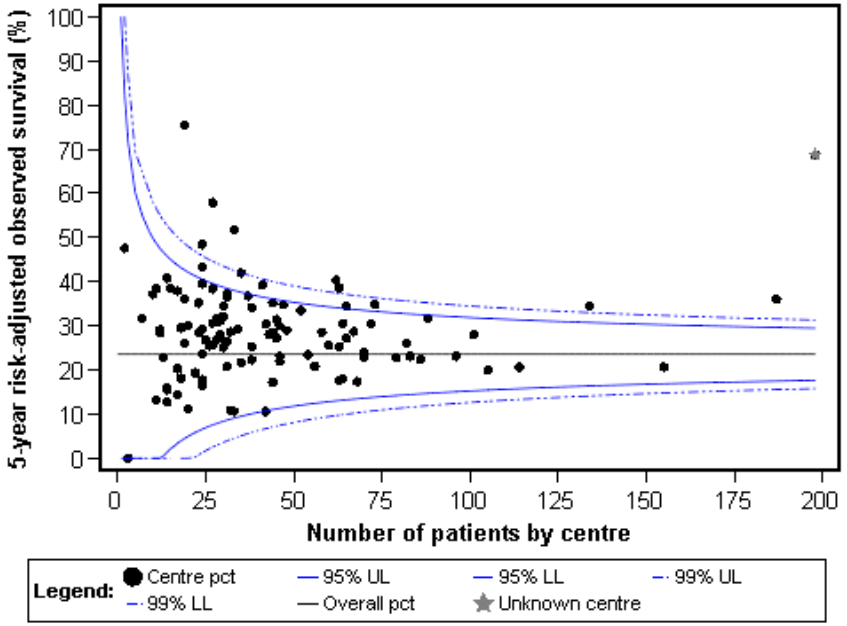
Demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of gastrectomies (<6, 6-19, ≥20 per year) were included in a multivariate analysis to predict 5-year observed mortality (Table 29). Multivariate Cox regression analysis showed that gender (higher mortality in men), older age, advanced stage and adenocarcinoma histological type were independently and significantly correlated with 5-year observed mortality of all patients with a gastric cancer. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR = 0.75; 95%CI 0.62 to 0.91).

Figure 42 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer, by centre



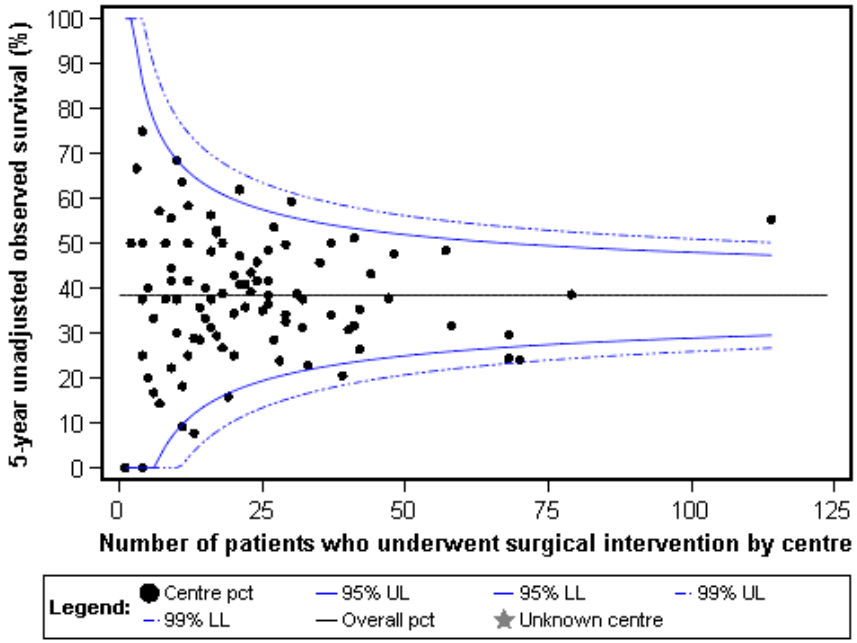
Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Figure 43 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer, by centre, adjusted for sex, age and combined stage



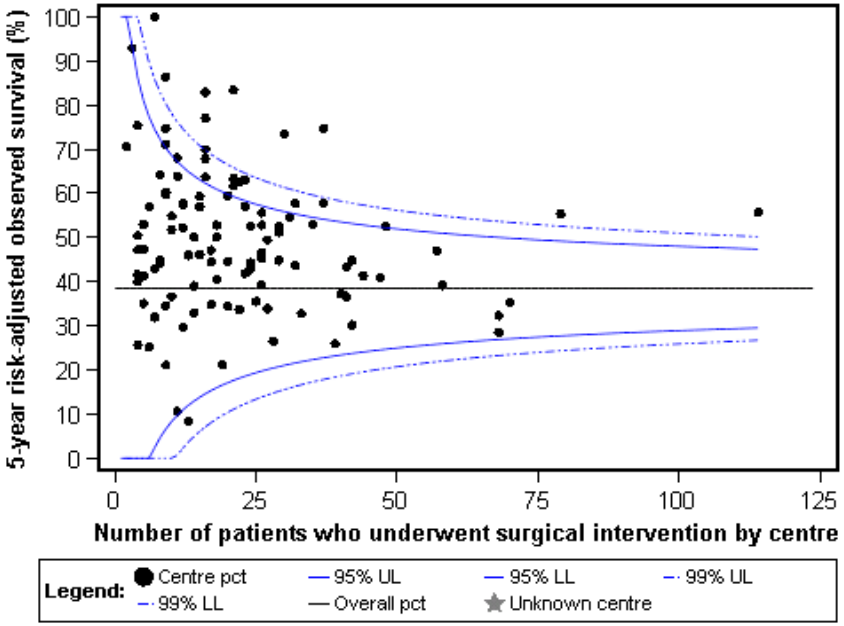
Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot. All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

Figure 44 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre



Note: For two centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot

Figure 45 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre, adjusted for sex, age and combined stage



Note: For two centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

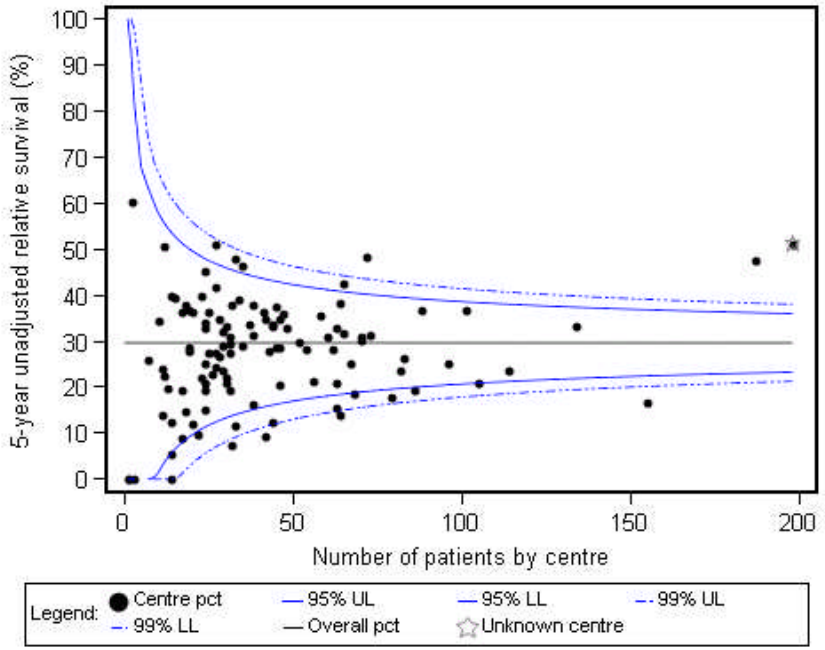
Table 29 – Gastric cancer: Multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality

	5-year observed mortality		
Variable	**Adjusted HR**	**95%CI**	**p-value**
Sex			0.002
Women (vs. men)	0.897	[0.839-0.959]	
Age			<0.001
50-59y (vs. <50y)	1.423	[1.180-1.716]	
60-69y (vs. <50y)	1.568	[1.324-1.857]	
70-79y (vs. <50y)	2.005	[1.707-2.354]	
80+ (vs. <50y)	3.380	[2.879-3.969]	
Histological type			<0.001
Other (vs. AC)	0.708	[0.620-0.807]	
Combined stage			<0.001
II (vs. I)	1.647	[1.414-1.917]	
III (vs. I)	3.042	[2.656-3.485]	
IV (vs. I)	6.422	[5.687-7.251]	
X (vs. I)	4.189	[3.728-4.709]	
Hospital volume			<0.001
Medium (6-19 per year) (vs. <6 per year)	1.081	[1.011-1.155]	
High (≥20 per year) (vs. <6 per year)	0.749	[0.617-0.908]	

Relative survival

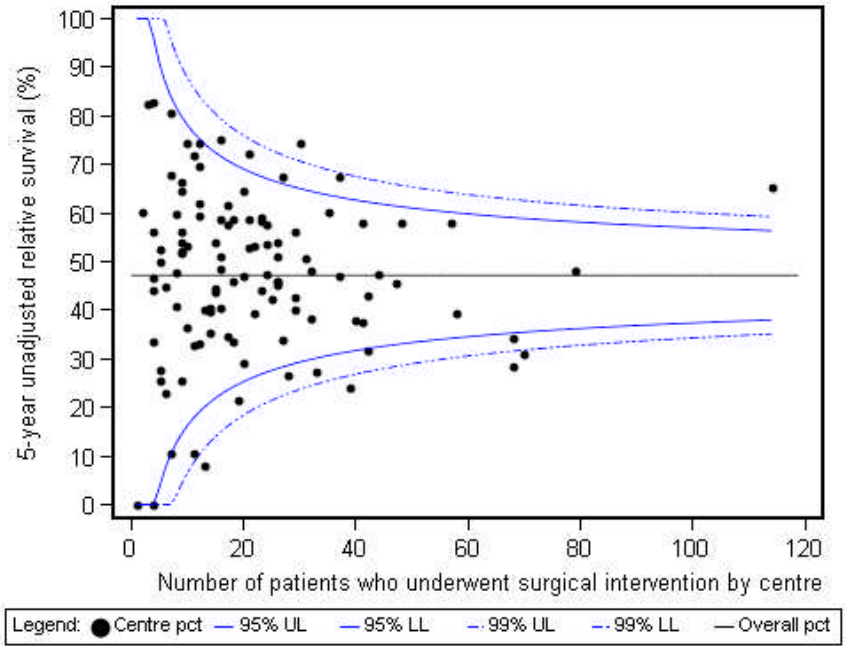
Figure 46 presents the 5-year relative survival rates for the centres in which patients with gastric cancer were treated. While four centres reported lower survival rates than the 99% lower limit, 9 additional centres reported lower rates than the 95% lower limit (Appendix 6.16, Table 185). Most of these centres clearly recorded a very low volume of gastric cancer patients (maximum 15 patients who received a medical or surgical treatment yearly). However, one of them recorded a higher yearly volume, i.e. around 30 patients. Two centres fell above the 99% upper limit, reporting higher survival rates than the nationwide value. One of them treated 15 patients per year while the other one recorded the highest volume of patients in the period 2004-2008 (38 patients per year). Restricting the patients' population to only those who underwent a surgical intervention increased the mean 5-year relative survival from 30% to 45% (Figure 47). In that scenario, 85.3% of the centres fell between the 95% limits, revealing no high variability. The highest volume hospital fell above the 99% upper limit, indicating a significantly higher 5-year relative survival compared with the other centres.

Figure 46 – Funnel plot of the 5-year relative survival for patients diagnosed with a gastric cancer, by centre



Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot. All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

Figure 47 – Funnel plot of the 5-year relative survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre



Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

5.3.4. Volume

To be in line with the volume definitions for oesophageal cancer (see paragraph 5.2.4), the following three volume categories were used for gastric cancer: low (<6/year), medium (6-19/year), and high (≥20/year).

5.3.4.1. High-volume care for gastric cancer

Using the criterion of at least 20 patients per year, only 1 Belgian hospital could be considered a high-volume hospital. Between 2004 and 2008, 4.7% of the patients with gastric cancer were surgically treated in this high-volume centre (Appendix 6.18, Table 200). This proportion remained quite stable, although it was higher in 2006 (7.2%). Older patients were less likely to be surgically treated in a high-volume hospital (Appendix 6.18, Table 201: 70+ vs. 70-, OR = 0.55, 95%CI 0.37 to -0.82). No statistically significant difference was found between men and women (Appendix 6.18, Table 202: OR = 1.27, 95%CI 0.86 to 1.88), or by stage (Appendix 6.18, Table 203).

5.3.4.2. Patient and tumour characteristics according to volume

Table 30 presents the distribution of patient characteristics (age, sex, ...) within each volume category. The proportion of women was slightly lower in low-volume centres than in high-volume centres (42.1% vs. 48.1%) and the proportion of older patients (80+) was also higher in low-volume centres (36.3% vs. 21.4%). High-volume centres also treated less stage IV patients (28.0% vs. 36.0%%). All these factors have been accounted for in the volume-outcome analyses presented in the other sections.

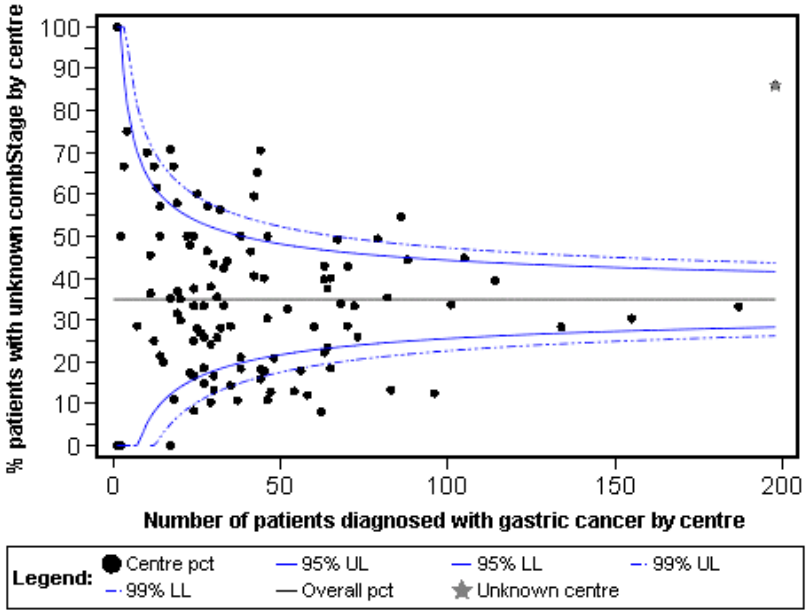
The differences in the reporting of the stage to the BCR are less striking than for oesophageal cancer: while in high-volume centres the percentage of missing stage was 33.2%, these percentages attained 39.3% and 31.2% in low- and medium-volume centres, respectively. Figure 48 depicts the variability between centres to report the (combined) stage to the BCR.

Table 30 – Gastric cancer: Differences in case mix between low-, medium- and high-volume centres

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (≥20 per year)	Total
N of hospitals	80	34	1	**115**
N of patients	2 173	2 487	187	**4 847**
Sex (%)				
Men	57.9	58.6	51.9	**58.1**
Women	42.1	41.4	48.1	**41.9**
Age (mean)	73.4	71.2	67.1	**72.0**
<50y (%)	5.8	7.3	19.9	**6.9**
50-59y (%)	8.2	10.5	13.4	**9.6**
60-69y (%)	17.2	20.2	23.0	**19.0**
70-79y (%)	32.5	32.3	28.3	**32.2**
80+ (%)	36.3	29.8	21.4	**32.4**
Histological type (%)				
AC	90.7	92.8	91.4	**91.8**
Other	9.3	7.2	8.6	**8.2**
Combined stage (%)				
I*	28.0	29.1	36.0	**28.9**
II*	17.1	15.3	15.2	**16.0**
III*	19.0	18.7	20.8	**18.9**
IV*	36.0	36.9	28.0	**36.2**
X	39.3	31.2	33.2	**34.9**

* Unknown stage (X) is excluded to calculate the percentages

Figure 48 – Funnel plot of the proportion of patients diagnosed with gastric cancer with unknown combined stage (combStage), by centre



All patients that could not be attributed to a centre were grouped and marked with an asterix on the funnel plot.

5.3.4.3. Outcome indicator results according to volume

Univariate analysis showed that age, stage and incidence year were significantly predictive for the 30-day mortality (Appendix 6.13, Table 162) and 90-day mortality (Appendix 6.13, Table 163). Hospital volume was not found to be a prognostic factor. In a multivariate analysis with adjustment for sex, age, histological type, combined stage and hospital volume, both age and stage remained significantly predictive for both outcomes (Table 31).

Table 31 – Multivariate analysis using logistic regression model to predict the risk of 30-day and 90-day mortality after a gastrectomy (N=2 408)

	30-day mortality			90-day mortality		
Variable	**Adjusted OR**	**95%CI**	**p-value**	**Adjusted OR**	**95%CI**	**p-value**
Sex			0.479			0.087
Women (vs. men)	0.876	[0.607-1.264]		0.793	[0.608-1.034]	
Age			<0.001			<0.001
<50y (vs. ≥80y)	0.159	[0.056-0.449]		0.128	[0.061-0.271]	
50-59y (vs. ≥80y)	0.226	[0.106-0.483]		0.183	[0.106-0.318]	
60-69y (vs. ≥80y)	0.168	[0.086-0.326]		0.239	[0.160-0.355]	
70-79y (vs. ≥80y)	0.514	[0.346-0.765]		0.433	[0.322-0.582]	
Histological type			0.577			0.608
Other (vs. AC)	1.261	[0.559-2.846]		1.170	[0.642-2.134]	
Combined stage			<0.001			<0.001
I (vs. IV)	0.421	[0.244-0.725]		0.317	[0.216-0.464]	
II (vs. IV)	0.433	[0.233-0.804]		0.38	[0.249-0.580]	
III (vs. IV)	0.808	[0.481-1.358]		0.616	[0.425-0.893]	
X (vs. IV)	1.134	[0.646-1.990]		0.855	[0.566-1.291]	
Hospital volume			0.291			0.403
Medium (6-<20 per year) (vs. <6 per year)	0.902	[0.629-1.294]		0.908	[0.699-1.178]	
High (≥20 per year) (vs. <6 per year)	0.326	[0.077-1.368]		0.614	[0.286-1.317]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Finally, demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of gastrectomies (<6, 6-19, ≥20 per year) were also included in a multivariate analysis to predict 5-year observed mortality of patients who underwent a gastrectomy (Table 32). Multivariate Cox regression analysis showed that gender (higher mortality in men), older age, advanced stage and adenocarcinoma histological type were independently and significantly correlated with 5-year observed mortality. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR = 0.73; 95%CI 0.55 to 0.97).

Table 32 – Multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality of patients who underwent surgical intervention

	5-year observed mortality		
Variable	**Adjusted HR**	**95%CI**	**p-value**
Sex			0.426
Women (vs. men)	0.958	[0.861-1.065]	
Age			<0.001
50-59y (vs. <50y)	1.293	[0.987-1.695]	
60-69y (vs. <50y)	1.318	[1.029-1.687]	
70-79y (vs. <50y)	1.830	[1.447-2.315]	
80+ (vs. <50y)	3.018	[2.372-3.839]	
Histological type			0.036
Other (vs. AC)	1.286	[1.017-1.627]	
Combined stage			<0.001
II (vs. I)	1.881	[1.578-2.243]	
III (vs. I)	3.897	[3.326-4.566]	
IV (vs. I)	6.989	[5.935-8.230]	
X (vs. I)	2.313	[1.904-2.810]	
Hospital volume			0.005
Medium (6-<20 per year) (vs. <6 per year)	1.110	[0.998-1.235]	
High (≥20 per year) (vs. <6 per year)	0.730	[0.546-0.975]	

5.3.4.4. Process indicator results according to volume

To explore the reasons for the volume-outcome relationship, the results for the process indicators were stratified by volume category (Table 33). High-volume centres had a lower proportion of patients discussed at the multidisciplinary team meeting, but a higher proportion of patients treated with neoadjuvant treatment and palliatively supported. The differences in the proportion of patients staged with CT or treated with palliative chemotherapy were less clear.

Table 33 – Process indicators for gastric cancer care by volume of centres

	Volume of centres (2004-2008)			
	Low (<6 per year)	**Medium (6-<20 per year)**	**High (≥20 per year)**	**Total**
N of hospitals	80	34	1	**115**
N of patients	2 173	2 487	187	**4 847**
Multidisciplinary discussion (%)	37.4	37.6	28.3	**37.1**
Staging CT neck/thorax/abdomen (%)	82.0	86.6	86.6	**84.5**
Neoadjuvant treatment (%)	15.9	22.6	36.4	**20.7**
Palliative chemotherapy (%)	37.5	45.3	42.3	**42.0**
Palliative support (%)	43.6	43.9	47.8	**43.9**

6. DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

For the discussion, conclusions and recommendations of this report, the reader is referred to the synthesis, which can be downloaded from the KCE website as a separate file.

APPENDICES

APPENDIX 1. SEARCH STRATEGY

1. exp esophageal neoplasms/
2. (esophag$ adj5 neoplas$).tw.
3. (oesophag$ adj5 neoplas$).tw.
4. (esophag$ adj5 cancer$).tw.
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8. (esophag$ adj5 tumo$).tw.
9. (oesophag$ adj5 tumo$).tw.
10. (esophag$ adj5 metasta$).tw.
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12. (esophag$ adj5 malig$).tw.
13. (oesophag$ adj5 malig$).tw.
14. exp stomach neoplasms/
15. (stomach adj5 neoplas$).tw.
16. (stomach adj5 cancer$).tw.
17. (stomach adj5 carcin$).tw.
18. (stomach adj5 tumo$).tw.
19. (stomach adj5 metasta$).tw.
20. (stomach adj5 malig$).tw.
21. (gastric adj5 neoplas$).tw.
22. (gastric adj5 cancer$).tw.
23. (gastric adj5 carcin$).tw.
24. (gastric adj5 tumo$).tw.
25. (gastric adj5 metasta$).tw.
26. (gastric adj5 malig$).tw.
27. exp Esophagogastric Junction/
28. (neoplas$ or cancer$ or carcin$ or tumo$ or metasta$ or malig$).tw.
29. exp Cardia/
30. or/1-26
31. (egj or ogj).mp.
32. (gej or goj).mp.
33. 27 or 29 or 31 or 32
34. 28 and 33
35. 30 or 34
36. "Quality of Health Care"/
37. Patient Care Management/
38. "Organization and administration"/
39. Quality Assurance, Health Care/
40. Quality Indicators, Health Care/
41. 36 or 37 or 38 or 39 or 40
42. 35 and 41

APPENDIX 2. OVERVIEW OF QUALITY INDICATORS

Item	Recommendation(s)	GOR	LoE	QI		Source	S/P/O
Oesophageal cancer							
Staging	All patients diagnosed with oesophageal cancer should be discussed at a multidisciplinary meeting	Strong	Low	O1	Proportion of patients diagnosed with oesophageal cancer discussed at the MDT before any treatment	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
				O2	Proportion of patients with an oesophageal cancer discussed at a MDT (stratified according to surgical volumes: <10, 10-20, >20 per year)	Werkgroep IKNL	Process
	In patients with newly diagnosed oesophageal cancer, CT scan of the neck (including lower neck region), thorax and abdomen should be performed routinely	Strong	Low	O3	Proportion of patients diagnosed with oesophageal cancer undergoing a CT thorax/abdomen before any treatment	KCE guideline (+Courrech Staal 2010)	Process
	Endoscopic ultrasonography (EUS), combined with fine needle aspiration cytology (FNAC) if technically feasible, should be considered to evaluate locoregional invasion (T and N stage) and celiac lymph nodes in patients with oesophageal cancer	Strong	Low	O4	Proportion of patients diagnosed with oesophageal cancer undergoing an EUS/FNA before any treatment	KCE guideline (+Courrech Staal 2010)	Process
				O5	Proportion of patients with vizualization of the celiac axis with EUS in the setting of non-obstructive oesophageal cancer staging	Coe, S. G., M. Raimondo, et al. (2009). "Quality in EUS: an assessment of baseline compliance and performance improvement by using the American Society for Gastrointestinal Endoscopy-American College of Gastroenterology quality indicators." Gastrointest Endosc 69(2): 195-201.	Process
				O6	Proportion of patients with oesophageal cancer staged with EUS having TNM status reported in the EUS report		Process
				O7	Proportion of patients with FNA performed on celiac lymph nodes vizualized during staging of thoracic		Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
					oesophageal cancer		
	PET/CT should be considered for M staging if a patient with T2-4 N+ oesophageal cancer is a candidate for a curative treatment after CT and EUS	Strong	Low	O8	Proportion of patients diagnosed with oesophageal cancer undergoing a FDG-PET after a CT and an EUS before any treatment	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
	The following examinations can be considered for specific indications: MRI, bronchoscopy +/- bronchial ultrasonography (BUS) +/- biopsy, thoracoscopy, or laparoscopy	Weak	Low		Weak recommendation, no QI proposed		
	Generic staging indicators			O9	Accuracy of staging (eg correlation between cStage and pStage) in relation with presence of dedicated thoracic imaging specialists (radiologists, nuclearists), dedicated endoscopists	KCE guideline	Outcome
				O10	Delay between diagnosis and first treatment	KCE guideline	Outcome
Treatment of mucosal cancer	When T1a oesophageal cancer is suspected, diagnostic staging endoscopic mucosal resection (EMR) should be performed whenever possible. If the diagnosis is pathologically confirmed, this procedure can be considered therapeutic, taking into account well-defined criteria relating to stage, size, length of Barrett, histological type, differentiation grade, lymphovascular invasion and completeness of resection	Strong	Low	O11	Proportion of patients diagnosed with T1a oesophageal cancer who underwent a EMR	KCE guideline	Process
				O12	Proportion of patients diagnosed with T1a oesophageal cancer undergoing EMR that had an en bloc resection	KCE guideline	Outcome
	Mucosal ablative techniques, such as argon plasma coagulation (APC), photodynamic therapy (PDT), radiofrequency ablation	Strong	Low	O13	Proportion of patients diagnosed with T1a oesophageal cancer who underwent APC, PDT, RFA or	KCE guideline	Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
	(RFA) or laser, are investigational and should be limited to units with appropriate expertise				laser treatment		
Neoadjuvant treatment	If after multidisciplinary discussion neoadjuvant treatment is considered for a locally-advanced oesophageal tumour (T2-4 N+ M0), neoadjuvant chemoradiotherapy is recommended	Strong	Low	O14	Proportion of patients with oesophageal cancer undergoing neoadjuvant chemoradiation	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
				O15	Proportion of patients with a potentially resectable oesophageal cancer who received neoadjuvant treatment before their surgical intervention	Werkgroep IKNL	Process
				O16	Proportion of patients with oesophageal cancer treated with neoadjuvant chemoradiotherapy that die before surgery	KCE guideline	Outcome
				O17	Incidence of grade 3/4 toxicity related to neoadjuvant chemoradiation	KCE guideline	Outcome
				O18	Delay between end of induction chemoradiation and surgery	KCE guideline	Outcome
Response assessment & restaging	The use of PET and EUS (with or without FNA) for the assessment of treatment response early in the course or after neoadjuvant treatment remains strictly investigational and requires a central prospective registration of all cases	Weak	Low		Weak recommendation, no QI proposed		
Surgery	Surgical resection is considered standard treatment for patients with resectable oesophageal cancer	Strong	High	O19	Proportion of patients with resectable oesophageal cancer who undergo oesophagectomy	KCE guideline	Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
	Surgery for oesophageal cancer should be aimed at achieving an R0 resection, and should be considered preferentially through a transthoracic en bloc resection	Strong	High	O20	Proportion of patients with resectable oesophageal cancer who underwent a transthoracic/transhiatal resection	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
				O21	Proportion of surgically treated patients who had a R0 resection		Process
	Minimally invasive oesophagectomy is under development and is not recommended in routine practice	Weak	Low		Weak recommendation, no QI proposed		
	Extensive two-field lymphadenectomy should be standard during oesophagectomy to improve staging, local disease control and potentially cure rate. The recommended minimum number of lymph nodes removed and examined is 10 for T1, 15 for T2 and 30 for T3/T4	Strong	Low	O22	Proportion of patients with Type I tumour who were treated by a radical transthoracic oesophagectomy and two-field lymphadenectomy of abdominal and thoracic lymph nodes	Werkgroep IKNL	Process
				O23	Number of resected lymph nodes (high vs low)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Outcome
	Three-field lymphadenectomy during oesophagectomy is strictly investigational	Weak	Low		Weak recommendation, no QI proposed		
	Oesophageal cancer surgery should be carried out in high-volume specialist units with experience and/or specialist training in oesophageal and gastro-oesophageal junction cancer	Strong	Low	O24	Hospital volume (high vs. low)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43. AHRQ quality indicators.	Structure
				O25	Surgeon volume (high vs. low)		Structure
				O26	Specialty training (general vs. thoracic surgeon)		Structure
				O27	ICU-physician staffing (daily rounds vs. no daily rounds)		Structure
				O28	ICU nurse-to-patient ratio (1 or		Structure

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
					2 vs. at least 3 pts per nurse)	Inpatient quality indicators: technical specifications [version 4.2]. IQI #1 esophageal resection volume. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2010 Sep. 2 p.	
				O29	Centralization (referral vs. regional centre)		Structure
				O30	Proportion of patients with oesophageal cancer treated in a dedicated unit familiar with major oesophageal surgery	KCE guideline	Process
				O31	Number of surgical resections of oesophagus and cardia per year	Werkgroep IKNL	Structure
	Generic surgery indicators			O32	Thoracic Epidural Analgesia (Yes versus no)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
				O33	In-hospital mortality (no vs yes)	Wouters, M. W., H. E. Karim-Kos, et al. (2009). "Centralization of esophageal cancer surgery: does it improve clinical outcome?" Ann Surg Oncol 16(7): 1789-98.	Outcome
				O34	Duration of ICU-stay (5 days versus 6 days)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Outcome
				O35	Postoperative complication (yes vs no; technical vs no complication; pneumonia vs no pneumonia)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Outcome

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
				O36	Anastomotic leak rate	KCE guideline	Outcome
				O37	Reintervention (none, 1, 2 ≥3)	Wouters, M. W., H. E. Karim-Kos, et al. (2009). "Centralization of esophageal cancer surgery: does it improve clinical outcome?" Ann Surg Oncol 16(7): 1789-98.	Outcome
				O38	Esophageal resection mortality rate - within 30 days and within 60 days (denominator: number of surgical resections, to split between transthoracic and transhiatal approach)	AHRQ quality indicators. Inpatient quality indicators: technical specifications [version 4.2]. IQI #8 esophageal resection mortality rate. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2010 Sep. 2 p. / Werkgroep NL	Outcome
Adjuvant treatment	Adjuvant treatment is not recommended for patients with oesophageal cancer	Strong	Low	O39	Proportion of patients with oesophageal cancer who received adjuvant treatment	KCE guideline	Process
Non-surgical treatment with curative intent	Definitive concomitant chemoradiotherapy should be considered in patients with oesophageal cancer who have locally advanced disease that is considered unresectable, in patients who are unfit for surgery, or in patients who decline surgery	Strong	Mode rate	O40	Proportion of T4bM0 patients (inoperable and irresectable) treated with definite chemoradiotherapy	Werkgroep IKNL	Process
	Definitive concomitant chemo-radiotherapy can be considered for patients with cervical oesophageal cancer in order to preserve the larynx	Weak	Low	O41	Proportion of patients with cervical oesophageal cancer that received definite concomitant chemoradiotherapy	KCE guideline	Process
Metastatic disease	Control of obstruction caused by oesophageal cancer should be obtained with stent placement or laser/ argon plasma coagulation (APC) therapy, depending on the local availability and expertise	Strong	High	O42	Proportion of patients with inoperable/unresectable obstructive oesophageal cancer who receive palliative treatment with stent or laser or APC therapy	KCE guideline	Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
	Partially covered self-expanding metal stents or plastic expandable stents are the best options for palliation of dysphagia caused by oesophageal cancer	Strong	Moderate	O43	Proportion of patients with dysphagia caused by an inoperable/unresectable oesophageal cancer who receive a partially covered self-expanding metal stent or plastic expandable stent	KCE guideline	Process
	Laser therapy, argon plasma coagulation (APC) therapy or restenting should be considered for control of tumour ingrowth or overgrowth in stented patients	Strong	Low	O44	Proportion of stented patients with tumour ingrowth or overgrowth treated with laser therapy, APC or restenting	KCE guideline	Process
	The use of oesophageal dilatation alone should be avoided	Weak	Low		Weak recommendation, no QI proposed		
	Oesophagectomy (transthoracic or transhiatal) should not be performed with palliative intent in patients with oesophageal cancer	Strong	Low	O45	Proportion of patients with inoperable/unresectable oesophageal cancer who underwent a transthoracic/transhiatal oesophagectomy	KCE guideline	Process
	Substernal bypass for oesophageal cancer should not be performed with palliative intent	Strong	Low	O46	Proportion of patients with inoperable/unresectable oesophageal cancer who underwent a substernal bypass	KCE guideline	Process
	In patients with locally advanced or metastatic cancer of the oesophagus, chemotherapy or chemoradiotherapy are treatment options that should be discussed in the multidisciplinary team	Weak	High	O47	Proportion of patients with inoperable/unresectable oesophageal cancer who received chemotherapy or chemoradiotherapy	KCE guideline	Process
	Palliative external-beam radiotherapy or endoluminal brachytherapy should be considered in patients with dysphagia from oesophageal cancer and with the perspective of a more prolonged survival	Strong	Low	O48	Proportion of patients with dysphagia caused by an inoperable/unresectable oesophageal cancer and with the perspective of a more prolonged survival who receive palliative EBRT or endoluminal	KCE guideline	Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
					brachytherapy		
	Patients with oesophageal cancer should have access to a specialist palliative care team, in particular in relation to comfort and symptom control, nutrition and quality of life	Strong	Low	O49	Proportion of patients with inoperable/unresectable oesophageal cancer who benefit from palliative team support	KCE guideline	Process
Follow-up	It is recommended that the follow-up of patients treated for oesophageal cancer includes a physical examination and blood analysis every three months, and a CT scan every six months in the first year and afterwards annually until the fifth year	Weak	Very low	O50	Proportion of patients with curatively treated oesophageal cancer that received follow-up according to the guidelines	KCE guideline	Process
	Patients treated with endoscopic mucosal resection (EMR) should have a follow-up endoscopy after three months, then every six months in the first two years, and then annually	Weak	Very low		Weak recommendation, no QI proposed		
Treatment of recurrent disease	In patients with recurrent oesophageal cancer, treatment options should be discussed in the multidisciplinary team	Strong	Very low	O51	Proportion of patients with recurrent oesophageal cancer discussed at the MDT meeting	KCE guideline	Process
	In patients with a local recurrence or new tumour after endoscopic mucosal resection (EMR), treatment options, including local treatment, should be discussed in the multidisciplinary team	Strong	Very low				
Generic indicators				O52	Pathology reporting (Accurateness of reporting)	Courrech Staal, E. F., M. W. Wouters, et al. (2010). "Quality-of-care indicators for oesophageal cancer surgery: A review." Eur J Surg Oncol 36(11): 1035-43.	Process
				O53	5-year overall survival	KCE guideline	Outcome

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
				O54	5-year disease-specific survival	KCE guideline	Outcome
				O55	Recurrence rate	KCE guideline	Outcome
Gastric cancer							
Staging	Treatment options for patients with gastric cancer should be discussed at the multidisciplinary team meeting	Strong	Low	G1	Proportion of patients diagnosed with gastric cancer discussed at the MDT before any treatment	KCE guideline	Process
	In patients with newly diagnosed gastric cancer, CT scan of the chest and abdomen should be performed routinely	Strong	Low	G2	Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen before any treatment	KCE guideline	Process
	Endoscopic ultrasonography can be considered in patients to be treated with curative intent based on clinical presentation and/or CT. Fine-needle aspiration cytology of suspicious lymph nodes can be considered if technically feasible	Weak	Low		Weak recommendation, no QI proposed		
	The following examinations can be considered for specific indications: PET scan, Magnetic Resonance Imaging, laparoscopy	Weak	Low		Weak recommendation, no QI proposed		
	Generic staging indicators			G3	Accuracy of staging (eg correlation between cStage and pStage) in relation with presence of dedicated thoracic imaging specialists (radiologists, nuclearists), dedicated endoscopists	KCE guideline	Outcome
				G4	Delay between diagnosis and first treatment	KCE guideline	Outcome
Treatment of mucosal cancer	When T1a gastric cancer is suspected, diagnostic staging endoscopic mucosal resection	Weak	Low		Weak recommendation, no QI proposed		

Item	Recommendation(s)	GOR	LoE	QI		Source	S/P/O
	(EMR) or endoscopic submucosal dissection (ESD) should be performed whenever possible. If the diagnosis is pathologically confirmed, the procedure can be considered therapeutic, taking into account well-defined criteria relating to stage, size, histological type, lymphovascular invasion, differentiation grade and completeness of resection						
				G5	Proportion of patients diagnosed with T1a gastric cancer undergoing EMR/ESD that had an en bloc resection	KCE guideline	Outcome
	Mucosal ablative techniques, such as photodynamic therapy (PDT), laser or argon plasma coagulation (APC), cannot be recommended as a curative option for patients with T1a gastric cancer	Weak	Very low	Weak recommendation, no QI proposed			
Neoadjuvant treatment	If after multidisciplinary discussion neoadjuvant treatment is considered for a locally-advanced gastric tumour (T2-4 N+ M0), neoadjuvant chemotherapy is recommended	Strong	Moderate	G6	Proportion of patients with gastric cancer treated with neoadjuvant treatment, that received neoadjuvant chemotherapy alone	KCE guideline	Process
				G7	Proportion of patients with gastric cancer treated with neoadjuvant chemotherapy that die before surgery	KCE guideline	Outcome
				G8	Incidence of grade 3/4 toxicity related to neoadjuvant chemotherapy	KCE guideline	Outcome
				G9	Delay between end of induction chemotherapy and surgery	KCE guideline	Outcome
Surgery	Surgical resection should be considered standard treatment for	Strong	Low	G10	Proportion of patients with resectable gastric cancer who	KCE guideline	Process

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
	patients with resectable gastric cancer				undergo resective surgery		
	Surgery for gastric cancer should aim at achieving an R0 resection	Strong	Low	G11	Proportion of surgically treated patients who had a R0 resection	KCE guideline	Process
	D2 lymphadenectomy (with a minimum of 15 lymph nodes removed and examined) performed in high-volume, specialized units with experience and/or specialist training should be standard during gastrectomy	Weak	Low	G12	Hospital volume (high vs. low)	KCE guideline	Structure
				G13	Proportion of patients with gastric cancer treated in a dedicated unit familiar with major gastric surgery	KCE guideline	Process
				G14	Number of resected lymph nodes (high vs low)	KCE guideline	Outcome
	Splenectomy and pancreatectomy should not be considered standard practice during gastrectomy if no disease infiltration in the spleen or pancreas is present	Weak	Low		Weak recommendation, no QI proposed		
	Laparoscopic surgery is strictly investigational	Weak	Low		Weak recommendation, no QI proposed		
	Generic surgery indicators			G15	In-hospital mortality (no vs yes)	KCE guideline	Outcome
				G16	Postoperative complication (yes vs no; technical vs no complication; pneumonia vs no pneumonia)	KCE guideline	Outcome
				G17	Anastomotic leak rate	KCE guideline	Outcome
				G18	Reintervention (none, 1, 2 ≥3)	KCE guideline	Outcome
				G20	Gastric resection mortality rate - within 30 days and within 60 days (denominator: number of	KCE guideline	Outcome

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
					surgical resections)		
Adjuvant treatment	Patients with gastric cancer who received neoadjuvant chemotherapy can be considered for postoperative chemotherapy	Weak	Low	G21	Proportion of patients with gastric cancer treated with neoadjuvant chemotherapy, that received postoperative chemotherapy	KCE guideline	Process
	Postoperative chemotherapy and chemoradiotherapy are optional treatments for patients with gastric cancer who did not receive neoadjuvant chemotherapy, and are not routinely recommended	Weak	Low	G22	Proportion of patients with gastric cancer not treated with neoadjuvant chemotherapy that received postoperative chemotherapy of chemoradiotherapy	KCE guideline	Process
	Postoperative adjuvant radiotherapy is not recommended for patients with gastric cancer	Weak	Low		Weak recommendation, no QI proposed		
Metastatic disease	Palliative gastric surgery is limited to symptomatic stenoses, bleeding tumours and perforation	Weak	Low		Weak recommendation, no QI proposed		
	For patients with malignant gastric outlet obstruction, treatment options include endoscopic stenting or surgical gastroenterostomy	Weak	Low		Weak recommendation, no QI proposed		
	In patients with locally advanced or metastatic cancer of the stomach with good performance status combination chemotherapy is recommended	Strong	High	G23	Proportion of patients with inoperable gastric cancer that received combination chemotherapy	KCE guideline	Process
	Patients with gastric cancer should have access to a specialist palliative care team, in particular in relation to comfort and symptom control, and quality of life	Strong	Low	G24	Proportion of patients with inoperable/unresectable gastric cancer who benefit from palliative team support	KCE guideline	Process
Follow-up	It is recommended that the follow-up of patients treated for gastric cancer includes a physical examination and blood analysis	Weak	Very low		Weak recommendation, no QI proposed		

Item	Recommendation(s)	GOR	LoE		QI	Source	S/P/O
	every three months, and a CT scan every six months in the first year and afterwards annually until the fifth year						
	Patients treated with endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD) should have a follow-up endoscopy after three months, then every six months in the first two years, and then annually	Weak	Very low		Weak recommendation, no QI proposed		
Treatment of recurrent disease	In patients with recurrent gastric cancer, treatment options should be discussed in the multidisciplinary team	Strong	Very low	G25	Proportion of patients with recurrent gastric cancer discussed at the MDT meeting	KCE guideline	Process
	In patients with a local recurrence or new tumour after endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD), treatment options, including local treatment, should be discussed in the multidisciplinary team	Strong	Very low				
Generic indicators				G26	Pathology reporting (Accurateness of reporting)	KCE guideline	Process
				G27	5-year overall survival	KCE guideline	Outcome
				G28	5-year disease-specific survival	KCE guideline	Outcome
				G29	Recurrence rate	KCE guideline	Outcome

APPENDIX 3. CONSTRUCTION OF AN ALGORITHM TO ASSIGN A PATIENT TO A CENTRE

Appendix 3.1. Introduction

Patients in general, and for this study more specifically patients with oesophageal/gastric cancer, often visit multiple centres during their care pathway. Because an important aim of this study was to describe the variability in results for quality indicators by centre, it was necessary to construct an algorithm to assign each individual patient with oesophageal/gastric cancer to one centre, namely the centre with the highest impact on the quality of care for that specific patient.

Appendix 3.2. Method

For this project, identification of the centre was possible using the BCR data in combination with the IMA data.

- **BCR data:** The centre of the oncological care program that first reported the tumour to the Cancer Registry was taken into account in the algorithm.
- **IMA data:** The centre that was specified in the variable SS00085 was taken into account in the algorithm for a selection of medical acts/interventions, i.e. major surgery (i.e. oesophagectomy/gastrectomy – Appendix 8.3), chemotherapy (Appendix 8.3.2), radiotherapy (Appendix 8.3.3) and discussion of the patient at the multidisciplinary team meeting (MDT – Appendix 8.1.1). The centre that was specified in the variable SS00075 was taken into account for the selected hospitalisation of the patient. For each type of medical act/intervention only one centre was taken into account, namely the centre for the medical act/intervention that was closest to the incidence date (or the date of major surgery in case of (neo)adjuvant treatment) and within a certain timeframe around the incidence date (or date of major surgery) (Table 34). When both neoadjuvant and adjuvant chemotherapy, or both neoadjuvant and adjuvant radiotherapy were performed in a different centre, the centre of the neoadjuvant therapy prevailed over the centre of the adjuvant therapy.

Table 34 – Timeframes applied to select one centre per medical act/intervention

Medical acts/interventions	Timeframe
Major surgery **Chemotherapy in the absence of major surgery** **Radiotherapy in the absence of major surgery**	from 1 month before until 9 months after incidence date (-1m<inc<+9m)
Neoadjuvant chemotherapy **Neoadjuvant radiotherapy**	from 9 months before major surgery until date of major surgery (-9m<surg)
Adjuvant chemotherapy **Adjuvant radiotherapy**	from date of major surgery until 9 months after major surgery (surg<+9m)
Discussion at the multidisciplinary team meeting	from 1 month before until 6 months after incidence date (-1m<inc<+6m)
Hospitalisation	from 1 month before until 1 months after incidence date (-1m<inc<+1m)

Linkage between coded centre IDs in the BCR database and the IMA database was provided by an authorised data manager from the Cancer Registry.

Hospital merges were taken into account until the end of the most recent incidence year that was included in this study, i.e. December 31, 2008. Hospitals that were merged before January 1, 2009 were considered as one hospital for the whole study period (2004-2008). Hospital merges after 2008 were not taken into account and were considered as separate hospitals in this report. However, it remains possible for the researchers to integrate the results of several hospitals into one feedback report.

A set of rules was used to assign each patient to one centre. The order indicates the priority between the rules (1 = highest priority):

1. When only one centre could be identified for surgery, chemotherapy, radiotherapy and/or discussion at the multidisciplinary team meeting (MDT), this centre was always chosen (NB: to apply this rule, not all medical acts/interventions should have taken place)
2. If more than one centre was identified for these interventions:
3. The centre where the surgery (if applicable) took place was chosen
4. The centre where both chemotherapy AND radiotherapy took place (only if both were performed) was chosen
5. The centre where chemotherapy AND the MDT took place (only if both are performed)
6. The centre where chemotherapy took place
7. The centre where the MDT took place
8. The centre that first reported the tumour to the Cancer Registry
9. The centre where the patient had at least one day of hospitalisation within the time frame of one month before or after the incidence date
10. The remaining patients for whom no centre could be identified were grouped into 1 'unknown centre'.

Appendix 3.3. Results

Table 35 shows the results of the algorithm to assign each patient to one centre. For more than two thirds of the patients, identification of the centre was unambiguous, because only one centre could be selected for major surgery, chemotherapy, radiotherapy and/or MDT. Use of the centre identified by the BCR data contributed in about 3% of the cases. Finally, for about 3% of the patients, it was impossible to identify a centre based on BCR and IMA data.

Table 35 – Results of the algorithm to assign a patient to one hospital, by cancer type

Applied rule to attribute a patient to a centre	Oesophageal cancer patients		Gastric cancer patients	
	N	%	N	%
1 – one centre available	3 679	63.3	3 419	70.5
2 – centre surgery	504	8.7	275	5.7
3 – centre chemo=centre RT	72	1.2	4	0.1
4 – centre chemo=centre MDT	390	6.7	18	0.4
5 – centre chemo	237	4.1	40	0.8
6 – centre MDT	112	1.9	9	0.2
7 – centre BCR	147	2.5	145	3.0
8 – centre hospitalisation	532	9.2	739	15.3
9 – unknown centre	140	2.4	198	4.1
Total	**5 813**	**100.0**	**4 847**	**100.0**

APPENDIX 4. METHODS OF ANALYSIS

Appendix 4.1. Data preparation

For this report, analyses concerning diagnostic and therapeutic procedures for oesophageal and gastric cancer patients were based on the linkage of patient and tumour characteristics (registered by the Belgian Cancer Registry) and administrative data from the health insurance companies (IMA data). This method has the advantage that nationwide data can be used, but has also the disadvantage that diagnostic and therapeutic procedures cannot directly be related to a specific diagnosis (in this case the diagnosis of oesophageal or gastric cancer) or a specific care pathway. E.g. computerised tomography can be done for the diagnostic workup of cancer, but can also be done for non-cancer related diseases or conditions.

To avoid this problem, it was necessary to work with timeframes around the incidence date of a selected tumour or around the date of major surgery to remove the tumour. Sensitivity analyses were performed to decide which timeframes were relevant for the different procedures or interventions (1 months = 30 days):

- diagnostic procedures: a timeframe of 3 months before until 3 months after the incidence date (-3m<inc<+3m)
- discussion at the multidisciplinary team meeting: a timeframe of 1 month before until 3 months after the incidence date (-1m<inc<+3m)
- major surgery and other therapeutic procedures like chemotherapy and radiotherapy in the absence of major surgery: 1 month before until 9 months after the incidence date (-1m<inc<+9m)
- neoadjuvant therapy: a timeframe of 9 months before major surgery until the date of major surgery (-9m<surg)
- adjuvant therapy: a timeframe of the date of major surgery until 9 months after major surgery (surg<+9m)

The chosen timeframes were then arbitrary used to define whether or not diagnostic and therapeutic procedures were performed for a selected tumour. Because having multiple oesophageal and/or gastric cancers might cause extreme confusion in defining the applicable diagnostic and therapeutic procedures (based on administrative data, one can never be sure whether a procedure is performed for a newly diagnosed oesophageal/gastric tumour or a recurrence of a previous oesophageal/gastric tumour), such patients were excluded for this study.

For palliative care, not all applicable data were available in the research database, leading to an underestimation of the real palliative care delivery for oesophageal/gastric cancer patients. First, not all palliative care interventions are registered in the IMA database, e.g. in-hospital intervention of a specialised palliative support team of the hospital. Second, not all existing nomenclature codes for palliative care interventions were available in the research database, e.g. consultation of a general practitioner by a palliative patient (Appendix 8.3.4). Based on the 'permanent sample (EPS)' of IMA (http://www.nic-ima.be/nl/imaweb/DT/content/imaweb/datas/eps / http://www.nic-ima.be/fr/imaweb/DT/content/imaweb/datas/eps) it was estimated that the proportion of patients with palliative care delivery that could be identified using the available nomenclature codes in the research database should be multiplied by 1.15 to near the real proportion of patients with palliative care delivery.

Appendix 4.2. Data analysis

Descriptive statistics were presented in frequency tables, crosstabs and bar charts (numbers and/or percentages). Funnel plots were used to describe the variability per centre (Appendix 4.3). Quality indicator results were reported as percentages, with the corresponding denominators and numerators.

The occurrence of the different stages of the tumours was reported as the proportion of the total number of selected tumours and as the proportion of only those tumours with a known stage.

The annual hospital volume of oesophagectomies/gastrectomies was calculated based on the total number of patients (diagnosis in 2004-2008) attributed to that specific centre who underwent this type of major surgery. Centres were categorised as follows:

- Low-volume centres: less than 6 patients with an oesophagectomy/gastrectomy per year
- Medium-volume centres: between 6 and 19 patients with an oesophagectomy/gastectomy per year

- High-volume centres: at least 20 patients with an oesophagectomy/gastrectomy per year

Univariate and multivariate logistic regression models (with 95% confidence intervals) were fitted to determine the relation between patient and tumour characteristics and hospital volume of oesophagectomies/gastrectomies versus the 30- and 90-day mortality after major surgery.

For survival analyses, a minimal follow up of the vital status of patients with oesophageal or gastric cancer could be guaranteed until April 1, 2012.

The overall 5-year observed survival rates/curves were calculated using the Kaplan Meier method. Univariate and multivariate Cox proportional hazard models (with 95% confidence intervals) were used to estimate the relationship between the survival and patient and tumour characteristics and hospital volume of oesophagectomies/gastrectomies.

Since calculation of the net survival was impossible, based on the available data, the relative survival (i.e. observed survival / expected survival) was used as a proxy. Expected survival rates were retrieved from the mortality tables of 2004-2008 (http://statbel.fgov.be/nl/statistieken/cijfers/bevolking/sterfte_leven/tafels/index.jsp) and were linked to the individual patients, taking into account sex, age, and the year of diagnosis.

All statistical analyses were performed using SAS V9.1 (SAS Institute Inc. Cary, NC).

Appendix 4.3. Graphical presentation of the variability between centres

For all quality indicators, the (un)adjusted variability in process and outcome results was graphically presented by volume of the centres using funnel plots, with binomial control limits of 95% and 99% around the overall estimate (overall result) [47]. To define the volume of each centre, an algorithm was designed to attribute each patient to one centre (Appendix 1). Patients who could not be attributed to a specific centre were all attributed to a fictive 'unknown centre' which was reported in the funnel plots as a grey star. Because the bullets in the funnel plots might represent more than one centre (with similar volume and process/outcome result), for each funnel plot in the technical fiches per quality indicator (Appendix 6) a table was added with the number and proportion of outlying centres.

The adjusted results were the product of the overall observed percentage and the ratio of observed to expected values from the logistic regression model/Cox proportional hazard model including demographic factors (sex, age and/or combined stage) [44].

One should be careful with the interpretation of funnel plots, since outliers do not automatically imply suboptimal or more optimal quality of care. Differences in case mix between centres should always be taken into account. Furthermore, results are less reliable with lower sample sizes or high levels of missing data (difficult to interpret when less than 30 cases).

Because many centres in this study had low volumes, the variability in the overall 5-year observed survival was also graphically presented in function of grouped centre data. Sample sizes of the centres with similar volumes were grouped. The size of the bullets represents the number of patients in each stratum. Control limits around the overall estimate were computed based on the number of patients in each stratum.

APPENDIX 5. VALIDATION BY SIX HOSPITALS

Appendix 5.1. Introduction and general methodology

Because it remains impossible to unambiguously link diagnoses to health insurance data, a subproject was initiated to validate the indicator results. The main research question of the validation project was: "*Do quality indicator results differ when they are calculated using cancer registry data linked to health insurance data compared to when they are calculated using data that are available at the hospital (e.g. medical file, financial data,…), and can the possible difference in results be considered as acceptable?*". During a first phase of the validation, it was tested whether it is possible (based on BCR and IMA data) to identify for each hospital a complete list of patients diagnosed with a specific cancer. Both completeness and validity of the BCR and IMA data, as well as the algorithm to assign patients to a centre (Appendix 1) itself were evaluated during this phase. In the second phase, which was only started when the involved hospitals had finished the first phase, it was evaluated whether quality of care indicators can correctly be calculated using BCR and IMA data. A detailed manual to help hospitals perform this task was developed for each phase.

Six hospitals were asked to participate in the validation of indicator results for oesophageal cancer. It was supposed that the results of a validation for oesophageal cancer would be similar for gastric cancer. Selection of the hospitals was based on the distribution of university versus non-university hospitals, low-medium-high volume hospitals and geographical location. To have a comparable workload, a subselection of patients was made (based on incidence years) for the higher volume hospitals. A small fee was provided to the participating hospitals: CH de l'Ardenne, CHU Liège, Institut Jules Bordet, OLV Aalst, Sint-Augustinus Antwerpen and UZ Leuven.

All contacts with the selected hospitals concerning non-coded patient data were done via authorised data managers from the Belgian Cancer Registry (BCR). When hospitals needed further assistance on the context of the study and on the calculation of quality indicators, this was done by researchers of the BCR and always concerned coded data. Afterwards, results of the validation procedure were discussed between the KCE, the BCR and the participating hospitals (per hospital one medical specialist and one data manager was invited to this meeting). Results of this validation procedure were presented anonymously (at this meeting and in this report) for reasons of privacy and confidentiality (for patients and hospitals).

Appendix 5.2. Validation of the algorithm to assign patients to a hospital

Appendix 5.2.1. Methodology

Each of the six hospitals received a list of the patients that were selected for their hospital. This list was constructed by using the algorithm to assign patients to a hospital (Appendix 1) and was based on both the BCR and IMA data. Next to the Unique National Number of the patient, a coded patient ID was provided and the number of the rule that was used to assign each specific patient to the hospital. Furthermore, the date of diagnosis, the sublocalisation and histological type were provided. Hospitals were asked to verify whether these patients were all treated (or followed) in their hospital in the context of an oesophageal cancer, and whether they could identify additional patients who were erroneously not included in the hospital list (due to missing data in the cancer registry data or incorrectly assigning to another hospital). Additionally, it was asked to verify if the rule used to assign the patients was correct.

Appendix 5.2.2. Results

Figure 49 49 shows the correctness of the patient lists per hospital. A range of 92% to 100% of patients per hospital was correctly assigned. Although the correct hospital was identified, this was sometimes based on a different rule (Appendix 1). Reasons were:

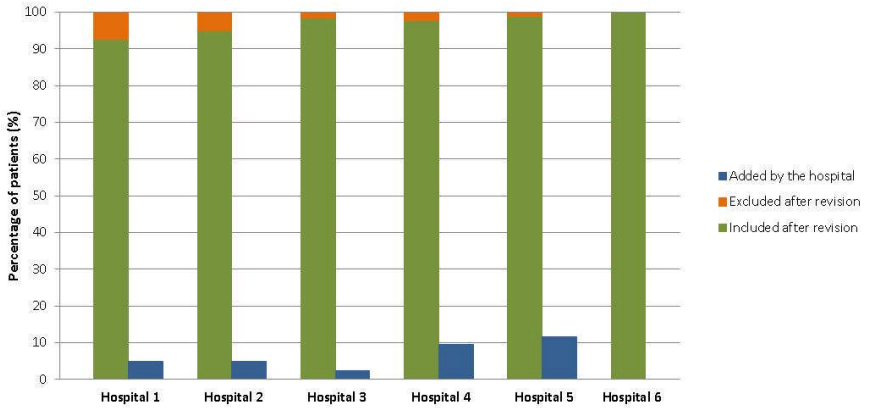
- Misunderstanding rule 1 "When only one centre could be identified for surgery, chemotherapy, radiotherapy and discussion at the multidisciplinary team meeting (if applicable), this centre is always chosen". This was sometimes interpreted as if all these medical acts/interventions should have taken place to apply this rule, but if 'one or more' of them were performed, they all must be performed in the same hospital;

- Inconsistency between health insurance data versus hospital data, most often concerning occurrence (or not) of a multidisciplinary team meeting;
- Access to health insurance data revealed another multidisciplinary team meeting in another hospital, which was closer to the incidence date;
- No tarification of the multidisciplinary team meeting (= the multidisciplinary team meeting was not registered in the health insurance data);
- The medical act/intervention that was selected using the research database was performed because of another tumour;
- Non-specific nomenclature codes for medical interventions, e.g. curative versus palliative chemotherapy, a nomenclature code for endoscopic mucosal resection was not available in the incidence years under consideration (introduced in 2010).

Thirty-one patients were added by the hospitals (a range from 0% to 12%). Thirteen of these patients were completely unknown in the cancer registry database. The tumours of the other patients were known in the cancer registry database with an incorrect topography (mostly of the stomach, other than the gastro-oesophageal junction), an incorrect tumour behaviour, or they were not included in the project because there were no health insurance data available.

For all six hospitals together, 14 patients were incorrectly assigned to a hospital (a range of 0% to 8%). First, 1 patient was incorrectly assigned to a hospital because of differences between the IMA data and the hospital data about which medical acts/interventions were performed or not. Second, 2 patients were incorrectly assigned to a hospital because diagnostic parameters were missing in the algorithm to assign patients to a hospital, and patients were therefore assigned based on another (less cancer-specific) criteria, for example hospitalisation which might not be in the context of oesophageal cancer. Finally, 11 patients should not have been included for the project because of two different reasons. For 2 of these patients the exact incidence date fell outside the study period (2004-2008). The other 9 patients should have been excluded because the tumours were found to be non-malignant or in fact had another localisation than the oesophagus or gastro-oesophageal junction.

Figure 49 – Correctness of the patient list by hospital



Note: Original patient lists as selected by the Belgian Cancer Registry ranged from 40 to 121 patients per hospital.

Appendix 5.3. Validation of indicator results

Appendix 5.3.1. Methodology

After consultation of experts, the KCE selected 15 quality indicators for oesophageal cancer care. Nine of them were calculable based on the available BCR and IMA data. Because some of these nine indicators only are relevant in a national context (e.g. OC15) or are more complex to calculate (e.g. survival), five indicators were considered during the second phase of the validation (OC1, OC2, OC4, OC6 and OC10). For each indicator, a short description of the indicator was provided to the participating hospitals, the rationale behind it (as background), the operational definition and a detailed description on how to calculate the indicator.

The indicator results, calculated by the BCR on the basis of the BCR and IMA data, were sent to the hospitals, together with the list of all patient information that was taken into account in the calculation. To estimate the influence on the indicator results from incorrectly assigned patients to the hospital (phase 1), these remained included in the calculations by the BCR. Hospitals were asked to verify these results, to check whether the

detailed information of the correctly assigned patients was correct, and to complete the detailed information for patients that were added by the hospital during the first phase of the validation.

Appendix 5.3.2. Results

OC 1: Proportion of patients diagnosed with oesophageal cancer discussed at the multidisciplinary team meeting

Denominator: All patients diagnosed with oesophageal cancer.

Numerator: All patients diagnosed with oesophageal cancer discussed at the MDT meeting within 1 month before and after incidence date.

For five hospitals, the OC1 indicator result was higher when hospital data were used (Table 36). The percentage of change in this indicator ranged from +6.3% to +87.9% for these five hospitals. The higher indicator result was mainly caused by additional MDTs that could be identified using the hospital data (higher numerator). Though, the absence of a nomenclature code for a MDT in the IMA data does not always imply that no MDT had taken place within the defined timeframe. It only indicates that there was no tarification for a MDT during that timeframe. The validating hospitals confirmed that for some patients there was no tarification while the meeting had taken place, or that another MDT outside the timeframe was tarificated. Furthermore, it was not possible to investigate the quality of the discussion at the MDT.

For one hospital the indicator result calculated by the hospital was lower than the one calculated based on BCR and IMA data. This was caused by the fact that the hospital added a substantial number of patients to their patient list (higher denominator), for whom no MDT had taken place, and because they were not aware of some MDTs which had taken place in another hospital (lower numerator).

Table 36 – OC1: Concordance between indicator results calculated based on the research database and on the hospital data

	Result BCR (%)	Result hospital (%)	Δ	% change
Hospital 1	26	35	9	34.6
Hospital 2	64	68	4	6.3
Hospital 3	54	62	8	14.8
Hospital 4	17	15	-2	-11.8
Hospital 5	40	43	3	7.5
Hospital 6	33	62	29	87.9

OC 2: Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen

Denominator: All patients diagnosed with oesophageal cancer.

Numerator: All patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen within 1 month before and after incidence date.

OC2 indicator results based on the research database or the hospital data were similar (range of percentage of change: -7.6% to +3.6% - Table 37). A higher number of CTs identified based on the BCR and IMA data can be caused by the fact that there was no specific nomenclature code available (includes neck and thorax and abdomen) or by the fact that diagnoses could not be linked to the nomenclature data (e.g. the identified CT had actually taken place in a non-cancer context). Other differences in the numerator can most of the time be explained by small differences in the date of diagnosis or the date of the CT which have an influence on whether or not the defined timeframe was applicable. Additionally, a changing number of patients on the hospital list had its influence on the denominator of this indicator.

Table 37 – OC2: Concordance between indicator results calculated based on the research database and on the hospital data

	Result BCR (%)	Result hospital (%)	Δ	% change
Hospital 1	83	86	3	3.6
Hospital 2	92	85	-7	-7.6
Hospital 3	84	87	3	3.6
Hospital 4	90	85	-5	-5.6
Hospital 5	83	80	-3	-3.7
Hospital 6	95	95	0	0.0

OC 4: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention

Denominator: All patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who underwent a surgical intervention.

Numerator: All patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention.

The concordance for OC4 indicator results was optimal for four of the six hospitals, although there were some differences in the number of patients included in the denominator and the numerator (Table 38). Hospitals were in general able to include more patients in the denominator, because the clinical TNM was underreported to the Cancer Registry, while it could be distracted from the medical file of the patient. For a few patients, data on major surgery or chemotherapy were lacking in the health insurance data (no tarification of actual medical acts).

Table 38 – OC4: Concordance between indicator results calculated based on the research database and on the hospital data

	Result BCR (%)	Result hospital (%)	Δ	% change
Hospital 1	81	81	0	0.0
Hospital 2	25	25	0	0.0
Hospital 3	52	52	0	0.0
Hospital 4	75	74	-1	-1.4
Hospital 5	35	48	3	37.1
Hospital 6	8	8	0	0.0

OC 6: Oesophageal resection mortality rate within 30 days

Denominator: All patients with oesophageal cancer treated with oesophagectomy in a given year.

Numerator: All patients with oesophageal cancer treated with oesophagectomy in a given year dying within 30 days.

For five of the participating hospitals, the indicator result that was based on hospital data matched completely with the calculation based on the research database (Table 39). Negligible differences in the denominator occurred, mainly because of additionally added patients who underwent an oesophagectomy that were not in the original patient list for the hospital due to missing data on surgery in the IMA database. This can fully explain the difference observed for one of the hospitals. The date of death that was available in the cancer registry database, and was obtained via the Crossroadsbank for Social Security, proved to be reliable.

Table 39 – OC6: Concordance between indicator results calculated based on the research database and on the hospital data

	Result BCR (%)	Result hospital (%)	Δ	% change
Hospital 1	0	0	0	0.0
Hospital 2	0	0	0	0.0
Hospital 3	1	1	0	0.0
Hospital 4	2	2	0	0.0
Hospital 5	8	7	-1	-12.5
Hospital 6	10	10	0	0.0

OC 10: Proportion of patients with any stage of oesophageal cancer treated with primary chemoradiotherapy

Denominator: All patients with any stage of oesophageal cancer

Numerator: All patients with any stage of oesophageal cancer who were treated with primary chemoradiotherapy (without surgical resection).

Results of the OC10 indicator were quite similar if calculated using hospital data or calculated using BCR data linked with IMA data (Table 40). Small differences were mainly due to differences in the original patient list per hospital (denominator). For three patients, the hospital was able to find more information on surgery or chemotherapy in the medical file of the patient, which resulted in a slightly higher numerator.

For hospital 3, the percentage of change of the indicator result seems high (16.7%), but this is relative because it corresponds to a decrease of the indicator result with one percent.

Table 40 – OC10: Concordance between indicator results calculated based on the research database and on the hospital data

	Result BCR (%)	Result hospital (%)	Δ	% change
Hospital 1	21	22	1	4.8
Hospital 2	59	58	-1	-1.7
Hospital 3	6	5	-1	-16.7
Hospital 4	21	22	1	4.8
Hospital 5	6	6	0	0.0
Hospital 6	34	34	0	0.0

Appendix 5.3.3. Conclusion

For OC2, OC4, OC6 and OC10, only small differences between the indicator results calculated using the hospital data versus the cancer registry data linked with the IMA data were found. Allthough small differences exist at the individual hospital level, it seems that the national indicator result is calculable based on the cancer registry data and IMA data because biases occur in both directions and are not systematically.

The proportion of patients discussed at the multidisciplinary team meeting should be interpreted cautiously. This indicator was evaluated as a weak indicator of the quality of care, because apparently tarification does not always correspond to the reality of medical practice.

APPENDIX 6. TECHNICAL FICHES PER INDICATOR

Appendix 6.1. OC1: Discussion at multidisciplinary meeting

Appendix 6.1.1. Rationale

According to the updated guidelines, all patients diagnosed with oesophageal cancer should be discussed at a multidisciplinary meeting (strong recommendation, low level of evidence).

Multidisciplinary team meetings (MDT) have been implemented in many countries as the predominant model of cancer care to ensure that all patients receive timely diagnosis and treatment, that patient management is evidence-based, and that there is continuity of care [48]. The positive impact of multidisciplinary team care in the management of oesophageal cancer was reported at least in two publications from UK [49, 50]. Stephens et al. reported that multidisciplinary team management resulted in improved staging, lower operative mortality, and improved 5-year survival when compared to a group of patients undergoing R0 resection by surgeons who were working independently. Davies et al. concluded that MDT significantly improved staging accuracy for gastro-oesophageal cancer and ensured that correct management decisions were made for the majority of patients. Moreover, multidisciplinary care tend to enable the construction of clinical pathways and to develop formal programs with a unified vision for therapy and palliation [51]. Such MDT have to be encouraged and generalized in the management of patients with oesophageal cancer.

Appendix 6.1.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting.

Numerator

All patients diagnosed with oesophageal cancer in a given year discussed at the MDT meeting within 1 month after incidence date.

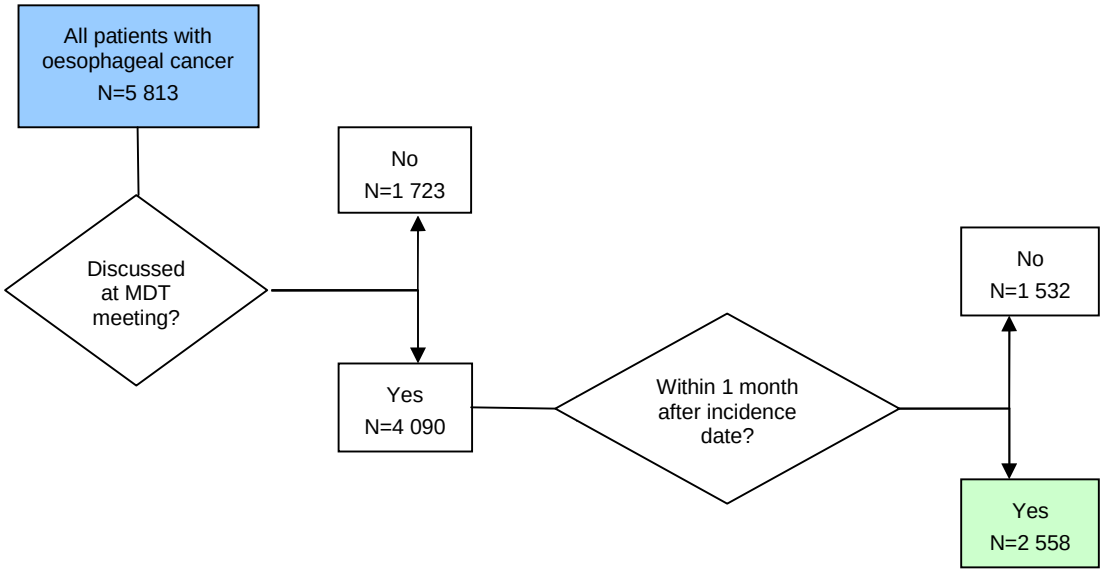
Denominator

All patients diagnosed with oesophageal cancer in a given year.

Appendix 6.1.3. Elaboration

Due to the algorithm used to define the incidence date, it is possible that the date of the actual diagnosis precedes the reported incidence date. Therefore, some patients will have acts, including the multidisciplinary team meeting, that are billed before the incidence date. To allow these acts to be accounted for, the operational numerator of the present indicator was: “All patients diagnosed with oesophageal cancer in a given year discussed at the MDT meeting within 1 month before and after incidence date”.

Flowchart



Supplementary analyses

Subgroup analysis

- Analysis by stage, age, sex and type of treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Supplementary analysis within 1 month before and (1) 3 months or (2) 6 months after incidence date

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD-10 code C15.0-C16.0 (BCR)
- MDT meeting: nomenclature codes (IMA) (see Appendix 8.1.1: Table 215)

Appendix 6.1.4. Results

National results

Overall, between 2004 and 2008, 44% of patients with oesophageal cancer were discussed at the MDT meeting within one month after incidence date (Table 41). The proportion slightly increased from 40.9% in 2004 to 49.2% in 2008. The proportion appeared to increase with cStage (Table 42). Patients with cStage III and IV oesophageal cancer were most

often discussed at the MDT (61.0% and 62.4%, respectively). Of the patients without a registered cStage, only 23.7% were discussed at the MDT meeting.

No clear differences were found in the proportion of patients discussed at the MDT meeting across the different age categories below 80 years, but the proportion was significantly lower in the 80+ category (80+ vs. 80-: OR = 0.80, 95%CI 0.69 to 0.93) (Table 43). The proportion was higher in men than in women (Table 44: 45.0 vs. 40.9%; OR = 1.18, 95%CI 1.05 to 1.34). When stratified by age, this gender difference only remained for the 80+ category (Table 45).

When the proportion was calculated according to the treatment type, patients receiving no major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were less likely to be discussed at a multidisciplinary team meeting (Table 46: OR = 0.53, 95%CI 0.47 to 0.61). On the contrary, patients receiving primary chemo- and/or radiotherapy were more likely to be discussed at a multidisciplinary team meeting than patients receiving no or other treatment (OR = 1.68, 95%CI 1.51 to 1.86).

If the time period was extended until 3 months after incidence date, 60% of patients with oesophageal cancer were discussed at the MDT meeting (Table 47). The proportion only slightly increased further to 64.5% if the time period was extended until 6 months after incidence date. However, specifically looking at the data for 2008, approximately 75% of patients with oesophageal cancer were discussed at a multidisciplinary team meeting within 6 months after incidence date.

Table 41 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date), by incidence year

	Numerator	Denominator	Proportion (%)
2004	449	1 099	40.9
2005	490	1 164	42.1
2006	497	1 181	42.1
2007	564	1 235	45.7
2008	558	1 134	49.2
Total	**2 558**	**5 813**	**44.0**

Table 42 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date), by clinical stage

	Numerator	Denominator	Proportion (%)
In situ	2	7	28.6
Stage I	173	401	43.1
Stage II	473	843	56.1
Stage III	606	993	61.0
Stage IV	737	1 181	62.4
Stage X	567	2 388	23.7
Total	**2 558**	**5 813**	**44.0**

Table 43 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date), by age

	Numerator	Denominator	Proportion (%)
<50y	204	459	44.4
50-59y	605	1 293	46.8
60-69y	704	1 564	45.0
70-79y	710	1 647	43.1
80+	335	850	39.4
Total	**2 558**	**5 813**	**44.0**

Table 44 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date), by sex

	Numerator	Denominator	Proportion (%)
Men	1 979	4 397	45.0
Women	579	1 416	40.9
Total	**2 558**	**5 813**	**44.0**

Table 45 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date): sex differences, stratified by age group

	Men			Women			
Age	**Numerator**	**Denominator**	**Proportion (%)**	**Numerator**	**Denominator**	**Proportion (%)**	**OR (95%CI)**
<50	171	384	44.5	33	75	44.0	1.02 (0.60-1.73)
50-59y	500	1 046	47.8	105	247	42.5	1.24 (0.93-1.65)
60-69y	567	1 242	45.7	137	322	42.5	1.13 (0.88-1.46)
70-79y	528	1 240	42.6	182	407	44.7	0.92 (0.73-1.16)
80+	213	485	43.9	122	365	33.4	1.56 (1.17-2.09)
Total	**1 979**	**4 397**	**45.0**	**579**	**1 416**	**40.9**	

Table 46 – Proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting (within 1 month after incidence date) by treatment type

	Numerator	Denominator	Proportion (%)
Surgery alone	405	1 046	38.7
Tx < Surgery	195	393	49.6
Tx < Surgery < Tx	105	218	48.2
Surgery < Tx	142	320	44.4
Primary CT and/or RT	1 260	2 454	51.3
No major treatment	451	1 382	32.6
Total	**2 558**	**5 813**	**44.0**

Table 47 – Sensitivity analyses: proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting within 1 month after, 3 months after, and 6 months after incidence date

	Numerator	Denominator	Proportion (%) 2004-2008	Proportion (%) 2004	Proportion (%) 2008
1 month	2 558	5 813	44.0	40.9	49.2
3 months	3 495	5 813	60.1	54.0	68.0
6 months	3 747	5 813	64.5	58.3	74.2

Comparison between centres

An important variability was found across the 112 centres (Figure 50). Twenty-nine centres had a proportion below the 95%LL (Table 48). Only 9 centres discussed at least 80% of their patients with oesophageal cancer in a multidisciplinary meeting, only 3 centres at least 90% of their patients.

When only the last two available years were considered (2007 and 2008), the 95% and 99% limits became less narrow (Figure 43), resulting in less outlying centres (Table 49: 19 below the 95%LL).

When the timeframe was extended to 3 months after incidence date, the variability remained unchanged (Figure 52). Twenty-seven centres had a proportion below the 95%LL (Table 50).

Figure 50 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting, by centre (2004-2008)

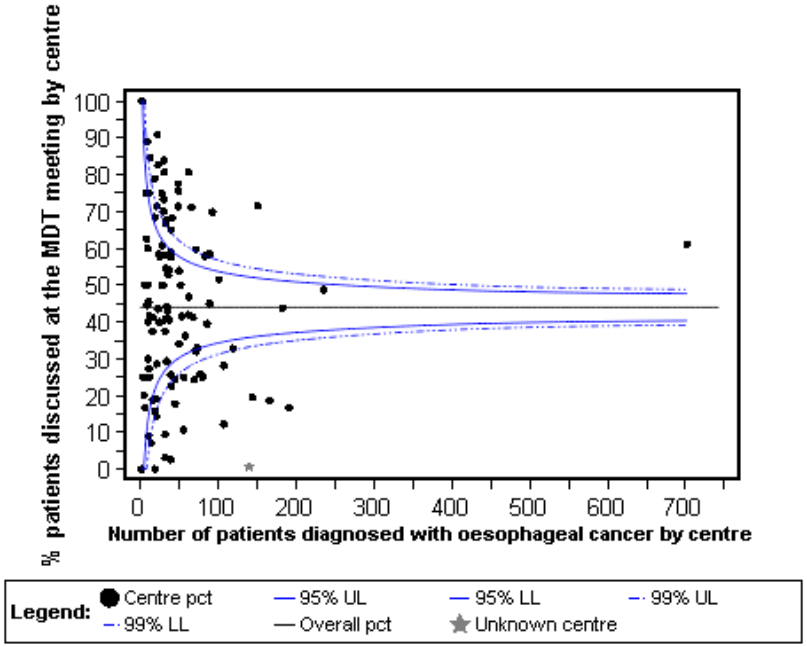


Table 48 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	20	17.86	20	17.86
Equal to 99%LL or lower than 95%LL	9	8.04	29	25.89
Between 95% control limits	55	49.11	84	75.00
Equal to 99%UL or upper than 95%UL	4	3.57	88	78.57
Upper than 99%UL	24	21.43	112	100.00

Figure 51 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting, by centre (2007-2008)

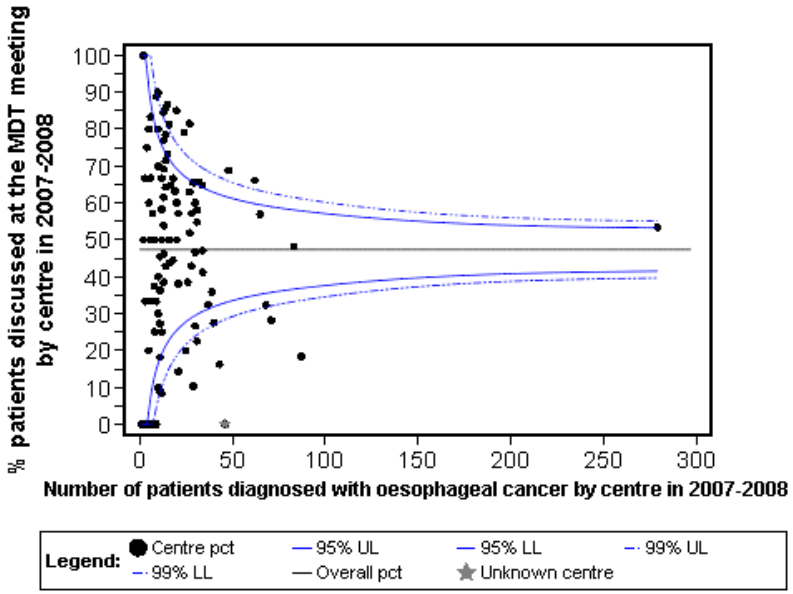


Figure 52 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer discussed at the MDT meeting within 3 months after incidence date, by centre (2004-2008)

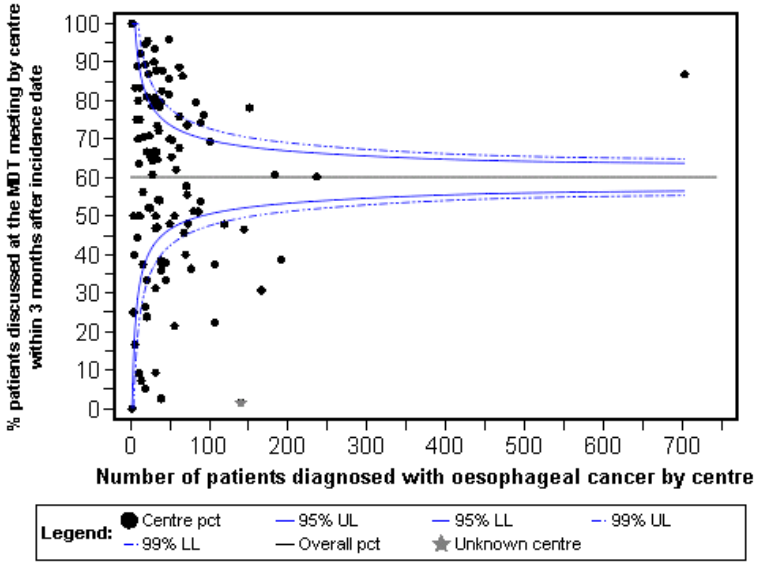


Table 49 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	11	9.91	11	9.91
Equal to 99%LL or lower than 95%LL	8	7.21	19	17.12
Between 95% control limits	73	65.77	92	82.88
Equal to 99%UL or upper than 95%UL	8	7.21	100	90.09
Upper than 99%UL	11	9.91	111	100.00

Table 50 – Number and proportion of outlying centres (2004-2008) (timeframe 3 months)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	23	20.54	23	20.54
Equal to 99%LL or lower than 95%LL	4	3.57	27	24.11
Between 95% control limits	56	50.00	83	74.11
Equal to 99%UL or upper than 95%UL	8	7.14	91	81.25
Upper than 99%UL	21	18.75	112	100.00

Appendix 6.1.5. Discussion

Since oesophageal cancer demands a specialized approach, a discussion of the therapeutic options in a multidisciplinary setting is necessary. Specific nomenclature codes for a multidisciplinary oncologic consultation became available on February 1st 2003. Between 2004 and 2008, only 44% of the patients with oesophageal cancer were discussed in a multidisciplinary consultation within 1 month after the incidence date, although the proportion increased to 64.5% if the time period was extended until 6 months after incidence date. Patients aged 80 years and above and female patients were less likely to be discussed in a multidisciplinary consultation, although this gender difference only remained for patients aged 80 years and above when stratified by age. In comparison with other cancer types, 74% of the patients with breast cancer were discussed in a multidisciplinary consultation within 6 months after the incidence date between 2003 and 2006 [4]. For patients with testicular cancer, the proportion was 58.4% between 2003 and 2006 [5].

The proportion appeared to increase with cStage, whereas for gastric cancer this increase was less pronounced (see indicator GC1: Appendix 6.10). A possible explanation is that the treatment algorithm for lower stages of oesophageal cancer is more straightforward than for higher stages.

Only about one fourth of patients without a registered cStage were discussed at a multidisciplinary team meeting within one month after incidence date. Furthermore, only about one third of patients not receiving major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were discussed at a multidisciplinary team meeting. Of course, it is difficult to conclude that these patients did not receive major treatment because they were not discussed or that they were not discussed because it was already decided not to give major treatment.

In the literature, few studies are available that allow a comparison with other countries. According to the Dutch Institute for Clinical Auditing (DICA) [28], 98% of the patients with oesophageal cancer were discussed in a preoperative multidisciplinary consultation, while 92% were discussed in a postoperative multidisciplinary consultation. In the UK, 72% of the local units had combined MDT meetings with the specialist centre [29] . These concern all patients with oesophagogastric cancer.

The variability between the Belgian centres was considerable. There are several possible explanations for this. First, the absence of a nomenclature code for a multidisciplinary meeting for a particular patient does not necessarily mean that no multidisciplinary meeting was held. Some centres might not charge multidisciplinary meetings and in turn, they do not appear in the IMA database. Second, some centres organize several MDT meetings for each patient and only charge the last meeting, which is often months after the incidence date (with the first meeting being within 1 month after incidence date). This may have led to an underestimation of the real proportion. In fact, this was confirmed during the validation phase for this indicator. Third, discussion at a multidisciplinary team meeting is not obligatory in Belgium. However, besides the reimbursement of the act, additional financial incentives have been set up in 2009 through the hospital financing. The financing of a data manager, psycho-oncologists, etc. has become dependent upon the number of registered multidisciplinary consultations. It is therefore expected that the proportion of patients discussed at a multidisciplinary consultation will significantly increase.

Key points

- **Between 2004 and 2008, only 44% of the patients with oesophageal cancer were discussed in a multidisciplinary consultation within 1 month after the incidence date, although the proportion increased to 64.5% if the time period was extended until 6 months after incidence date.**
- **The proportion slightly increased from 40.9% in 2004 to 49.2% in 2008.**
- **The following subgroups were less likely to be discussed in a multidisciplinary consultation:**
  - **Patients aged 80 years, and in paticular female patients in this age category;**
  - **Patients without an unknown cStage;**
  - **Patients not receiving major treatment (i.e. chemotherapy, radiotherapy and/or surgery).**
- **Variability between the Belgian centres was considerable.**

Appendix 6.2. OC2: Staging CT neck/thorax/abdomen

Appendix 6.2.1. Rationale

According to the updated guidelines [8], in patients with newly diagnosed oesophageal cancer, computed tomography (CT) of the neck (including lower neck region), thorax and abdomen should always be performed (strong recommendation, low level of evidence).

The main contribution of CT scan to the staging of oesophageal cancer is the detection of distant metastases and gross invasion of adjacent structures/organs [52-54]. If metastatic disease is detected with CT, curative treatment is excluded and additional staging with endoscopic ultrasonography (EUS) and/or positron-emission tomography (PET) is unnecessary.

Appendix 6.2.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen

Numerator

All patients diagnosed with oesophageal cancer in a given year undergoing a CT neck/thorax/abdomen within 1 month before and after incidence date

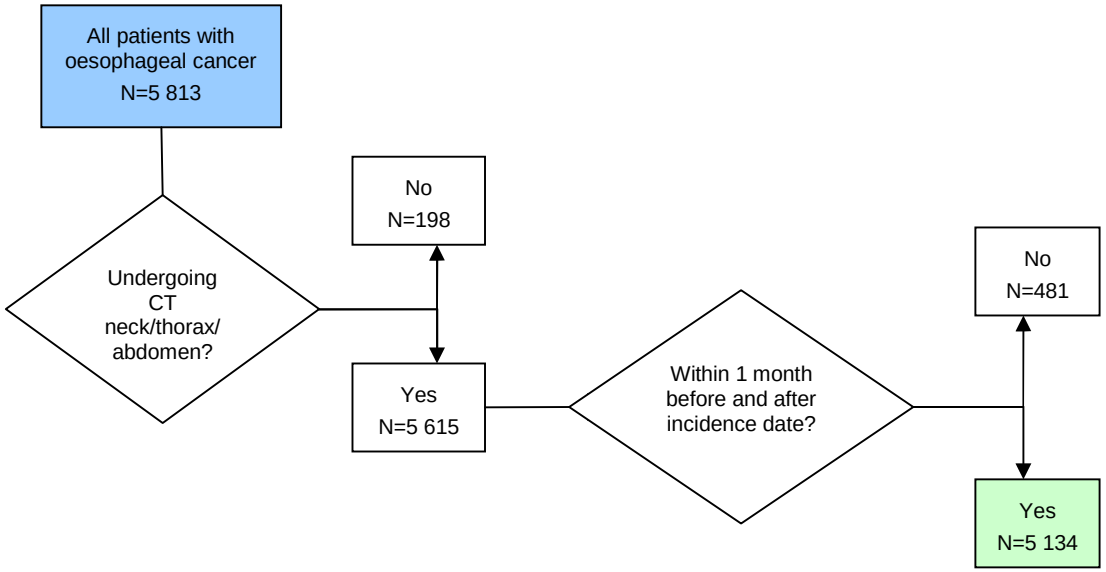
Denominator

All patients diagnosed with oesophageal cancer in a given year

Appendix 6.2.3. Elaboration

Due to the algorithm used to define the incidence date, it is possible that the date of the actual diagnosis preceded the reported incidence date. Therefore, some patients will have acts, including CT scan, that are billed before the incidence date. Above this, some patients underwent a diagnostic CT prior but close to the incidence date. To allow these acts to be accounted for, the operational numerator of the present indicator was: “All patients diagnosed with oesophageal cancer in a given year undergoing a CT neck/thorax/abdomen within 1 month before and after incidence date”.

Flowchart - General



Supplementary analyses

Subgroup analysis

- Analysis by age, sex, clinical stage and type of treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Additional analysis within 1 month before and 3 months after incidence date

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD-10 code C15.0-C16.0 (BCR)
- CT neck/thorax/abdomen: nomenclature codes (IMA) (see appendix 8.1.2: Table 216)

Limitations

- Until 2010, specific nomenclature codes by anatomical location were not available

Appendix 6.2.4. Results

National results

Overall, between 2004 and 2008, 88.3% of the patients with oesophageal cancer received a CT neck/thorax/abdomen within 1 month before and 1 month after incidence date (Table 51). The proportion remained quite stable between 2004 (88.2%) and 2008 (89.4%). Patients in the age category 50-59 years most frequently received a CT neck/thorax/abdomen (91.8%). Patients aged 80 years and above were least likely to receive a CT neck/thorax/abdomen (80+ vs. 80-: OR = 0.46, 95%CI 0.38 to 0.56) (Table 52). The proportion was slightly higher in men than in women (Table 53: 88.9 vs. 86.4%; OR = 1.27, 95%CI 1.06 to 1.52). However, this gender difference disappeared when stratified by age (Table 54).

The proportion appeared to increase with cStage (Table 55). Patients with an unknown cStage were less likely to receive a staging CT neck/thorax/abdomen (cStage X vs. cStage 0-IV: OR = 0.45, 95%CI 0.38 to 0.53).

Patients receiving no major treatment were significantly less likely to receive a staging CT neck/thorax/abdomen (Table 56: OR = 0.19, 95%CI 0.16 to 0.22). Patients treated with multimodality treatment or primary (chemo)radiotherapy had the highest proportions. Patients only treated with surgery had a proportion of 88.8%.

If the time period was extended until 3 months after incidence date, 92.4% of patients with oesophageal cancer received a CT neck/thorax/abdomen (Table 57).

Table 51 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (1 month before and 1 month after incidence date), by incidence year

	Numerator	Denominator	Proportion (%)
2004	969	1 099	88.2
2005	1 003	1 164	86.2
2006	1 050	1 181	88.9
2007	1 098	1 235	88.9
2008	1 014	1 134	89.4
Total	**5 134**	**5 813**	**88.3**

Table 52 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (1 month before and 1 month after incidence date), by age

	Numerator	Denominator	Proportion (%)
<50	408	459	88.9
50-59y	1 187	1 293	91.8
60-69y	1 404	1 564	89.8
70-79y	1 455	1 647	88.3
80+	680	850	80.0
Total	**5 134**	**5 813**	**88.3**

Table 53 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (1 month before and 1 month after incidence date), by sex

	Numerator	Denominator	Proportion (%)
Men	3 911	4 397	88.9
Women	1 223	1 416	86.4
Total	**5 134**	**5 813**	**88.3**

Table 54 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (1 month before and 1 month after incidence date): sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	343	384	89.3	65	75	86.7	1.29 (0.57-2.83)
50-59y	963	1 046	92.1	224	247	90.7	1.19 (0.71-1.98)
60-69y	1 117	1 242	89.9	287	322	89.1	1.09 (0.72-1.65)
70-79y	1 089	1 240	87.8	366	407	89.9	0.81 (0.55-1.18)
80+	399	485	82.3	281	365	77.0	1.39 (0.98-1.97)
Total	**3 911**	**4 397**	**88.9**	**1 223**	**1 416**	**86.4**	

Table 55 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (1 month before and 1 month after incidence date) by cStage

	Numerator	Denominator	Proportion (%)
0	4	7	57.1
I	304	401	75.8
II	773	843	91.7
III	949	993	95.6
IV	1 112	1 181	94.2
X	1 992	2 388	83.4
Total	5 134	5 813	88.3

Table 56 – Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen (within 1 month before and 1 month after incidence date) by treatment

	Numerator	Denominator	Proportion (%)
Surgery alone	929	1 046	88.8
Tx < Surgery	371	393	94.4
Tx < Surgery < Tx	208	218	95.4
Surgery < Tx	298	320	93.1
Primary CT and/or RT	2 330	2 454	94.9
No major treatment	998	1 382	72.2
Total	**5 134**	**5 813**	**88.3**

Table 57 – Sensitivity analysis: Proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen within 1 month before and one month after incidence date and 1 month before and 3 months after incidence date

	Numerator	Denominator	Proportion (%)
1 month	5 134	5 813	88.3
3 months	5 373	5 813	92.4

Comparison between centres

The variability between the 112 centres was limited (Figure 53). Only 6 centres had a proportion below the 95%LL (Table 58). In only 13 centres, less than 80% of patients with oesophageal cancer received a CT neck/thorax/abdomen. In 15 centres, all patients with oesophageal cancer received a CT neck/thorax/abdomen. Of the patients that could not be attributed to a centre, only 32% received a staging CT.

Figure 53 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer undergoing a CT neck/thorax/abdomen within 1 month before and one month after incidence, by centre (2004-2008)

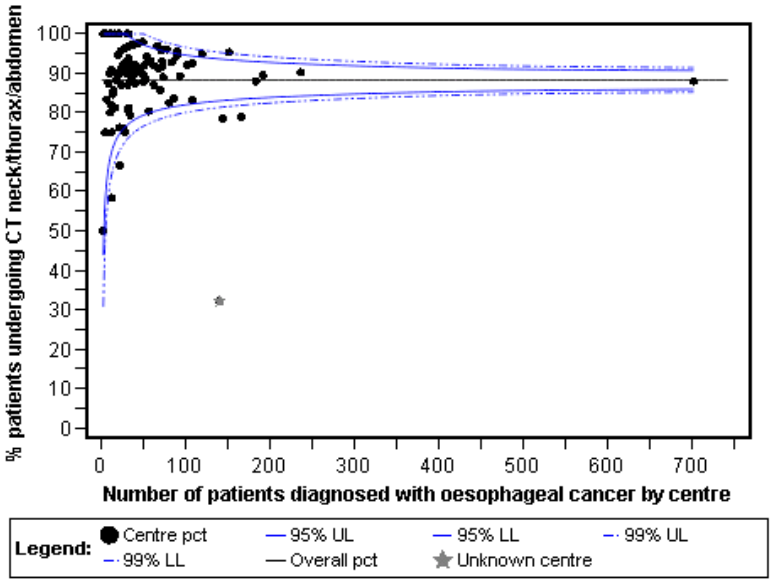


Table 58 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	5	4.46	5	4.46
Equal to 99%LL or lower than 95%LL	1	0.89	6	5.36
Between 95% control limits	96	85.71	102	91.07
Equal to 99%UL or upper than 95%UL	9	8.04	111	99.11
Upper than 99%UL	1	0.89	112	100.00

Appendix 6.2.5. Discussion

CT neck/thorax/abdomen is one of the key diagnostic interventions during the staging phase of patients with oesophageal cancer. In principle, all patients with oesophageal cancer should receive a CT, corresponding to a target value of 100% for this indicator. Fifteen centres reached this target, the national average was about 88%. Patients aged 80 years and above and women were less likely to receive a CT scan, although the gender difference disappeared when stratified by age.

In the literature, few studies are available that allow a comparison with other countries. According to the Dutch Institute for Clinical Auditing (DICA) [28], 99% of patients with oesophageal cancer received a staging CT thorax/abdomen and 93% received a CT or ultrasonography of the neck. In the UK, 89% of patients with oesophagogastric cancer underwent a CT-scan as part of their staging investigations [29]. The proportion was also lower in patients aged 80 years and above and in patients with a ECOG score of 3 and 4. However, it is unclear what the time lag was between incidence date and CT in these reports.

Key points

- **Between 2004 and 2008, 88.3% of the patients with oesophageal cancer received a staging CT neck/thorax/abdomen within 1 month before and 1 month after incidence date.**
- **The following subgroups were less likely to receive a staging CT neck/thorax/abdomen:**
  - **Patients aged above 80 years;**
  - **Patients with an unknown cStage;**
  - **Patients not receiving major treatment.**

Appendix 6.3. OC4: Neoadjuvant treatment before a surgical resection for oesophageal cancer

Appendix 6.3.1. Rationale

Resectable tumors are characterized by the absence of extension into mediastinal structures and the absence of nodal or organ metastases. Direct invasion of the aorta, bronchi, pleura, or laryngeal nerve or distant organ metastases are evidence of nonresectable disease. Neoadjuvant treatment may sometimes downstage the cancer to a resectable or potentially curable stage.

There is evidence for a survival benefit of neoadjuvant chemoradiotherapy (carboplatin and paclitaxel and concurrent radiotherapy) over surgery alone in patients with oesophageal carcinoma, irrespective of the histological type (high level of evidence [55]; low level of evidence [56]). The complete histological response rates observed after this treatment suggest that it could contribute to improving disease-free survival (low level of evidence [57]). The highest potential benefit was observed in a minority of patients with a complete response. Moreover, neoadjuvant chemoradiotherapy is associated with a higher likelihood of R0 resection, without increasing postoperative morbidity or 30-day mortality (high level of evidence [55]; low level of evidence [58]). However, a clear advantage of neoadjuvant chemoradiotherapy over neoadjuvant chemotherapy has not been established (low level of evidence [56]). If, after multidisciplinary discussion, neoadjuvant treatment is considered for a locally-advanced oesophageal or junction tumour, neoadjuvant chemoradiotherapy is preferred (strong recommendation, low level of evidence).

Appendix 6.3.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{Any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention.

Numerator

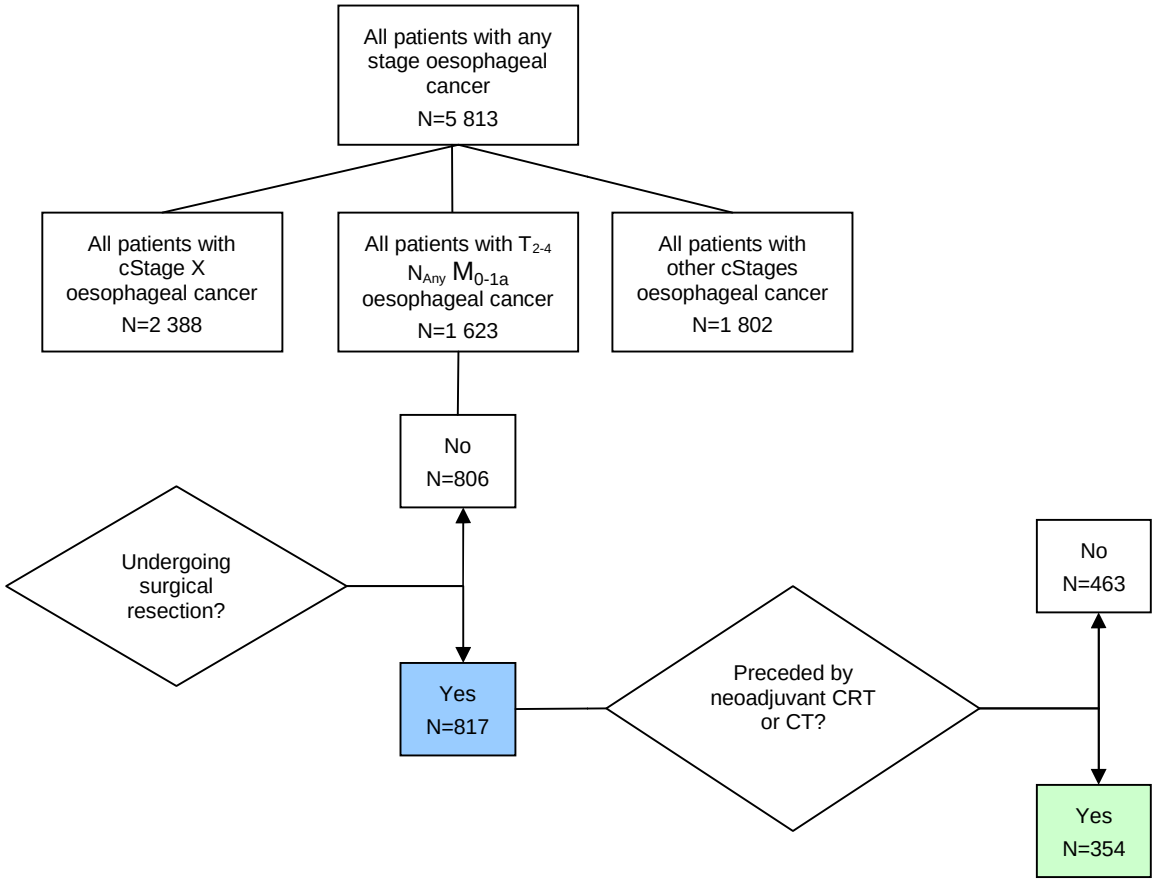
All patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{Any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention.

Denominator

All patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{Any} M_{0-1a}) who underwent a surgical intervention.

Appendix 6.3.3. Elaboration

Flowchart



Supplementary analyses

Subgroup analyses

- Consider separately SCC and AC, by stage
- Subgroup analyses by age group, sex, nodal involvement and neoadjuvant treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Same analysis without T_4 and without T_4M_{1a}

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD10 code C15.0-C16.0 (BCR)
- Cancer stages: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3: Table 230, Table 232 and Table 233)
  - Radiotherapy: nomenclature codes (IMA) (Appendix 8.3.3, Table 236)
  - Chemotherapy: Pharmanet codes (IMA) (Appendix 8.3.2, Table 235)

Appendix 6.3.4. Results

National results

Overall, between 2004 and 2008, of all patients with known stage oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who underwent surgical resection, 43.3% received neoadjuvant treatment (Table 59). This proportion clearly increased annually, from 34.2% in 2004 to 50.3% in 2008 (Table 59). When patients with T_4 or T_4M_{1a} were excluded, the proportion of patients who received neoadjuvant treatment did not change (43.3%) (Table 60).

The proportion of operated patients who received neoadjuvant treatment was clearly higher in SCC group than in AC group (Table 61: 54.2% vs. 38.9%, OR = 1.85, 95%CI 1.34 to 2.56). For both types, more patients with stage IV (100% and 85.2%, respectively) or III (71.9% and 54.8%, respectively) received a neoadjuvant treatment (Table 61), probably to downstage the cancer to a resectable or potentially curable stage. Only 23.7% of all patients with stage II cancer received neoadjuvant therapy and the proportion was even lower for stage I cancer patients (6.8% in the AC group) (cStage III-IV vs. I-II: OR = 6.11, 95%CI 4.41 to 8.47).

Clear differences were found in the proportion of patients with T_{2-4} N_{any} M_{0-1a} oesophageal cancer treated with neoadjuvant treatment according to age. The proportion of patients receiving preoperative treatment decreased from 49.3% before 70 years to 33.3% after 70 years (OR = 3.41, 95%CI 2.46 to 4.74). None of the 34 patients older than 80 years received neoadjuvant treatment (Table 62).

No statistical differences were observed according to sex (OR 1.10 [95%CI 0.77 – 1.58]) (Table 63 and Table 64).

A higher proportion of patients with nodal involvement (cN_{any} OR cM_{1a}) received neoadjuvant treatment (55.3% vs. 18.4% in cN_0M_0, OR = 5.49, 95%CI 3.76 to 8.03]) (Table 65).

When comparing the main types of neoadjuvant treatment, a higher proportion of patients received chemoradiotherapy than chemotherapy only (29% vs. 14.3%) (Table 66).

Table 59 – Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by incidence year

	Numerator	Denominator	Proportion (%)
2004	54	158	34.2
2005	58	159	36.5
2006	70	158	44.3
2007	91	181	50.3
2008	81	161	50.3
Total	**354**	**817**	**43.3**

Table 60 – Sensitivity analysis: Proportion of patients with oesophageal cancer beyond the mucosa who received neoadjuvant treatment before their surgical intervention (T_{2-4} N_{any} M_{0-1a} / without T_4 / without T_4M_{1a})

	Numerator	Denominator	Proportion (%)
with T4	354	817	43.3
without T4	336	791	42.5
without T4M1a	354	817	43.3

Table 61 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention : SCC and AC by TNM stage (clinical stage)

	SCC			AC		
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)
I	-	-	-	3	44	6.8
II	27	99	27.3	53	238	22.3
III	82	114	71.9	143	261	54.8
IV	14	14	100.0	23	27	85.2
Total	**123**	**227**	**54.2**	**222**	**570**	**38.9**

Table 62 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by age group

	Numerator	Denominator	Proportion (%)
<50	62	99	62.6
50-59y	103	217	47.5
60-69y	122	266	45.9
70-79y	67	201	33.3
80+	0	34	0.0
Total	**354**	**817**	**43.3**

Table 63 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by sex

	Numerator	Denominator	Proportion (%)
Men	286	653	43.8
Women	68	164	41.5
Total	**354**	**817**	**43.3**

Table 64 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention: sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	52	80	65.0	10	19	52.6	1.67 (0.54-5.14)
50-59y	83	175	47.4	20	42	47.6	0.99 (0.48-2.05)
60-69y	99	211	46.9	23	55	41.8	1.23 (0.65-2.34)
70-79y	52	163	31.9	15	38	39.5	0.72 (0.33-1.59)
80+	0	24	0.0	0	10	0.0	-
Total	**286**	**653**	**43.8**	**68**	**164**	**41.5**	

Table 65 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by nodal involvement vs. no nodal involvement

	Numerator	Denominator	Proportion (%)
Nodal involvement (cN_{any} OR cM_{1a})	291	526	55.3
No nodal involvement (cN_0M_0)	46	250	18.4

Table 66 – Subgroup analysis: Proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, NACRT versus NACT

	Numerator	Denominator	Proportion (%)
NACRT	237	817	29.0
NACT	117	817	14.3

Comparison between centres

The funnel plot (Figure 54) depicts the variability between the 72 centres that were included in this analysis, based on the 2004-2008 data (the 40 other centres did not have eligible patients for this analysis). The majority of the very low volume centres were situated within the 99% limits. An important variability was observed between centres that treated more than 50 patients with oesophageal cancer beyond the mucosa during the 5 years period; in the highest volume centre (> 300 patients with T_{2-4} N_{any} M_{0-1a} cancer), 35.3% received a neoadjuvant treatment versus 77.1% of patients in a centre having treated 70 patients (Table 67). Restricting the analyses to the two last available years (2007 and 2008) did not change the global picture (Figure 55). For this shorter period, 54 centres were identified to have surgically treated a total of 342 patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}). Of these centres, 87% fell within the 95% limits of the funnel plot and 7.4% of the centres were situated above the 95% upper limits (Table 68).

When the population was restricted to patients with nodal involvement (cT_{2-4} $_cN_+$ $_cM_{0-1a}$ or cT_{2-4} $_cN_0$ $_cM_{1a}$), the mean estimated value for all centres increased to 55%. Four centres clearly differentiated from the other low- and medium-volume centres, giving neoadjuvant treatment to at least 85% of patients. Around 40% of patients with a nodal involvement treated in the highest volume centre received neoadjuvant treatment, a proportion that fell under the 99% lower limits (Figure 56).

Figure 54 – Funnel plot of the proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by centre (2004-2008)

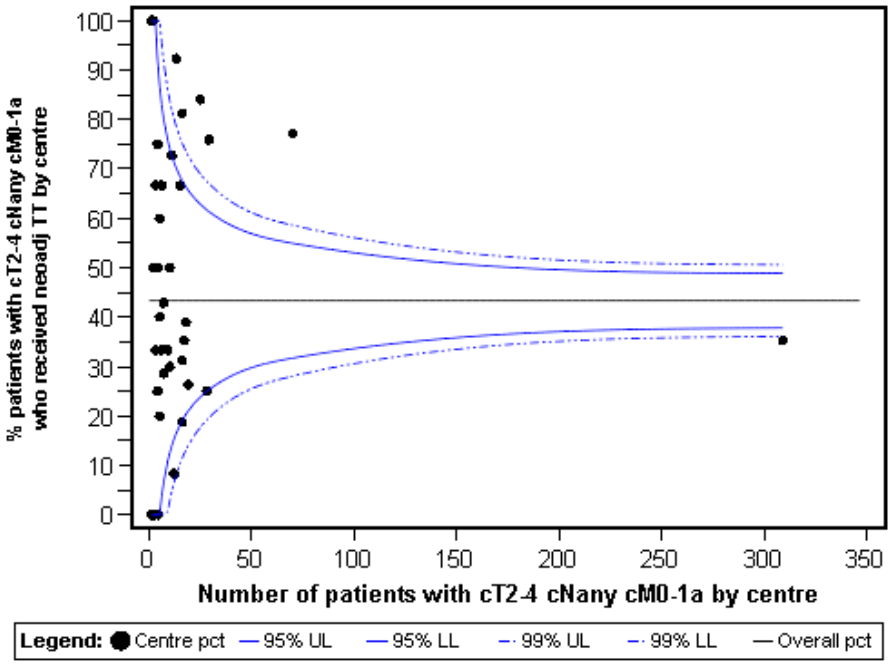


Table 67 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	1.39	1	1.39
Equal to 99%LL or lower than 95%LL	3	4.17	4	5.56
Between 95% control limits	62	86.11	66	91.67
Equal to 99%UL or upper than 95%UL	1	1.39	67	93.06
Upper than 99%UL	5	6.94	72	100.00

Figure 55 – Funnel plot of the proportion of patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who received neoadjuvant treatment before their surgical intervention, by centre (2007-2008)

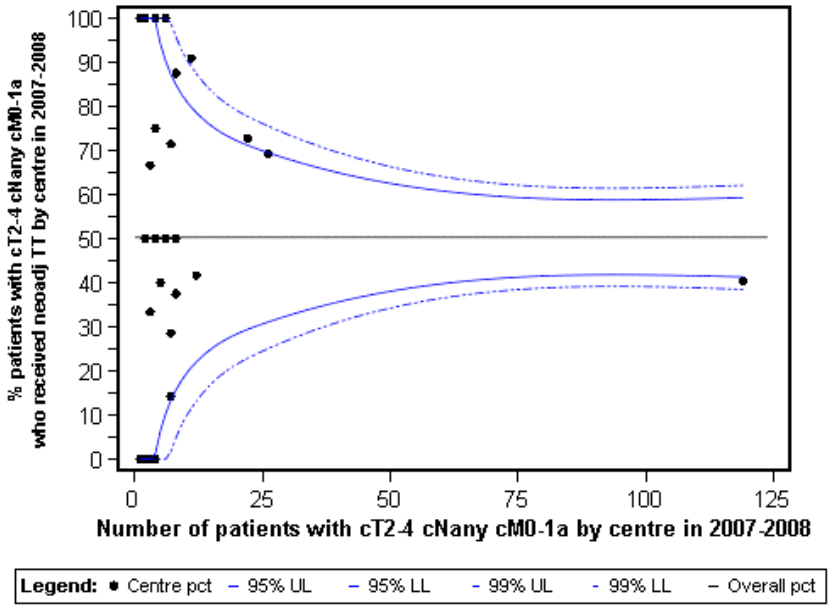


Table 68 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	2	3.70	2	3.70
Between 95% control limits	47	87.04	49	90.74
Equal to 99%UL or upper than 95%UL	4	7.41	53	98.15
Upper than 99%UL	1	1.85	54	100.00

Figure 56 – Funnel plot of the proportion of patients with oesophageal cancer with nodal involvement ($cT_{2-4}\ _cN_+\ _cM_{0-1a}$ or $cT_{2-4}\ _cN_0\ _cM_{1a}$) who received neoadjuvant treatment before their surgical intervention, by centre (2004-2008)

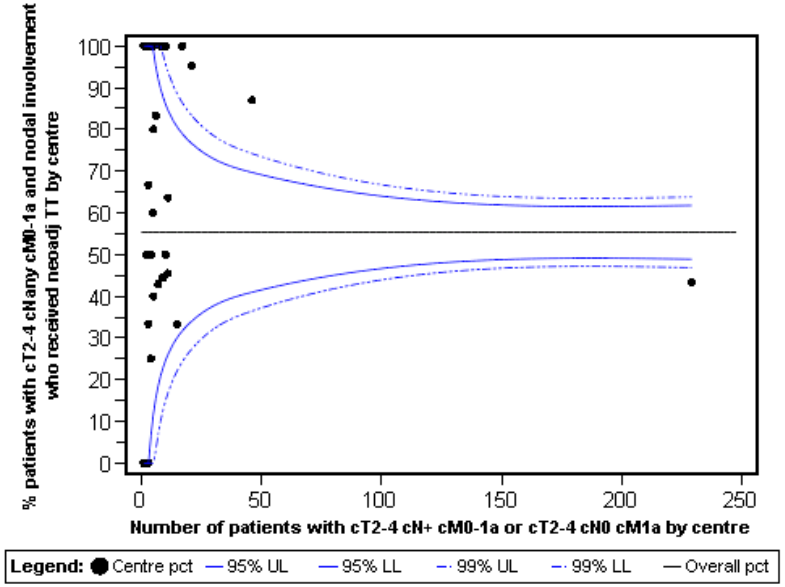


Table 69 – Number and proportion of outlying centres, cN+ or cM_{1a} only (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	1.52	1	1.52
Between 95% control limits	59	89.39	60	90.91
Equal to 99%UL or upper than 95%UL	2	3.03	62	93.94
Upper than 99%UL	4	6.06	66	100.00

Appendix 6.3.5. Discussion

Due to insufficient cure rates with oesophagectomy alone, neoadjuvant therapy for oesophageal cancer was proposed in the 1980s to improve long-term survival rates. In the following years, many heterogeneous and non-standardized clinical studies were conducted, with variable and often inconsistent results [59]. At that time, international guidelines did not recommend the use of neoadjuvant treatment. For example in 2005, Cancer Care Ontario (CCO) [60] recommended surgery alone (i.e. without neoadjuvant or adjuvant therapy) as the standard practice for resectable thoracic oesophageal cancer. More recent trials support the use of neoadjuvant therapy in locally-advanced and locoregional oesophageal cancer, leading some agencies to revise their recommendations. Both CCO and the Agency for Healthcare Research and Quality revised their recommendations in favour of the combination of preoperative cisplatin-based chemotherapy plus radiotherapy as the preferred modality for the management of surgically resectable patients with oesophageal cancer [33, 34]. In the Netherlands, the Dutch Comprehensive Cancer Centre (IKNL) also recommends that patients with potentially resectable oesophageal cancer (except T_1N_0 tumors) be treated with concurrent chemoradiotherapy prior to surgery [35]. In 2012, KCE revised its guideline[8] using a more flexible formulation, recommending that "*If, after multidisciplinary discussion*, neoadjuvant treatment is considered for a locally-advanced oesophageal or junction tumour, neoadjuvant

chemoradiotherapy is preferred (strong recommendation, low level of evidence)".

The results presented in this report apply to the period 2004-2008, when inconsistent results were reported in the international literature and when no national guidelines were available, explaining a liberal and heterogeneous use of neoadjuvant treatment. Clearly, the target could never have been 100% in that time period. Furthermore, the patient selection for neoadjuvant therapy needs to be based on specific factors including the fitness for systemic therapy and surgery. Therefore, all results reported here need to be considered as baseline values. Quality of care based on this process indicator cannot currently be assessed, but well in the future by comparing further results with baseline values.

In Belgium, of all patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who underwent a surgical intervention between 2004 and 2008, 43.3% received neoadjuvant treatment. This proportion increased annually to reach 50% in 2008. In comparison, in Italy, 33.2% of 3 493 patients with oesophageal cancer hospitalized in a university tertiary referral center between 2000 and 2004 received such neoadjuvant treatment [61]. In the US, Merkow et al. [59] conducted a nationwide study based on data from 1 000 hospitals and reported higher proportions of patients treated with neoadjuvant treatment according to the cancer stage (stage II 72.5%; stage III 90.1% in 2007).

In the UK, only 17.4% of patients who underwent surgery for oesophageal or gastric cancer between 1998 and 2008 received neo-adjuvant chemotherapy (population-based study). This may be because the time period of the study (1998–2008) partly preceded the publication of evidence on the effectiveness of neo-adjuvant chemotherapy on survival in gastric and oesophageal cancer [62]. On a more recent period, The National Oesophago-Gastric Cancer Audit [29] prospectively collected data from patients diagnosed with invasive epithelial cancer of the oesophagus between 1 October 2007 and 30 June 2009 from 30 Cancer Networks in England. This report revealed that 97% of patients with an oesophageal cancer (SCC, AC or GOJ) planned to have a curative resection began a neoadjuvant chemotherapy. Patients who had a combination of surgery and chemotherapy were on average younger and fitter than those having surgery only, which was expected given that patient selection is based on their ability to cope with the physiological impact of both the chemotherapy and the surgery. However, around 13% of patients did not complete their neoadjuvant treatment. The main reasons for incomplete treatment were acute chemotherapy toxicity and progressive disease [29].

In the Netherlands, the majority of patients with potentially resectable oesophageal cancer is treated with preoperative chemoradiotherapy followed by a transhiatal oesophageal resection (89% in 2011) [28]. Percentages reported for patients with a GOJ cancer were slightly higher (91%). According to DICA[28], the high percentage of radical resections for oesophageal carcinoma (91%) reflects the high percentage of patients undergoing preoperative treatment.

Subgroup analyses have shown that in Belgium a higher proportion of patients with SCC of the oesophagus underwent neoadjuvant treatment compared to patients with an adenocarcinoma (54.2% vs. 38.9%). In the US, Merkow et al. [59] reported high proportions of patients who received neoadjuvant treatment for both SCC and adenocarcinoma (60% and 58.7% respectively). The meta-analysis of Sjoquist et al. [56] reported that patients with adenocarcinoma and patients with SCC both benefited from neoadjuvant therapy, in terms of reduced all-cause mortality [56]. A recent large Dutch RCT (CROSS trial) [55] confirmed a significant impact on the hazard ratio for death for SCC (HR 0.422, 95%CI 0.226–0.788; p=0.007) and a similar trend for adenocarcinoma (HR 0.741, 95%CI 0.536–1.024; p=0.07). In UK, neoadjuvant chemotherapy is given whatever the histological type (SCC and AC) and the anatomical location (upper, mid, lower part of the oesophagus and GOJ).

In Belgium, neoadjuvant treatment is mainly given to stage III and IV patients and less often to stage II patients: nearly 3 in 4 patients with stage II disease and 4 in 10 patients with stage III disease did not receive preoperative systemic therapy. Clinical arguments supporting treatment decisions are not available in administrative databases. An in-depth analysis of each medical record could clarify the decision-making process for each patient, but such an analysis is beyond the objectives of this project. Contrasting results are found in the US where less than 20% of stage II patients and less than 10% of stage III patients underwent surgery alone. In UK, less than 20% of patients with stage II-III underwent surgery alone[29]. In patients with stage I cancer, as surgical resection alone is recommended, it was expected to observe low proportions of patients who received neoadjuvant treatment (6.8% in the AC group of the Belgian

cohort). In the US, the proportion was 11.2% in 2007, whereas surgery alone remained the dominant treatment modality in 81.0% of patients with stage I cancer.

Over 70 years of age, one third of patients who were surgically treated received neoadjuvant treatment and over 80 years of age no patient received neoadjuvant treatment. In the US, older age was also associated with a decreasing use of neoadjuvant therapy between 2005–2007. Nevertheless, a study conducted in Italy [63] in 238 patients <70 years and 31 patients ≥70 years undergoing oesophageal resection after neoadjuvant treatment showed that elderly patients receiving neoadjuvant therapy did not suffer from a higher risk of developing major postoperative complications as compared to their younger counterparts. The prevalence of mortality and major postoperative complications was similar between both groups, although cardiovascular complications were more likely to occur in older patients. Similar conclusions were reported by Fogh et al. [64] who did not find significant differences with respect to morbidity and mortality in elderly patients (≥70 years). The presence of cardiac disease, higher scores on the Charlson index, or diabetes did not significantly influence length of stay, postoperative complications, or postoperative death. The authors concluded that neoadjuvant therapy should not be discounted in carefully selected fit elderly patients [63, 64].

When comparing the two main types of neoadjuvant treatment, results indicated a higher proportion of chemoradiotherapy than chemotherapy only (29% vs. 14.3%) as recommended in international guidelines. Both strategies are associated with an improvement in survival compared with surgery alone. As clinical studies did not demonstrate the superiority of one neoadjuvant treatment over the other, further randomised trials comparing these two strategies directly are warranted.

One major limitation in our analysis is the lack of TNM staging reporting. For oesophageal cancer patients, cStage remained unreported for 2 388 patients (41%) that restricted our baseline sample to 1 623 patients with T_{2-4} N_{any} M_{0-1a} and only 817 who underwent a surgical resection. Such underreporting was already denounced for breast cancer (between 2004-2006, cStage was not documented in 48% of the breast cancer patients) (KCE report 150).

Finally, this indicator is not optimal to draw conclusions on the variability between centres. Using 5-year data, the majority of the very small volume centers (86.1%) contribute very few data (due to low prevalence of T_{2-4} N_{any} M_{0-1a}) and hence are *de facto* within the expected limits of the funnel plot. A group of medium size hospitals (around 50 patients within 5 years) clearly make different therapeutic choices than other hospitals, with rates of neoadjuvant treatment around 80-90%. Finally, the highest volume centre (> 300 patients) also adopts a different therapeutic strategy, with respectively 35.3% of patients T_{2-4} N_{any} M_{0-1a} and 40% of patients with nodal involvement (cT_{2-4} $_cN_+$ $_cM_{0-1a}$ or cT_{2-4} $_cN_0$ $_cM_{1a}$) who received neoadjuvant treatment prior to their surgical intervention.

Key points

- **In Belgium, of all patients with oesophageal cancer beyond the mucosa (T_{2-4} N_{any} M_{0-1a}) who underwent a surgical intervention between 2004 and 2008, 43.3% received neoadjuvant treatment. This proportion increased annually to reach 50% in 2008.**
- **These results apply to the period 2004-2008, when inconsistent results were reported in the international literature and when no national guidelines were available, explaining a liberal and heterogeneous use of neoadjuvant treatment.**
- **In general, a high proportion of patients who would be candidates for neoadjuvant treatment did not receive this treatment, whatever the underlying reasons (not documented).**
- **Between 2004 and 2008, neoadjuvant treatment was more common in patients with T_{2-4} N_{any} M_{0-1a} oesophageal cancer with the following characteristics:**
  - **SCC histological type;**
  - **cStage III or IV;**
  - **Nodal involvement.**
- **Patients with oesophageal cancer aged 70 years and above were less likely to receive neoadjuvant treatment.**
- **A large variability between centres was observed in the use of neoadjuvant treatment, even when medium and high volume centres were compared. However, this variability was largely within the expected limits of chance.**

- **Quality of care based on this process indicator cannot currently be assessed, but well in the future by comparing further results with baseline values.**

Appendix 6.4. OC6: Oesophageal resection mortality rate

Appendix 6.4.1. Rationale

For patients with resectable oesophageal cancer beyond the mucosa, surgery (+/- neoadjuvant chemoradiotherapy) is considered standard (strong recommendation, high level of evidence) [8]. However, oesophageal surgery is associated with an important postoperative mortality rate. A recent meta-analysis showed a significantly higher early mortality (< 30-day or in-hospital) after transthoracic oesophagectomy than after transhiatal oesophagectomy (10.6% vs. 7.2%; OR 1.48, 95%CI 1.20-1.83, p<0.001) [65]. This meta-analysis included both randomized and observational studies.

Many studies have shown a relationship between patient outcomes (e.g. 30-day mortality) and surgeon or hospital volume [52, 54, 66, 67]. The recent meta-analysis done by Wouters et al. [46], applying strict criteria for methodological quality of included studies, reported that hospital volume had a strong inverse relation with postoperative mortality, and that patients operated on in high-volume centres had better survival (HR 1.17; 95%CI 1.05-1.31).

Appendix 6.4.2. Definition

Type of indicator

Outcome indicator

Description

Esophageal resection mortality rate within 30 days.

Numerator

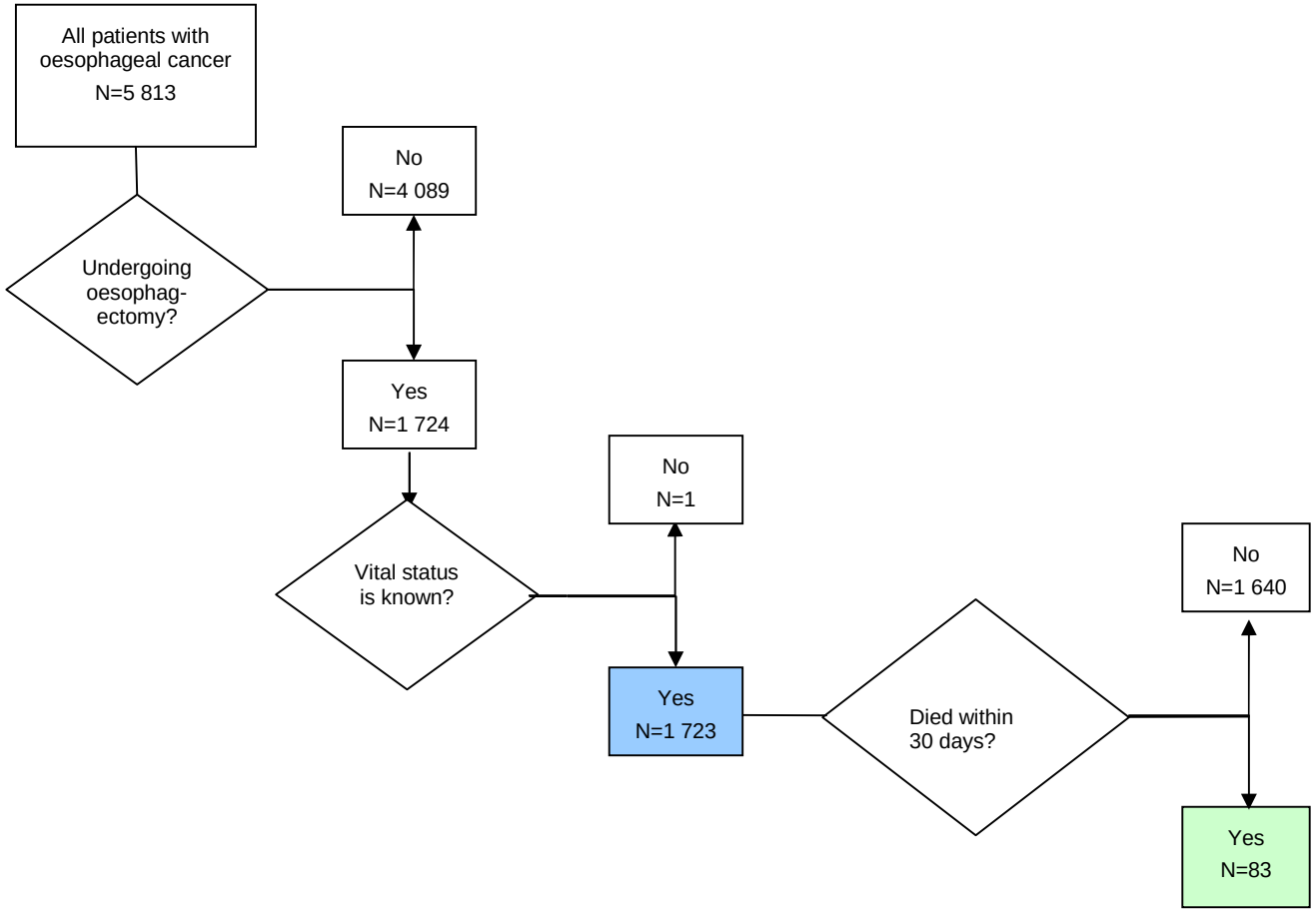
All patients with oesophageal cancer treated with oesophagectomy in a given year dying within 30 days.

Denominator

All patients with oesophageal cancer treated with oesophagectomy in a given year.

Appendix 6.4.3. Elaboration

Flowchart



Note: One patient who is lost to follow-up was still alive 30 days (and 60 and 90 days) after the oesophagectomy and is taken into account as not died within 30 days (or 60 or 90 days). The other patient became lost to follow-up at the day of surgery and is therefore not taken into account in the calculation of the indicator (not in the numerator no r in the denominator).

Supplementary analyses

Subgroup analysis

- Separate analysis for oesophageal tumours and junction tumours
- Transthoracal vs. transhiatal oesophagectomy
- Neoadjuvant treatment or not
- Neoadjuvant chemo(radio)therapy or not (so excluding neoadjuvant radiotherapy alone)

Risk adjustment

- To be adjusted for sex, age, stage, histological type, comorbidity (WHO), hospital volume

Sensitivity analysis

- Analysis at 60 days and 90 days
- Logistic regression model with the following factors as covariates: age, sex, type of tumour (oesophageal or junction), stage, comorbidity (WHO), year of intervention and hospital volume of oesophagectomies.

Data sources

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD-10 code C15.0-C16.0 (BCR)
- Stage: combined stage (BCR)
- Oesophagectomy: nomenclature codes (IMA) (Appendix 8.3, Table 230)
- Mortality data: Crossroads bank of Social Security

Limitations

- Comorbidity data other than WHO performance status are not available at the BCR or in the IMA data available to the BCR.
- The nomenclature does not allow a distinction between transthoracic and transhiatal oesophagectomies.

Appendix 6.4.4. Results

National results

Overall, between 2004 and 2008, 4.8% of the 1 723 patients with oesophageal cancer that underwent oesophageal resection and for whom the vital status was known died within 30 days after surgery (Table 70). The proportion varied between 2004 and 2008, and was the lowest in 2004 (3.5%) and 2008 (3.7%), and the highest in 2005 (6.7%). Women had a slightly higher 30-day mortality than men, although the difference was not statistically significant (Table 71: men vs. women, OR = 0.76, 95%CI 0.44 to 1.30). The 30-day mortality clearly increased with age (Table 72: 80+ vs. 80-, OR = 5.11, 95%CI 2.40 to 10.67). No significant sex differences were found when stratified by age (Table 73).

Oesophageal tumours tended to have a higher 30-day postoperative mortality than junction tumours, although the difference was not statistically significant (5.4% vs. 3.4%, OR = 1.65, 95%CI 0.93 to 2.95) (Table 74).

Patients receiving neoadjuvant treatment tended to have a better short-term outcome than patients not receiving neoadjuvant treatment, although the difference was not statistically significant (4.2% vs. 5.1%, OR = 0.81, 95%CI 0.81 to 1.35) (Table 75 and Table 76).

When the period was extended to 60 and 90 days, the mortality rose to 8.2% and 9.9%, respectively (Table 77).

Table 70 – Oesophageal resection mortality rate within 30 days, by incidence year

	Numerator	Denominator	Proportion (%)
2004	11	317	3.5
2005	24	359	6.7
2006	18	364	4.9
2007	18	357	5.0
2008	12	326	3.7
Total	**83**	**1 723**	**4.8**

Table 71 – Oesophageal resection mortality rate within 30 days, by sex

	Numerator	Denominator	Proportion (%)
Men	62	1 368	4.5
Women	21	355	5.9
Total	**83**	**1 723**	**4.8**

Table 72 – Oesophageal resection mortality rate within 30 days, by age group

	Numerator	Denominator	Proportion (%)
<50	3	188	1.6
50-59y	19	461	4.1
60-69y	23	572	4.0
70-79y	27	441	6.1
80+	11	61	18.0
Total	**83**	**1 723**	**4.8**

Table 73 – Oesophageal resection mortality rate within 30 days: sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	3	153	2.0	0	35	0.0	-
50-59y	15	378	4.0	4	83	4.8	0.82 (0.24-3.00)
60-69y	21	452	4.6	2	120	1.7	2.87 (0.64-18.00)
70-79y	16	336	4.8	11	105	10.5	0.43 (0.18-1.02)
80+	7	49	14.3	4	12	33.3	0.33 (0.06-1.76)
Total	**62**	**1 368**	**4.5**	**21**	**355**	**5.9**	

Table 74 – Oesophageal resection mortality rate within 30 days, by type of tumour

	Numerator	Denominator	Proportion (%)
Oesophageal tumours	66	1 217	5.4
Junction tumours	17	506	3.4
Total	**83**	**1 723**	**4.8**

Table 75 – Oesophageal resection mortality rate within 30 days, by neoadjuvant therapy or not

	Numerator	Denominator	Proportion (%)
Neoadjuvant therapy	23	552	4.2
No neoadjuvant therapy	60	1 171	5.1
Total	**83**	**1 723**	**4.8**

Table 76 – Oesophageal resection mortality rate within 30 days, by neoadjuvant chemotherapy or not

	Numerator	Denominator	Proportion (%)
Neoadjuvant chemotherapy	23	547	4.2
No neoadjuvant chemotherapy	60	1 176	5.1
Total	**83**	**1 723**	**4.8**

Table 77 – Sensitivity analysis: mortality within 60 and 90 days

	Numerator	Denominator	Proportion (%)
30 days	83	1 723	4.8
60 days	141	1 723	8.2
90 days	171	1 723	9.9

Univariate analysis showed that age and hospital volume were significantly predictive for the 30-day mortality (Table 78), while age, histological type and hospital volume were predictive for the 90-day mortality (Table 79). Type of tumour was also predictive for the 30-day and 90-day mortality, although not statistically significant. In a multivariate analysis with adjustment for sex, age, histological type, combined stage and hospital volume, both age and hospital volume remained significantly predictive for 30-day mortality, while age, histological type, combined stage and hospital volume were predictive for 90-day mortality.

Table 78 – Univariate and multivariate analysis using logistic regression model to predict the risk of 30-day mortality after an oesophagectomy (N=1 723)

				Unadjusted odds ratio			Adjusted odds ratio*		
	N of patients with an oesophagectomy	N of events (30-day mortality)	% of events (30-day mortality)	OR	95%CI	p-value	OR	95%CI	p-value
Sex						0.279			0.798
Men (Reference)	1 368	62	4.5	1			1		
Women	355	21	5.9	1.325	[0.796-2.204]		1.073	[0.624-1.846]	
Age						0.005			0.004
<50y	188	3	1.6	0.198	[0.060-0.649]		0.187	[0.056-0.624]	
50-59y	461	19	4.1	0.525	[0.298-0.924]		0.487	[0.270-0.879]	
60-69y	572	23	4.0	0.512	[0.300-0.871]		0.479	[0.277-0.828]	
>=70y (Reference)	502	38	7.6	1			1		
Type of tumour						0.071			
Oesophageal (Reference)	1 217	66	5.4	1					
Junction	506	17	3.4	0.606	[0.352-1.044]				
Histological type						0.173			0.055
AC (Reference)	1 167	49	4.2	1			1		
SCC	506	32	6.3	1.540	[0.974-2.436]		1.825	[1.107-3.011]	
Other	50	2	4.0	0.951	[0.225-4.025]		0.851	[0.195-3.717]	
Combined stage						0.151			0.240
I	411	15	3.6	0.552	[0.253-1.205]		0.452	[0.202-1.010]	
II	507	25	4.9	0.756	[0.372-1.538]		0.544	[0.261-1.137]	
III	475	19	4.0	0.608	[0.289-1.278]		0.5	[0.233-1.075]	

	N of patients with an oesophagectomy	N of events (30-day mortality)	% of events (30-day mortality)	Unadjusted odds ratio OR	95%CI	p-value	Adjusted odds ratio* OR	95%CI	p-value
IV (Reference)	187	12	6.4	1			1		
X	143	12	8.4	1.336	[0.582-3.069]		0.797	[0.336-1.890]	
Incidence year						0.303			
2004 (Reference)	317	11	3.5	1					
2005	359	24	6.7	1.993	[0.960-4.137]				
2006	364	18	4.9	1.447	[0.673-3.112]				
2007	357	18	5.0	1.477	[0.687-3.177]				
2008	326	12	3.7	1.063	[0.462-2.446]				
Hospital volume						<0.001			<0.001
Low (≤5 per year) (Reference)	689	51	7.4	1			1		
Medium (6-19 per year)	435	22	5.1	0.666	[0.398-1.115]		0.669	[0.397-1.128]	
High (20+ per year)	599	10	1.7	0.212	[0.107-0.422]		0.226	[0.113-0.454]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Table 79 – Univariate and multivariate analysis using logistic regression model to predict the risk of 90-day mortality after an oesophagectomy (N=1 723)

	N of patients with an oesophagectomy	N of events (90-days mortality)	% of events (90-days mortality)	Unadjusted odds ratio			Adjusted odds ratio*		
				OR	95%CI	p-value	OR	95%CI	p-value
Sex						0.343			0.563
Men (Reference)	1 368	131	9.6	1			1		
Women	355	40	11.3	1.199	[0.824-1.745]		0.888	[0.592-1.330]	
Age						<0.001			<0.001
<50y	188	7	3.7	0.201	[0.091-0.444]		0.157	[0.070-0.354]	
50-59y	461	39	8.5	0.480	[0.320-0.720]		0.375	[0.244-0.577]	
60-69y	572	44	7.7	0.433	[0.294-0.639]		0.36	[0.240-0.541]	
>=70y (Reference)	502	81	16.1	1			1		
Type of tumour						0.072			
Oesophageal (Reference)	1 217	131	10.8	1					
Junction	506	40	7.9	0.712	[0491-1.031]				
Histological type						<0.001			<0.001
AC (Reference)	1 167	91	7.8	1			1		
SCC	506	75	14.8	2.058	[1.486-2.849]		2.711	[1.886-3.897]	
Other	50	5	10.0	1.314	[0.509-3.392]		1.214	[0.452-3.259]	
Combined stage						0.082			0.039
I	411	30	7.3	0.510	[0.291-0.895]		0.422	[0.234-0.759]	
II	507	48	9.5	0.678	[0.405-1.135]		0.477	[0.276-0.822]	
III	475	48	10.1	0.728	[0.435-1.221]		0.601	[0.350-1.033]	
IV (Reference)	187	25	13.4	1			1		

	N of patients with an oesophagectomy	N of events (90-days mortality)	% of events (90-days mortality)	Unadjusted odds ratio OR	95%CI	p-value	Adjusted odds ratio* OR	95%CI	p-value
X	143	20	14.0	1.054	[0.559-1.984]		0.634	[0.325-1.238]	
Incidence year						0.738			
2004 (Reference)	317	35	11.0	1					
2005	359	40	11.1	1.010	[0.624-1.635]				
2006	364	33	9.1	0.803	[0.487-1.326]				
2007	357	35	9.8	0.876	[0.534-1.437]				
2008	326	28	8.6	0.757	[0.449-1.277]				
Hospital volume						<0.001			<0.001
Low (≤5 per year) (Reference)	689	87	12.6	1			1		
Medium (6-19 per year)	435	54	12.4	0.981	[0.682-1.410]		0.994	[0.683-1.447]	
High (20+ per year)	599	30	5.0	0.365	[0.237-0.561]		0.367	[0.235-0.573]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Comparison between centres

The adjusted funnel plot shows variability between the 88 centres that were included in this analysis (Figure 58). Adjusted for age and combined stage, 25 centres had a 30-day mortality above 10%, and 9 centres even had a 30-day mortality above 20%. Nine centres had a 30-day mortality above the 95%UL. In contrast, 46 centres had a 30-day mortality below 1%.

Multivariate analysis showed that centres performing at least 20 oesophagectomies per year had a significantly lower 30-day mortality (Table 78: adjusted OR 0.226, 95%CI 0.113 to 0.454) and 90-day mortality (Table 79: adjusted OR 0.367, 95%CI 0.235 to 0.573) than those performing less than 6 oesophagectomies per year.

Figure 57 – Funnel plot of the 30-day mortality rate after an oesophagectomy, by centre

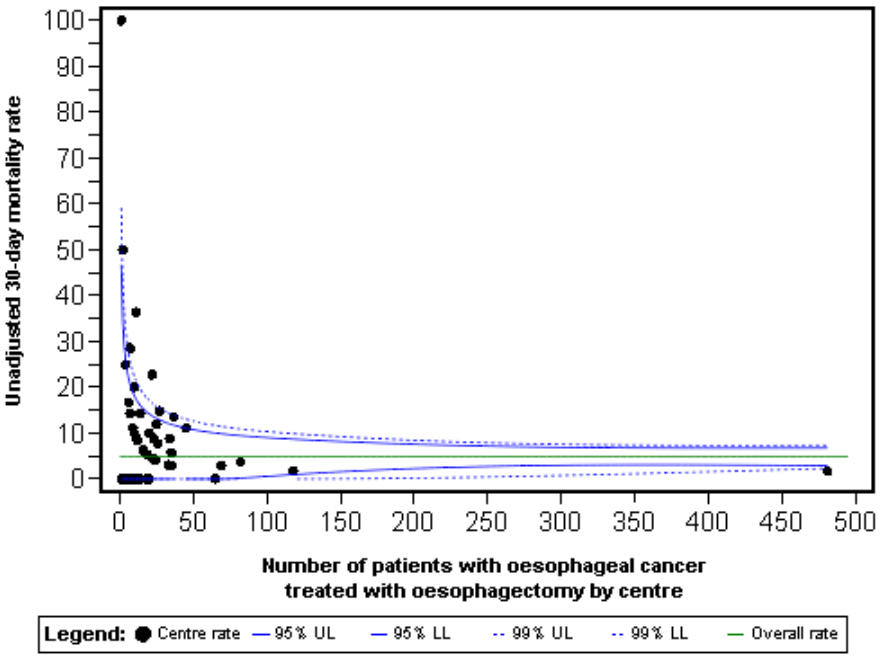
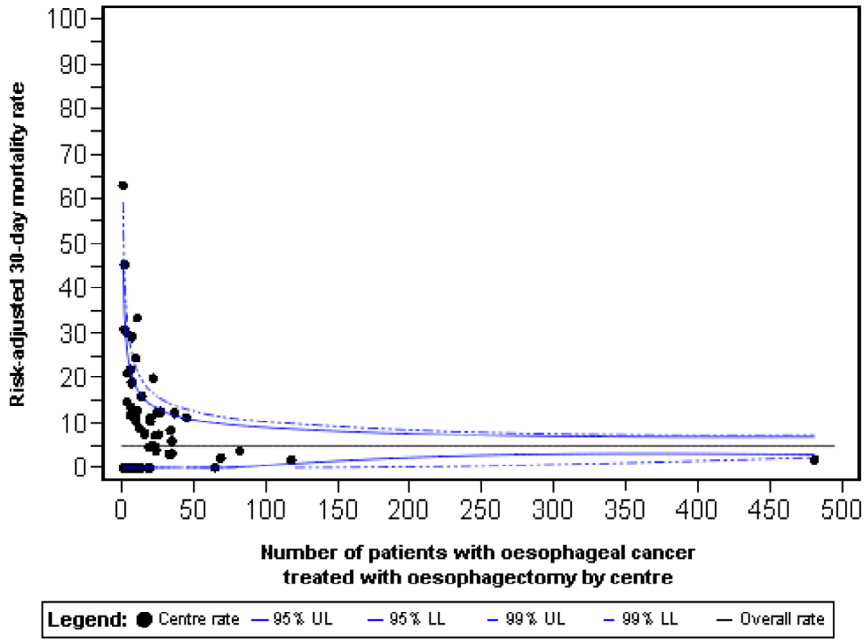


Figure 58 – Funnel plot of the 30-day mortality rate after an oesophagectomy, by centre, adjusted for age and combined stage



Note: Due to a low sample size for most centres and low percentages of deaths, one should be careful with the interpretation of adjusted rates; small changes might have a significant impact on the adjusted rate (observed rate / expected rate).

Table 80 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	1.14	1	1.14
Between 95% control limits	77	87.50	78	88.64
Equal to 99%UL or upper than 95%UL	4	4.55	82	93.18
Upper than 99%UL	6	6.82	88	100.00

Table 81 – Number and proportion of outlying centres, adjusted for age and combined stage (2004-2008)

Adjusted rate	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	1.14	1	1.14
Between 95% control limits	78	88.64	79	89.77
Equal to 99%UL or upper than 95%UL	3	3.41	82	93.18
Upper than 99%UL	6	6.82	88	100.00

Appendix 6.4.5. Discussion

Overall, a 30-day mortality of 4.8% and a 90-day mortality of 9.9% were found for the 1 723 patients with oesophageal cancer (diagnosed between 2004 and 2008) that underwent oesophageal resection. Age and hospital volume were found to be independent risk factors for 30-day mortality, while age, histological type, combined stage and hospital volume were predictive for 90-day mortality. However, due to a low sample size for most centres and a low number of events, the adjusted rates should be interpreted with caution. Indeed, small changes in the number of events might have a significant impact on the ratio observed / expected rate.

According to the Dutch Institute for Clinical Auditing (DICA) [28], 30-day mortality was 1.4% in 573 patients surgically treated for oesophageal cancer. DICA started in 2011 aiming at the registration of patients with oesophagogastric cancer with the intention to be surgically treated. In the UK, the National Oesophago-Gastric Cancer Audit reported a 30-day mortality of 3.8% and a 90-day mortality of 5.7% in 2 200 patients undergoing oesophagectomy (diagnosed between October 2007 and June 2009) [29]. Importantly, the Dutch results were measured after the instauration of a volume criterion for the treatment of patients with oesophageal cancer and are based on 614 patients treated in 42 centres in 2011 (15 patients per centre per year on average). In the Belgian cohort, 30-day and 90-day mortality for patients treated in high-volume centres (defined as treating at least 20 patients per year) was 1.7% and 5.0%, respectively, compared to 7.4% and 12.6%, respectively, for patients treated in low-volume centres (defined as treating 5 or less patients per year).

In the literature, age and comorbidity are frequently cited as independent risk factors for postoperative mortality [25, 68-71]. For age, we were also able to show this association. However, in the absence of complete data of sufficient quality on comorbidity (using the WHO scale), we were unable to include this factor in our model.

A recent meta-analysis found an in-hospital mortality of 8.5% in the low-volume group and 2.8% in the high-volume group (8 studies; OR = 0.29; 95%CI 0.16 to 0.53, p<0.0001) [72]. The 30-day mortality was 2.1% vs. 0.7%, respectively (2 studies; OR = 0.31; 95%CI 0.19 to 0.51). The studies included in this meta-analysis used several different thresholds to define low- and high-volume centres. In addition, in another recent systematic review, Blencowe et al. found an important heterogeneous reporting and use of definitions for postoperative mortality, making a comparison of our results with those of other studies difficult [73]. Nevertheless, the literature seems to support our findings of a relation between postoperative mortality and hospital volume.

In the literature, various definitions are used to evaluate postoperative mortality. Most commonly, 30-day and in-hospital mortality are used. However, in particular the in-hospital mortality is dependent on discharge practice. To avoid this, extending the follow-up to 90 days may be an option, at the risk of including patients who die from rapidly progressive disease. However, for elective surgery with curative intent, staging examinations should exclude patients with advanced disease and 90-day mortality may serve as an outcome indicator for both surgical care and preoperative selection [74].

Key points

- **For patients with oesophageal cancer diagnosed between 2004 and 2008 and treated with oesophageal resection, a 30-day mortality of 4.8% and a 90-day mortality of 9.9% were found.**
- **Age and hospital volume were found to be independent risk factors for 30-day mortality, while age, histological type, combined stage and hospital volume were predictive for 90-day mortality.**

Appendix 6.5. OC10: Primary chemoradiotherapy

Appendix 6.5.1. Rationale

Primary concomitant chemoradiotherapy is associated with a survival benefit compared to radiotherapy alone in patients with oesophageal cancer (moderate level of evidence [75-77]). Consequently, definitive concomitant chemoradiotherapy should be considered in patients with oesophageal cancer of any histological type (strong recommendation, moderate level of evidence):

- If the tumour is considered unresectable;
- If the patient is unfit for surgery;
- If the patient declines surgery.

Definitive concomitant chemoradiotherapy can be considered for patients with cervical oesophageal cancer in order to preserve the larynx (weak recommendation, low level of evidence).

Appendix 6.5.2. Definition

Type of quality indicator

Process indicator

Description

Proportion of patients with any stage of oesophageal cancer treated with primary chemoradiotherapy.

Numerator

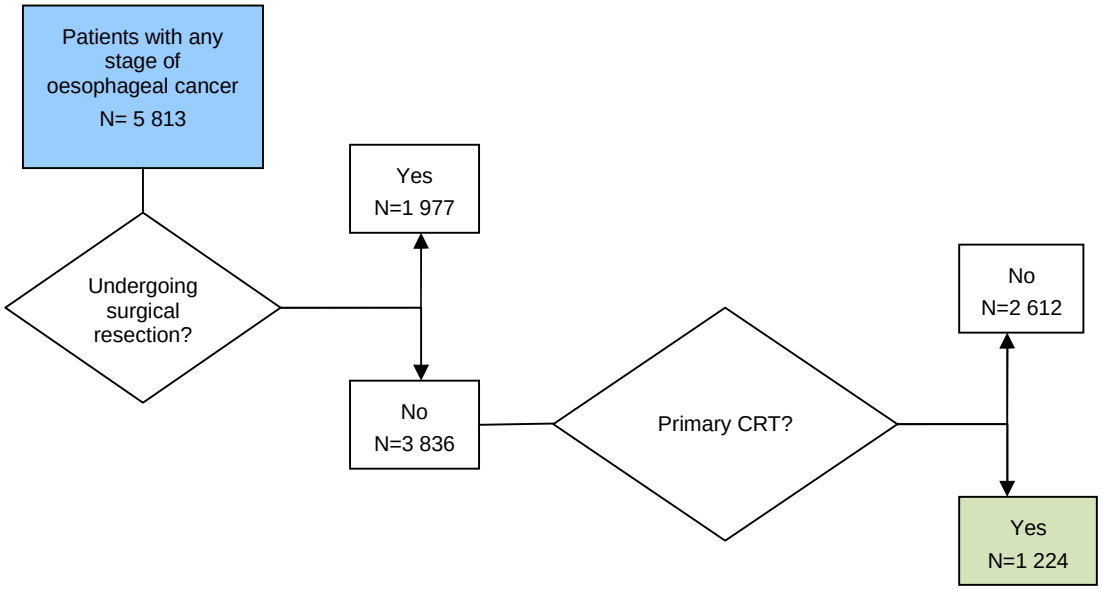
All patients with any stage of oesophageal cancer who were treated with primary chemoradiotherapy (without surgical resection).

Denominator

All patients with any stage of oesophageal cancer.

Appendix 6.5.3. Elaboration

Flowchart



Supplementary analyses

Subgroup analyses

- Analysis by clinical stage, histological type, age group, sex and incidence year

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- No sensitivity analysis

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD10 code C15.0-C16.0 (BCR)
- Cancer stages: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3: Table 230, Table 232 and Table 233)
  - Radiotherapy: nomenclature codes (IMA) (Appendix 8.3.3, Table 236)
  - Chemotherapy: nomenclature codes (IMA) (Appendix 8.3.2, Table 235)

Appendix 6.5.4. Results

National results

Globally, in Belgium, during the period 2004-2008, 1 977 patients with oesophageal cancer underwent a surgical resection (34%) whereas 3 836 patients (66%) received medical treatment (curative or palliative) (Table 82). Whereas 70-80% of patients with tumours located in the upper and middle third of the oesophagus were treated with definitive chemoradiotherapy, half of the patients with tumours located in the lower third of the oesophagus and the GOJ benefited from surgery (Table 83). Most cancers of the upper two thirds of the oesophagus were squamous cell tumours (>86%) whereas cancers of the lower esophagus were most often adenocarcinomas (66% for the lower third and 94.6% for the GOJ) (Table 84).

Patients who were in cStage III or IV were most likely to receive a primary chemoradiotherapy compared to patients with lower cStages (30.6% vs. 18.6%; OR 1.93 [95%CI 1.62 – 2.29]). However, 4.6% of patients who had a cancer in situ or a cStage I cancer were not surgically treated and received primary CRT (Table 85). In the Belgian cohort, 45.3% of patients with a SCC in cStage III-IV were treated with primary chemoradiotherapy whereas only 19.8% of patients with adenocarcinoma in cStage III-IV received this therapy (Table 86). Globally, patients with SCC were most likely treated with primary chemoradiotherapy than patients with adenocarcinoma (35.4% vs. 11.2%; OR=4.33 [95%CI 3.76 – 4.98]).

Clear differences were found in the proportion of patients with an oesophageal cancer treated by primary chemoradiotherapy across age categories; the proportion of patients receiving such treatment decreased from 26.3% before 70 years to 14% after 70 years (OR 2.18 [95%CI 1.90 – 2.51]). Among patients older than 80 years, 7.3% received a primary chemoradiotherapy (Table 87).

Slight differences were observed according to sex, with a higher proportion reported for men than for women (21.8% vs. 18.6%; OR 1.22 [95%CI 1.04 – 1.42]) (Table 88). However, this difference disappeared when stratified by age category (Table 89).

The proportion of patients who received primary chemoradiotherapy remained stable over time, around 20% (Table 90).

Table 82 – Oesophageal cancer: Distribution of surgery and non surgical treatment (yes/no) by histological type

		Histological type		
	Total	**AC**	**SCC**	**Other**
Surgery (N)	**1 977**	**1 402**	**512**	**63**
Row %		70.9	25.9	3.2
Column %		42.9	22.2	26.7
No surgery (N)	**3 836**	**1 866**	**1 797**	**173**
Row %		48.6	46.9	4.5
Column %		57.1	77.8	73.3
Total (N)	**5 813**	**3 268**	**2 309**	**236**

Table 83 – Oesophageal cancer: Distribution of surgery (yes/no) by sublocalisation

	Total	Sublocalisation				
		Cervical part/ Upper third	Thoracic part/ Middle third	Abdominal part/ Lower third	Overlapping parts and unspecified	GOJ
Surgery (N)	**1 977**	**54**	**140**	**562**	**484**	**737**
Row %		2.7	7.1	28.4	24.5	37.3
Column %		18.4	29.4	47.2	20.2	50.8
No surgery (N)	**3 836**	**240**	**336**	**629**	**1 916**	**715**
Row %		6.3	8.8	16.4	50.0	18.6
Column %		81.6	70.6	52.8	79.8	49.2
Total (N)	**5 813**	**294**	**476**	**1 191**	**2 400**	**1 452**

Table 84 – Oesophageal cancer: Distribution of histological type by sublocalisation

	Total	Sublocalisation				
		Cervical part/ Upper third	Thoracic part/ Middle third	Abdominal part/ Lower third	Overlapping parts and unspecified	GOJ
AC (N)	**3 268**	**29**	**54**	**791**	**1 020**	**1 374**
Row %		0.89	1.65	24.2	31.21	42.04
Column %		9.86	11.34	66.41	42.5	94.63
SCC (N)	**2 309**	**255**	**414**	**351**	**1 268**	**21**
Row %		11.04	17.93	15.2	54.92	0.91
Column %		86.73	86.97	29.47	52.83	1.45
Other (N)	**236**	**10**	**8**	**49**	**112**	**57**
Row %		4.24	3.39	20.76	47.46	24.15
Column %		3.4	1.68	4.11	4.67	3.93
Total (N)	**5 813**	**294**	**476**	**1 191**	**2 400**	**1 452**

Table 85 – Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by clinical stage

	Numerator	Denominator	Proportion (%)
In situ	1	7	14.3
Stage I	18	401	4.5
Stage II	214	843	25.4
Stage III	319	993	32.1
Stage IV	346	1 181	29.3
Stage X	326	2 388	13.7
Total	**1 224**	**5 813**	**21.1**

Table 86 – Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy: SCC and AC by clinical stage

	SCC			AC		
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)
In situ				1	7	14.3
Stage I	10	80	12.5	8	310	2.6
Stage II	161	384	41.9	51	435	11.7
Stage III	220	467	47.1	90	487	18.5
Stage IV	190	437	43.5	141	682	20.7
Stage X	236	941	25.1	76	1 347	5.6
Total	**817**	**2 309**	**35.4**	**367**	**3 268**	**11.2**

Note: 236 tumours are other specified or unspecified carcinoma or unspecified malignant neoplasm

Table 87 – Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by age group

	Numerator	Denominator	Proportion (%)
<50	101	459	22.0
50-59y	376	1 293	29.1
60-69y	396	1 564	25.3
70-79y	289	1 647	17.5
80+	62	850	7.3
Total	**1 224**	**5 813**	**21.1**

Table 88 – Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by sex

	Numerator	Denominator	Proportion (%)
Men	960	4 397	21.8
Women	264	1 416	18.6
Total	**1 224**	**5 813**	**21.1**

Table 89 – Subgroup analysis: Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy: sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	86	384	22.4	15	75	20.0	1.15 (0.60-2.24)
50-59y	302	1 046	28.9	74	247	30.0	0.95 (0.69-1.30)
60-69y	323	1 242	26.0	73	322	22.7	1.20 (0.89-1.62)
70-79y	218	1 240	17.6	71	407	17.4	1.01 (0.74-1.37)
80+	31	485	6.4	31	365	8.5	0.74 (0.43-1.27)
Total	**960**	**4 397**	**21.8**	**264**	**1 416**	**18.6**	

Table 90 – Proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by incidence year

	Numerator	Denominator	Proportion (%)
2004	226	1 099	20.6
2005	244	1 164	21.0
2006	253	1 181	21.4
2007	275	1 235	22.3
2008	226	1 134	19.9
Total	**1 224**	**5 813**	**21.1**

Comparison between centres

Figure 59 presents the variability between the centres for the use of primary chemoradiotherapy, based on the 2004-2008 data. The differences between individual centres are fairly large, but the funnel plots reveal that this may be due to random fluctuations alone. The group of medium-volume hospitals (25-50 patients with oesophageal cancer of any stage treated yearly per hospital) did not adopt different therapeutic options than low-volume hospitals. The highest volume hospital (around 140 patients with oesophageal cancer treated yearly) used primary chemoradiotherapy in less than 10% of all patients.

Figure 59 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer treated with primary chemoradiotherapy, by centre (2004-2008)

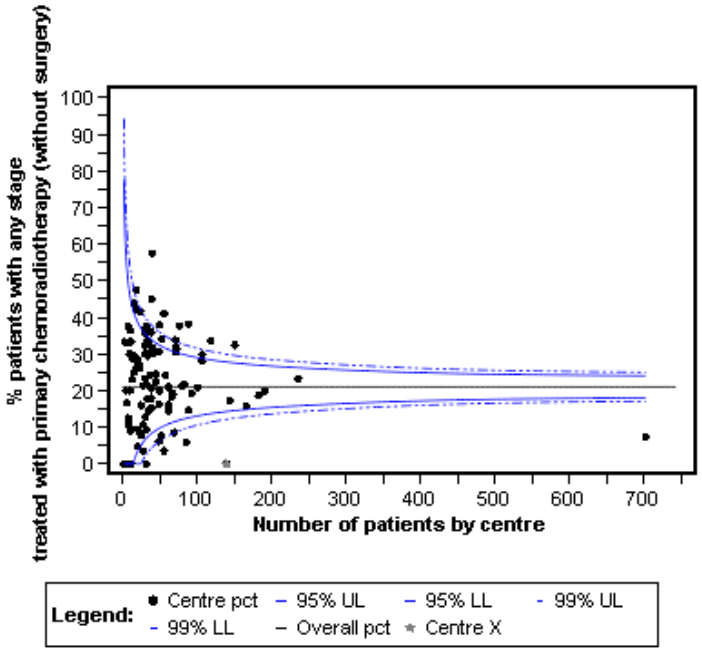


Table 91 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	5	4.46	5	4.46
Equal to 99%LL or lower than 95%LL	4	3.57	9	8.04
Between 95% control limits	80	71.43	89	79.46
Equal to 99%UL or upper than 95%UL	13	11.61	102	91.07
Upper than 99%UL	10	8.93	112	100.00

Appendix 6.5.5. Discussion

Two pivotal studies of definitive chemoradiotherapy (RTOG 85-01 [36] and RTOG 94-05/INT 0123 trial [37]), were decisive to consider in Western countries chemoradiotherapy as a standard of care for patients who either are not suitable for surgery or who do not wish to undergo surgery. Later, a phase III trial (FFCD 9102) [38] concluded that patients with SCC who respond to exclusive CRT showed similar median survival and quality of life whether patients were resected or not. These trials led clinicians to adopt different strategies according to the histological type of the oesophageal tumour and the morphologic response after induction treatment [39]. For locally advanced adenocarcinomas, neoadjuvant chemotherapy or neoadjuvant chemoradiotherapy followed by surgery was considered as the standard of care. In France for example, for locally advanced SCC (cStage III) exclusive CRT was considered in morphological responder patients, allowing similar overall survival with less post-treatment morbi-mortality than CRT followed by surgery [40]. However, surgery should be kept in mind as salvage treatment in patients with no morphological response or persistent tumour after definitive CRT.

In Belgium, the proportions of patients treated by a non surgical approach were higher among SCC histological types with advanced cancer stages (cStages III-IV). This observation is congruent with therapeutic standards adopted in Western countries. By comparison, in the US (1998-2007) [78], patients with non metastatic SCC were also more often treated with definitive chemoradiotherapy (SCC, 54.1% vs. AC, 25.7%; p<.0001), whatever the stage of disease.

The population of patients younger than 70 years old totalized 3 316 individuals of all stages of whom 26.3% received a non surgical treatment of their disease. Among older patients (≥ 70 years old), 14.1% were treated with primary CRT. In the US, the non operative management strategy was more often preferred in older patients (>70 years) compared to surgery [78].

One quarter of all patients treated by exclusive CRT also received palliative care after the curative CRT supporting the assumption of a poor general health or an impossibility to appeal to more intensive salvage therapies for these patients.

In UK, The National Oesophago-Gastric Cancer Audit [29] prospectively collected data from patients diagnosed with invasive epithelial cancer of the oesophagus between 1 October 2007 and 30 June 2009 from 30 Cancer Networks in England. This report revealed that 4% of patients with an oesophageal cancer were documented as having received a definitive curative therapy (334 patients had a definitive chemo-radiotherapy, and another 142 had definitive radiotherapy). Both treatments were most commonly used in patients with squamous cell tumours. Patients having chemo-radiotherapy were typically younger than patients having only radiotherapy, the median (IQR) ages being 68 years (60-74) and 77 years (73-80), respectively.

Overall, 85% of patients completed definitive chemoradiotherapy. The most common reason for incomplete therapy was acute chemotherapy toxicity; there were no cases of radiotherapy toxicity. Radiotherapy was tolerated better, with 97 per cent of patients completing their therapy [29].

With administrative data, it remains impossible to document the choice for a therapeutic strategy in Belgium. Different plausible hypotheses can be formulated to explain percentages observed. It is possible that patients treated by definitive CRT were unfit for the surgical resection (poor performance status and comorbidities, locally non resectable tumour) or refused the intervention. Comorbidity data such as those allowing to calculate a Charlson index are not systematically recorded. The Belgian Cancer Registry currently records a general question about the performance status of all patients. However, less than half of all files reports this global information, too unreliable to be considered as an explicative variable. It is also possible that some patients were eligible for surgery and assigned chemoradiotherapy as neoadjuvant treatment;

neither dosages nor schemes of radiotherapy and chemotherapy being documented in IMA databases, no difference can be made between primary and neoadjuvant treatment. For patients who responded to the first treatment, a subsequent surgery was not performed, converting a neoadjuvant treatment into a definitive primary CRT. Finally, as surgery (oesophagectomy or substernal bypass) should not be performed with palliative intent in patients with metastatic oesophageal cancer, chemoradiotherapy is also a treatment option recommended by international guidelines [8, 54, 79]. In UK, for example, such treatment is adopted in palliative setting in 26% of all patients diagnosed with a non-curative oesophageal cancer [29].

This process indicator is thus not really useful to assess the quality of care and certainly not to compare centres in a benchmarking exercise. Results obtained have to be considered as a description of the current situation in Belgium. Increasing the relevance of this indicator needs a prospective recording.

Key points

- **Between 2004 and 2008, a lower proportion of patients with oesophageal cancer were surgically treated (34%) compared to the proportion of patients who received a medical (curative or palliative) treatment (66%).**
- **In general, patients with the following characteristics were more likely to be treated with definitive chemoradiotherapy:**
  - **tumours located in the upper and middle third of the oesophagus;**
  - **SCC histological type;**
  - **cStage III or IV;**
- **Patients with oesophageal cancer aged 70 years and above were less likely to receive definitive chemoradiotherapy.**
- **Since it remains impossible to document the choice for this therapeutic option with retrospective administrative data, this process indicator is not useful to assess the quality of care or to benchmark the Belgian centres.**

Appendix 6.6. OC11: Oesophageal cancer – palliative support

Appendix 6.6.1. Rationale

Although no specific recommendation was formulated, the updated guideline clearly states that patients with oesophageal cancer should have access to a specialist (outpatient and/or inpatient) palliative care team, in particular in relation to comfort and symptom control, and quality of life [8].

Appendix 6.6.2. Definition

Description

Proportion of patients with metastatic oesophageal cancer who received palliative support.

Numerator

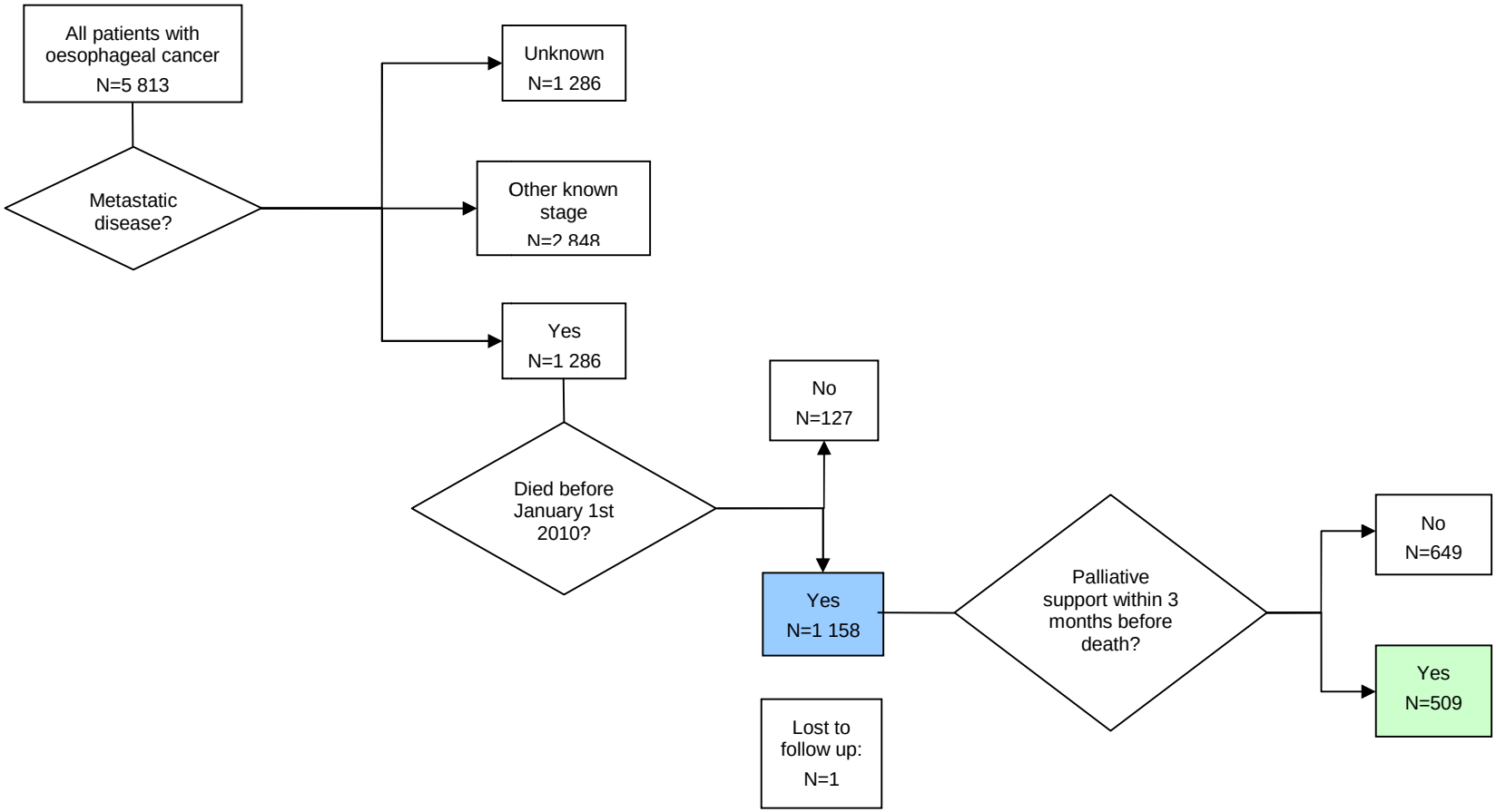
All patients diagnosed with metastatic oesophageal cancer that died in a given year and had palliative support within 3 months before death.

Denominator

All patients diagnosed with metastatic oesophageal cancer that died in a given year.

Appendix 6.6.3. Elaboration

Flowchart



Supplementary analyses

Risk adjustment

- Not necessary

Sensitivity analysis

- Not necessary

Subgroup analysis

- Geographical presentation of results (by province)

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD-10 code C15.0-C16.0 (BCR)
- Stage: combined stage (BCR)
- Palliative support: nomenclature codes (Appendix 8.3.5)

Limitations

- Not all nomenclature codes related to palliative care are available to the BCR.

Appendix 6.6.4. Results

National results

Overall, of all patients diagnosed with metastatic oesophageal cancer between 2004 and 2008 that died before January 1st 2010, 44% received palliative support within 3 months before death (Table 92). No clear time trend was found, although the highest rate was found for 2009 (49.3%).

Important differences were found across the Belgian provinces, with the highest rates found in Luxembourg (59.3%) and the lowest in Hainaut (29.0%) (Table 93). Older patients were more likely to receive palliative support than younger patients (80+ vs. 80-: OR = 1.56, 95%CI 1.04 to 2.34) (Table 94). No important difference was found between men and women (male vs. female: OR = 0.94, 95%CI 0.69 to 1.27) (Table 95). However, when stratified by age group, men aged 80 years and above were more likely to receive palliative support than women aged 80 years and above (Table 96: OR = 1.56, 95%CI 1.17-2.09).

Table 92 – Proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by year of death

	Numerator	Denominator	Proportion (%)
2004	32	89	36.0
2005	81	195	41.5
2006	99	218	45.4
2007	119	256	46.5
2008	107	256	41.8
2009	71	144	49.3
Total	**509**	**1 158**	**44.0**

Table 93 – Proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by province / region

	Numerator	Denominator	Proportion (%)
Antwerpen	104	234	44.4
Brussels Capital Region	26	76	34.2
Vlaams-Brabant	42	99	42.4
Brabant Wallon	12	33	36.4
West-Vlaanderen	89	181	49.2
Oost-Vlaanderen	103	213	48.4
Hainaut	29	100	29.0
Liège	32	87	36.8
Limburg	35	67	52.2
Luxembourg	16	27	59.3
Namur	21	41	51.2
Total	**509**	**1 158**	**44.0**

Note: Province where the patient lives (not where the hospital is located).

Table 94 – Proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by age group

	Numerator	Denominator	Proportion (%)
<50	58	116	50.0
50-59y	128	292	43.8
60-69y	131	314	41.7
70-79y	130	321	40.5
80+	62	115	53.9
Total	**509**	**1 158**	**44.0**

Table 95 – Proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by sex

	Numerator	Denominator	Proportion (%)
Men	409	937	43.6
Women	100	221	45.2
Total	**509**	**1 158**	**44.0**

Table 96 – Proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death): sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	53	105	50.5	5	11	45.5	1.22 (0.31-4.99)
50-59y	107	245	43.7	21	47	44.7	0.96 (0.49-1.88)
60-69y	103	261	39.5	28	53	52.8	0.58 (0.31-1.10)
70-79y	101	244	41.4	29	77	37.7	0.69 (0.40-1.19)
80+	45	82	54.9	17	33	51.5	1.14 (0.47-2.78)
Total	**409**	**937**	**43.6**	**100**	**221**	**45.2**	

Comparison between centres

The variability between the 108 centres included in the analysis was limited (Figure 60). Four centres had a proportion below the 95%LL (Table 97). In 27 centres, more than 50% of the patients received palliative support within 3 months before death. In contrast, in 12 centres no patient received palliative support. Similar results were found when only considering the period 2007-2008 (Figure 61).

Figure 60 – Funnel plot of the proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by centre (2004-2008)

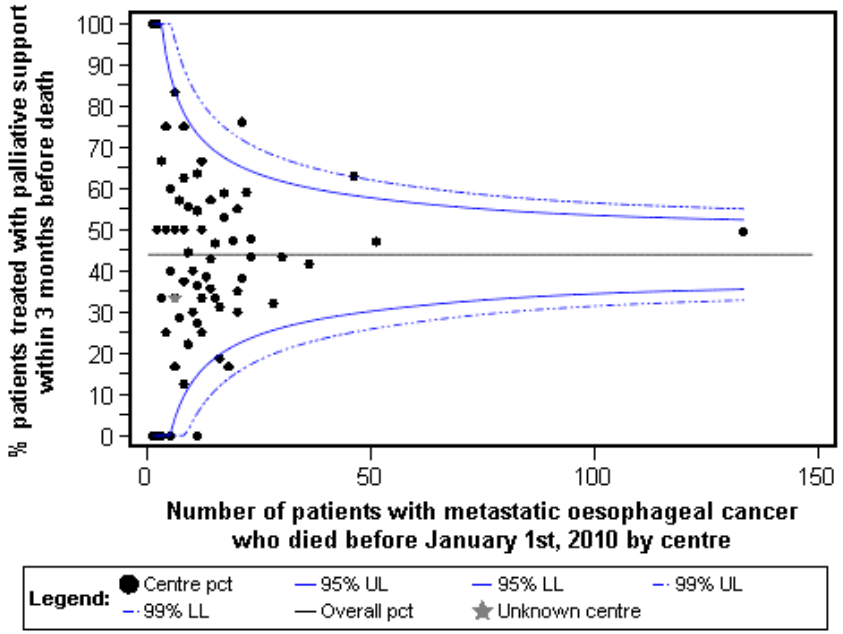


Figure 61 – Funnel plot of the proportion of patients with metastatic oesophageal cancer who received palliative support (within 3 months before death), by centre (2007-2008)

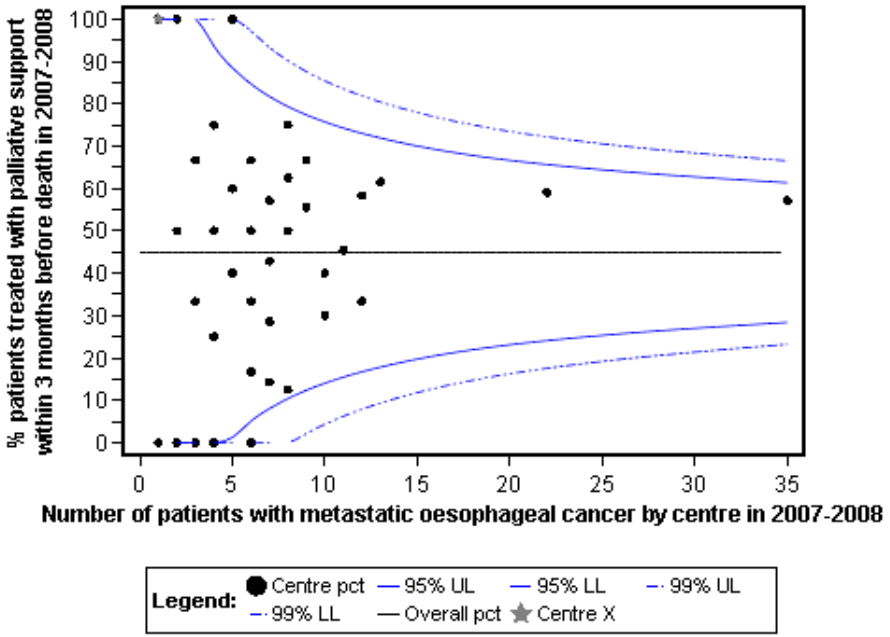


Table 97 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	0.93	1	0.93
Equal to 99%LL or lower than 95%LL	3	2.78	4	3.70
Between 95% control limits	102	94.44	106	98.15
Upper than 99%UL	2	1.85	108	100.00

Table 98 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	1	1.03	1	1.03
Between 95% control limits	95	97.94	96	98.97
Equal to 99%UL or upper than 95%UL	1	1.03	97	100.00

Appendix 6.6.5. Discussion

Overall, 44% of the patients with metastatic oesophageal cancer diagnosed between 2004 and 2008 and that died before January 1st 2010, received palliative support within 3 months before death. Older patients were more likely to receive palliative support than younger patients, but women aged 80 years and above were less likely to receive palliative support than men aged 80 years and above. Variability was considerable between the Belgian provinces, but limited between the individual centres, probably due to the low sample sizes per centre and the resulting large 95% and 99% limits. Importantly, not all nomenclature codes for palliative care were available for this report, and thus the reported proportions are probably slight underestimations. For example, no data were available on palliative home visits and in-hospital palliative care teams. To correctly evaluate this indicator, prospective registration is probably a better option.

In 2009, the Christian Sick Funds published a series of reports about end of life [32]. Of the 40 965 members of the Christian Sick Funds older than 40 years that died between July 1st 2005 and June 30th 2006, 27% had cancer. Of these 42% received palliative care (defined as lump sum palliative home care, stay in palliative hospital unit, contact with multidisciplinary palliative care team, or stay in palliative day care centre), which corresponds well to our results.

In the international literature, few studies are available that allow a comparison with other countries. In the UK, an agreed protocol for managing patients whose treatment plan is best supportive care was available in 28 of the audited NHS organizations (21%) [30]. These data concern all patients with oesophagogastric cancer.

The interpretation of these results is hampered by the fact that a centre not necessarily has impact on the palliative care of its patients and that the awareness about the available structures and their reimbursement modalities in the palliative care setting is suboptimal. Sometimes, palliative care is coordinated by the general practitioner or provided in another centre than wee the patient was initially treated. Therefore, this indicator should not be used to compare the quality of care between centres (although it remains valid to evaluate the quality of care on a national level).

Key points

- **Between 2004 and 2008, 44% of the patients with metastatic oesophageal cancer received palliative support within 3 months before death.**
- **Variability was considerable between Belgian provinces.**
- **This indicator should not be used to compare the quality of care between centres, but can serve to evaluate the quality of care on a national level.**

Appendix 6.7. OC13: 5-year relative survival

Appendix 6.7.1. Rationale

Because oesophageal cancer usually is not diagnosed until the disease has spread, the death rate is high. Cancer survival is an indicator of the effectiveness of a country's health care system in the area of cancer screening, early detection and treatment. The health care system can improve the survival of certain cancers through early detection and appropriate treatment [80].

Problems with the observed survival rate are due to the fact that not all deaths among cancer patients will be due to the primary cancer in question. To avoid this problem of comparability, relative survival rates are calculated [80]. Five-year relative survival compares the 5-year survival rate of patients diagnosed with oesophageal cancer to the national 5-year survival rate of patients with the same age and sex (supposed to have approximately the same comorbidities but not the cancer). The difference between the two rates can thus be attributed to the oesophageal cancer.

Appendix 6.7.2. Definition

Type of indicator

Outcome indicator.

Description

Five-year survival rates computed after the oesophageal cancer incidence date by combined stage.

Calculation

Relative survival rate is calculated as the observed rate of persons diagnosed with oesophageal cancer surviving five years after incidence date, divided by expected survival rate in the general population.

Supplementary analyses

Subgroup analyses

- Analysis by age, sex, stage, histological type, anatomical location

Risk adjustment

- See observed survival

Sensitivity analysis

- No sensitivity analysis needed

Data source(s)

Source database(s)

- BCR for source population
- Crossroads bank of Social Security: mortality data

Administrative codes

- Diagnosis of oesophageal cancer: ICD10 code C15.0-C16.0 (BCR)
- Stage: BCR

Appendix 6.7.3. Results

National results

The number of men with oesophageal cancer exceeds the number of women. This unequal incidence distribution did not seem to impact 5-year relative survival, proportions reported in both groups being similarly very low (around 22%) (Table 99), mainly due to the high proportion of patients who were diagnosed with an advanced disease (≥ stage III) at an older age. Considering the age groups, younger patients were more likely to be alive 5 years after their diagnosis than older patients (Table 10). Below the age of 50 years, survival rates were higher in women than in men (39.2% vs. 28.1%). This advantage disappeared after the age of 50 years, since survival rates became similar between sex groups (Table 100, Figure 62 and Figure 63).

Five-year relative survival, i.e. survival corrected for age- and gender-specific background mortality, was slightly higher than 5-year overall survival in both sexes (18.9%). This is particularly true for stages I and II where the differences are the largest, indicating that other causes of mortality play a role during a 5-year period after the incidence date. In stages III and IV, the majority of deaths were caused by the presence of oesophageal cancer, since 5-year relative and overall survival cancer were very close (Table 101 and Table 107).

Women were more likely to have an undocumented combined stage (33.7% vs. 27.3%). Patients with undocumented cancer stages (N=1 679) had a 5-year relative survival that was between survival rates reported for stages III and IV (Table 101, Figure 64 and Figure 65).

Most cancers of the upper two thirds of the oesophagus were squamous cell tumours (>86%) whereas cancers of the lower esophagus were most often adenocarcinomas (66% for the lower third and 94.6% for the GOJ) (Table 84).

In men, tumours located in the abdominal part of the oesophagus had a better prognosis at 5-year (29.2%) than tumours located in the thoracic part (17.3%) or in the cervical part (16.8%) (Table 102 and Figure 66). A higher proportion of men were diagnosed with an adenocarcinoma than with a SCC (59.9% vs. 36.1%).

The 5-year relative survival was clearly higher for adenocarcinomas than for SCC (25.5% vs. 16.0% of survivors; p<0.0001) (Table 103 and Figure 68).

In women, such differences were not so large, and tumours located in the thoracic part were associated with the highest proportion of survivors at 5 years (25.8%) followed by tumours located in the abdominal part (23.9%) (Table 102 and Figure 67). In women, a lower proportion of adenocarcinomas was diagnosed (44.6% vs. 50.8%). The 5-year relative survival of women with an adenocarcinoma was similar to survival for women with SCC (22.1% vs. 20.9%; p=0.55) (Table 103 and Figure 69), and similar to survival for men with the same histological type (22.1% vs. 25.5%; p=0.08). On the contrary, women with a SCC were more likely to be alive at 5 years than men with a SCC (20.9% vs. 16%; p<0.05) (Table 103, Figure 68, Figure 69).

Table 99 – Oesophageal cancer: Relative survival by sex

	N at risk*	Relative survival (%)				
		1 year	2 year	3 year	4 year	5 year
Men	4 396	53.9	34.9	27.5	24.0	21.7
Women	1 416	49.5	33.4	27.0	23.9	21.6

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Table 100 – Oesophageal cancer: Relative survival by sex and age group

	Men							Women						
	No at Risk*		Relative Survival (%)					No at Risk*		Relative Survival (%)				
Age	n	%	1 year	2 year	3 year	4 year	5 year	N	%	1 year	2 year	3 year	4 year	5 year
0-49 years	383	8.7	66.3	43.6	34.5	30.5	28.1	75	5.3	80.1	57.5	52.3	48.1	39.2
50-59 years	1 046	23.8	59.2	38.9	30.8	27.2	24.2	247	17.4	54.9	39.6	30.3	26.9	24.7
60-69 years	1 242	28.3	58.5	38.6	30.6	26.8	23.4	322	22.7	60.8	38.5	31.6	28.2	25.2
70+ years	1 725	39.2	44.1	27.5	21.1	18.1	17.2	772	54.5	39.7	26.5	21.2	18.3	17.0

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Figure 62 – Oesophageal cancer: Relative survival in men by age group

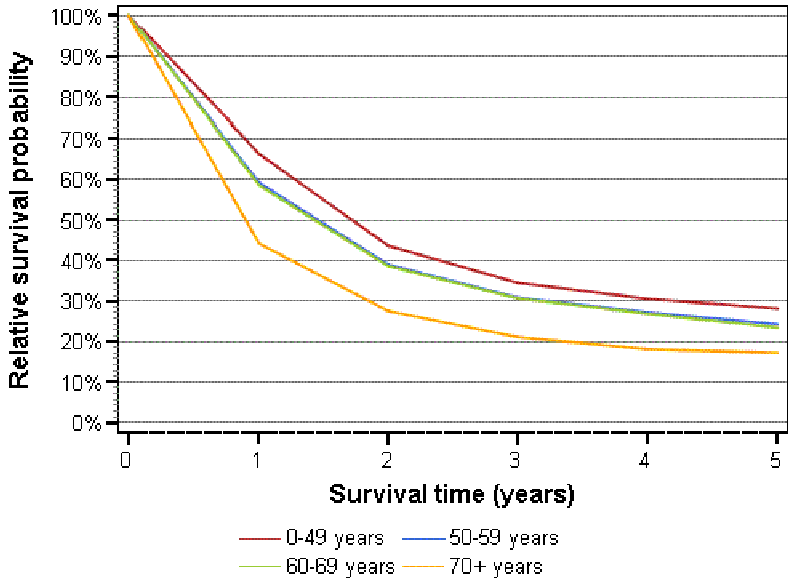


Figure 63 – Oesophageal cancer: Relative survival in women by age group

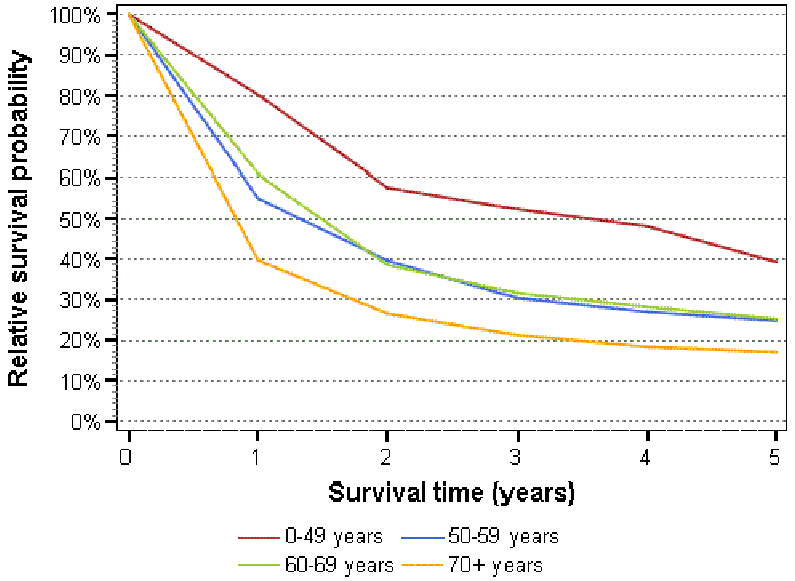


Table 101 – Oesophageal cancer: Relative survival by sex and combined stage (combStage)

	Men							Women						
	No at Risk*		Relative Survival (%)					No at Risk*		Relative Survival (%)				
Stage	n	%	1 year	2 year	3 year	4 year	5 year	N	%	1 year	2 year	3 year	4 year	5 year
Stage I	526	12.0	87.3	79.5	73.8	68.9	65.1	162	11.4	86.2	76.0	71.9	69.4	70.3
Stage II	747	17.0	67.7	50.9	38.8	33.6	30.9	260	18.4	63.7	45.0	36.1	31.4	28.4
Stage III	841	19.1	58.0	33.6	24.6	20.4	17.3	263	18.6	55.6	37.2	29.5	23.6	18.9
Stage IV	1 080	24.6	40.0	15.0	8.4	6.1	5.1	254	17.9	36.7	15.5	7.9	5.1	4.3
Stage X	1 202	27.3	40.2	24.3	19.4	17.3	15.2	477	33.7	32.5	19.7	15.4	14.5	12.0

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Figure 64 – Oesophageal cancer: Relative survival in men by combined stage (combStage)

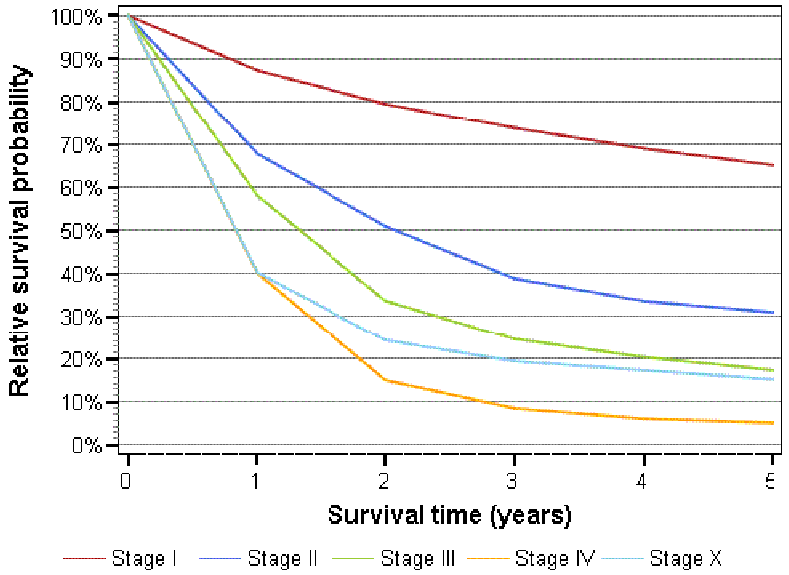


Figure 65 – Oesophageal cancer: Relative survival in women by combined stage (combStage)

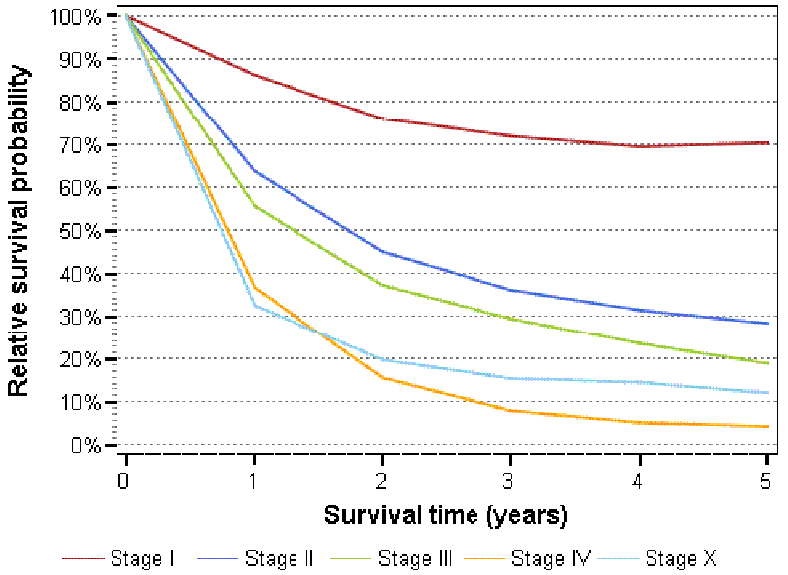


Table 102 – Oesophageal cancer: Relative survival by sex and sublocalisation

	Men							Women						
	No at Risk*		Relative Survival (%)					No at Risk*		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	N	%	1 year	2 year	3 year	4 year	5 year
Cervical part/Upper third	220	5.0	55.8	37.3	26.3	21.8	16.8	74	5.2	47.4	39.8	26.3	23.7	20.0
Thoracic part/Middle third	300	6.8	54.3	34.3	27.8	23.4	17.3	176	12.4	58.2	39.2	35.7	29.4	25.8
Abdominal part/Lower third	958	21.8	63.6	44.2	35.1	31.0	29.2	233	16.5	54.5	35.8	31.0	26.7	23.9
Oesophagus, unspecified	1 762	40.1	46.9	30.0	23.9	21.1	19.5	638	45.1	42.9	28.9	23.8	21.2	19.9
GOJ	1 156	26.3	56.2	34.6	26.8	23.3	21.1	295	20.8	55.4	36.2	25.6	24.1	21.3
All	4 396	100.0	53.9	34.9	27.5	24.0	21.7	1 416	100.0	49.5	33.4	27.0	23.9	21.6

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Figure 66 – Oesophageal cancer: Relative survival in men by sublocalisation

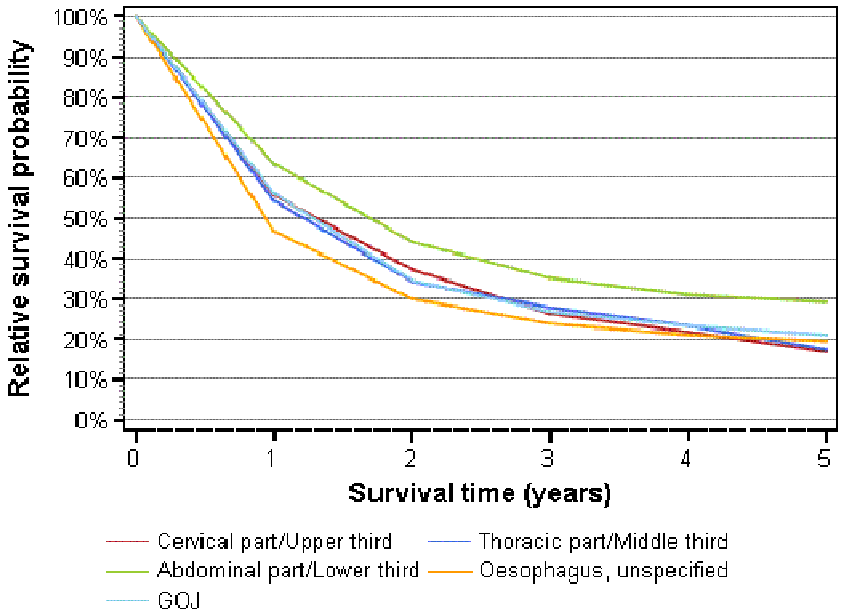


Figure 67 – Oesophageal cancer: Relative survival in women by sublocalisation

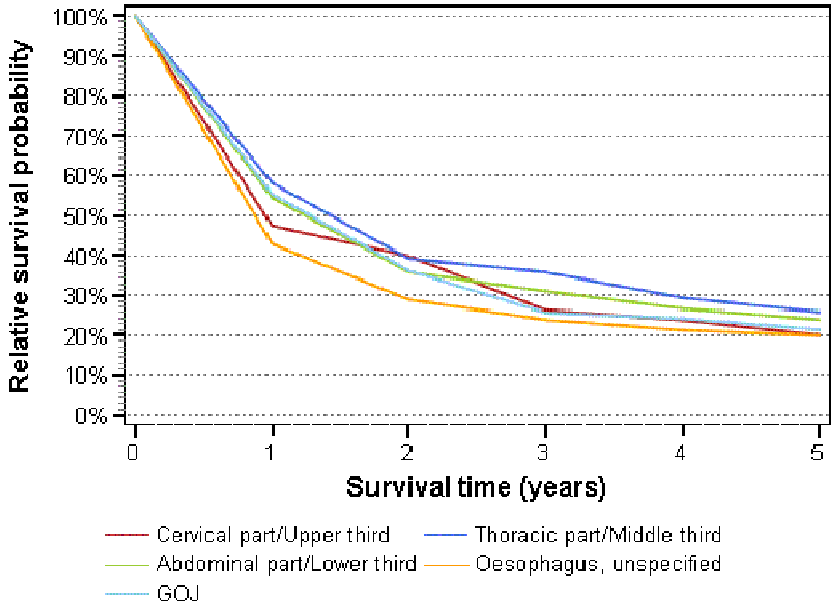


Table 103 – Oesophageal cancer: Relative survival by sex and histological type

	Men							Women						
	No at Risk*		Relative Survival (%)					No at Risk*		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	N	%	1 year	2 year	3 year	4 year	5 year
AC	2 635	59.9	57.9	38.5	31.1	27.4	25.5	632	44.6	51.3	35.2	27.4	25.1	22.1
SCC	1 589	36.1	48.6	29.7	22.4	19.2	16.0	720	50.8	48.8	32.2	26.6	22.5	20.9

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Figure 68 – Oesophageal cancer: Relative survival in men by histological type

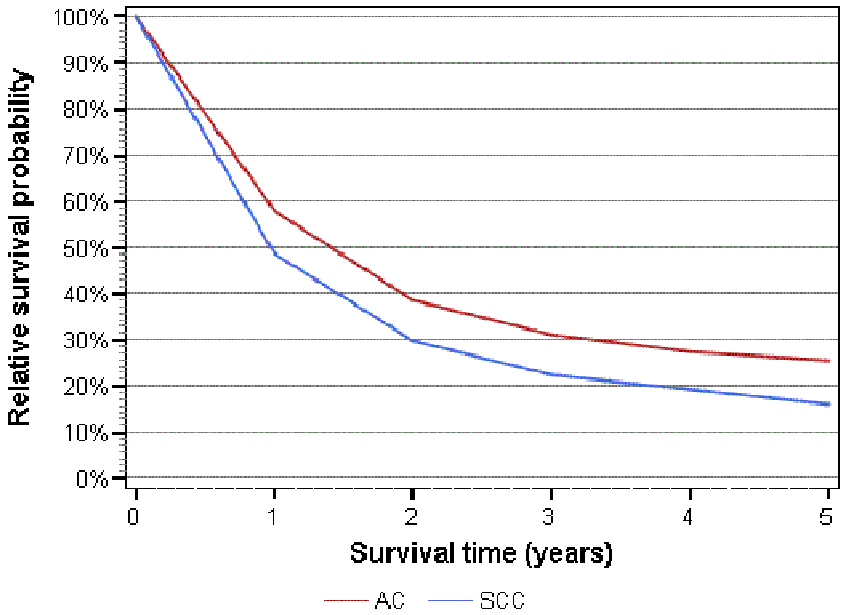
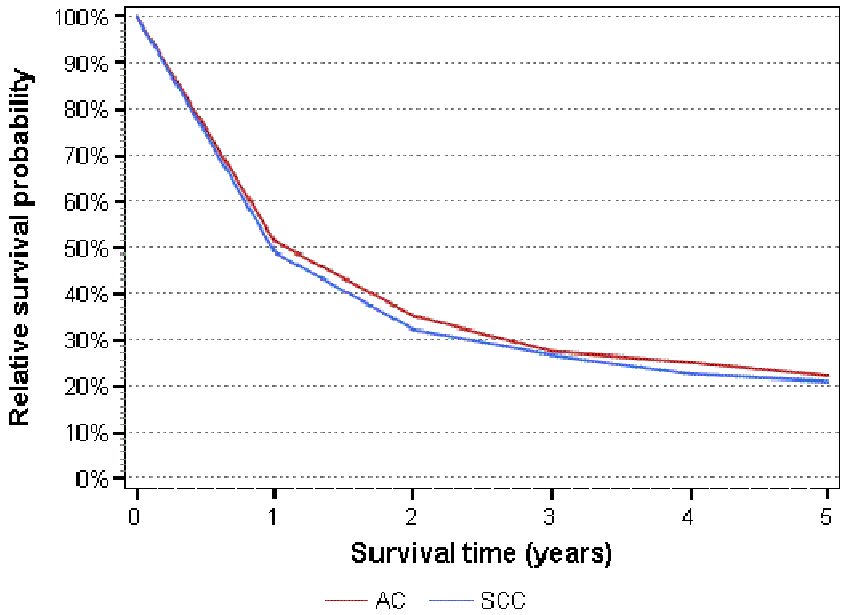


Figure 69 – Oesophageal cancer: Relative survival in women by histological type



Comparison between centres

Figure 70 presents 5-year relative survival rates for the centres in which patients with oesophageal cancer were treated. While four centres reported lower survival than the 99% lower limit, nine additional centres reported lower rates than the 95% lower limit. These centres had a low volume of oesophageal cancer patients (maximum 30 patients who received a medical or surgical treatment yearly). Three centres fell above the 99% upper limit and reported higher survival rates than the nationwide value. Two of them treated 30-40 patients per year while the third recorded the highest volume of patients in the period 2004-2008 (around 140 patients per year). Restricting the patients' population to only those who underwent a surgical intervention increased the mean 5-year relative survival from 21.6% to beyond 40% (Figure 71).

In that scenario, 92% of the centres fell between the 95% limits, revealing no high variability. The highest volume hospital fell beyond the 99% upper limit, indicating a significant higher 5-year relative survival compared with the other centres where surgical interventions were underwent.

Figure 70 – Funnel plot of the 5-year relative survival for patients diagnosed with oesophageal cancer, by centre

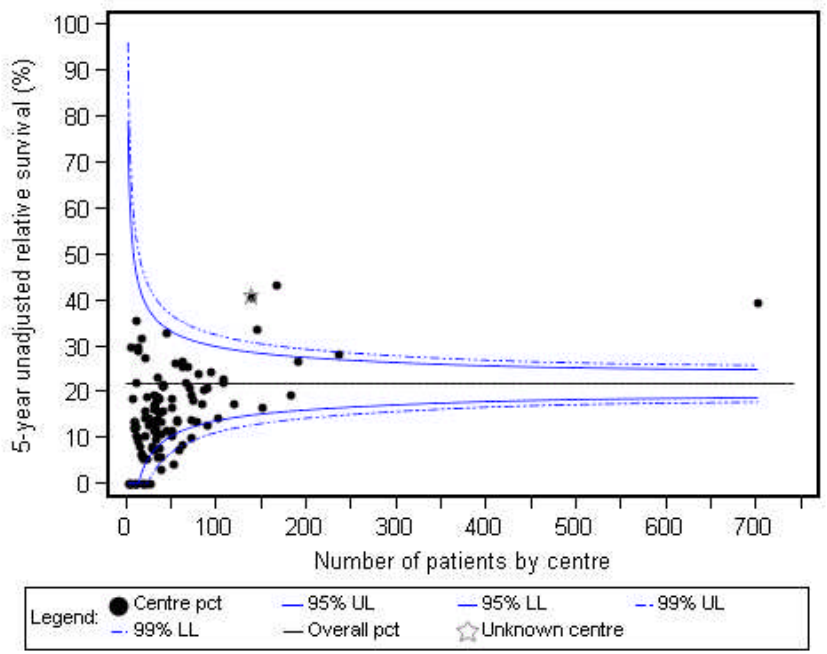
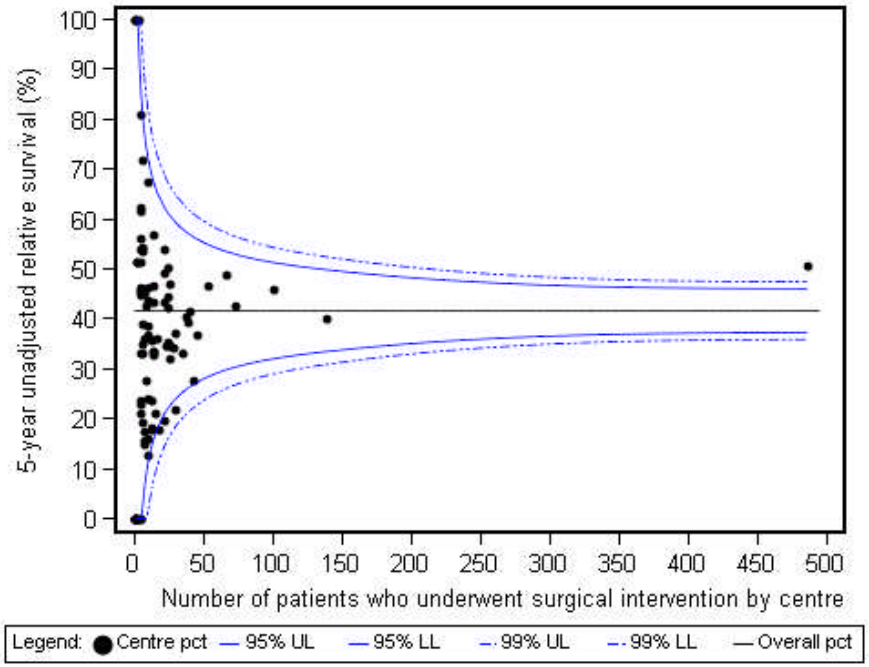


Table 104 – Number and proportion of outliers

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	4	3.67	4	3.67
Equal to 99%LL or lower than 95%LL	9	8.26	13	11.93
Between 95% control limits	91	83.49	104	95.41
Equal to 99%UL or upper than 95%UL	1	0.92	105	96.33
Upper than 99%UL	4	3.67	109	100.00

Figure 71 – Funnel plot of the 5-year relative survival for patients diagnosed with an oesophageal cancer who underwent surgical intervention, by centre



Note: Three centres are not reported in the funnel plot because none of their patients have a theoretical follow up time of 5 years

Table 105 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	3	3.13	3	3.13
Between 95% control limits	91	94.79	94	97.92
Equal to 99%UL or upper than 95%UL	1	1.04	95	98.96
Upper than 99%UL	1	1.04	96	100.00

Discussion

The lethality of oesophageal cancer was already reported in a number of papers [43, 81-84]. The low 5-year survival is due to the late onset of symptoms when disease is in an advanced stage with a high potential of occult metastases [84].

The EUROCARE-4 study reported a European estimate for 5-year relative survival as low as 9.8% (95%CI 9.4-10.1%) for oesophageal cancers diagnosed between 1995 and 1999 [41]. However, Belgium ranked among the best rates reported by the participating European countries with the highest survival rates in men (17.2%) and the second ones in women (20.9%) [41]. For the period 2002-2006, Germany reached a 5-year relative survival as high as 18.3% [42]. Our analysis on Belgian data for a more recent period (2004-2008) reported a higher estimation (around 22% for both sex groups).

Globally, gender showed no association with survival in Belgium as also reported in the Netherlands [85]. However, subgroup analyses tended to show some survival advantage for younger women, those diagnosed with a stage I or a SCC, located in the upper and middle thirds of the oesophagus on their male counterparts. In Germany, estimates of 5-year survival were higher for women than for men (21.5% vs. 17.5%), particularly in women with cancer in the mid-thoracic part of the oesophagus [42]. More globally, women had lower 5-year (RER women vs. men 0.89, 95%CI 0.86–0.91) relative excess risks of death than men [41].

As reported in similar studies conducted in the Netherlands [84], in Germany [42] and in Europe [41], older age at the time of diagnosis and higher tumour stage were associated with lower survival, despite taking into account background mortality.

Adenocarcinoma and abdominal location were associated with a better prognosis than SCC and other anatomical locations. Similar observations were reported on Central European 5-year relative survival rates [41]. Siewert et al. [86] were the first to show that adenocarcinoma patients had a survival advantage over patients with squamous cell carcinoma following resection (whatever the TNM category, the surgical approach or the use of neoadjuvant therapy) and that patients with oesophageal squamous cell carcinoma had higher rates of occult micrometastases, with a gloomier prognosis. Resection rates were also higher in patients with oesophageal adenocarcinoma compared to squamous cell carcinoma (42.9% vs. 22.2%; see OC10).

In the Netherlands, Dikken et al. [85] conducted a trend analysis, showing improvements in 5-year relative survival between 1989-1993 and 2004-2008, from 12.2% (95%CI 10.0%-14.6%) to 25.3% (95%CI 22.9%-27.8%) for M0 oesophageal adenocarcinoma and from 11.6% (95%CI 9.9%-13.6%) to 18.9% (95%CI 16.5%-21.5%) for M0 oesophageal SCC. In the metastatic setting, 2-year relative survival also significantly increased for oesophageal adenocarcinoma from 3.3% (95%CI 1.8%-5.7%) to 9.0% (95%CI 7.7%-10.4%) and SCC (from 6.0% (95%CI 3.6%-9.2%) to 10.1% (95%CI 8.0%-12.4%) [85]. Such evolution cannot currently be estimated for Belgium, since results were only available for 5 years between 2004 and 2008. A that short period cannot be used to reliably identify trends. In the Netherlands, the observed increase in survival for non-metastatic patients was explained by an increasing concentration of oesophageal surgery (10 oesophagectomies per hospital), an improved accuracy of staging, an increase in and better selection of the proportion of patients who underwent resections and an increasing use of (neo)adjuvant treatment. For M1 tumours, the increase in survival can be attributed to stage migration due to improved detection of distant metastases [84, 85].

It is important to stress that relative survival has to be documented by cancer stage. However, 29% of all patients with oesophageal cancer had undocumented stages. These patients had a 5-year relative survival that was between survival rates reported for stages III and IV. In the Netherlands, the percentage of patients with an unknown stage was higher in the former period (around 40% in 1989-1993) and steadily decreased (22% of unknown stages for SCC and 15% for adenocarcinoma between 2004 and 2008), with a corresponding increase in the proportion of stage IV patients [85]. The high proportion of missing data for cancer stage was also problematic in Germany, where it reached a proportion of 48%, leading to potential biases in estimating stage group specific survival [42]. In EUROCARE-4 study, only 19 registries on 66 (28.8%) had sufficient information on cancer stage at diagnosis [41].

Finally, this outcome indicator seems to be pertinent to compare all Belgian centres according to the volume of patients they treat per year. While the majority of the centres were low-volume centres, reporting survival rates that fell between the limits of the funnel plot, three identified centres reported higher survival rates than the nationwide value. Two of them treated 30-40 patients a year while the third recorded the highest volume of patients in the period 2004-2008 (around 140 patients per year). This highest volume centre also reported the highest survival rates after a surgical intervention. There is evidence that centralization of oesophageal cancer patients in a limited number of hospitals within a country leads to substantial improvements in outcome (USA [87], the Netherlands [24, 46], Japan [88]).

Key points

- **Oesophageal cancer remains highly lethal due to the late onset of symptoms when disease is in an advanced stage (9.8% at a European level).**
- **Belgium reported higher 5-year survival rates than other European countries, reaching 22% between 2004 and 2008.**
- **In Belgium, gender showed no association with survival in general, but a survival advantage was observed for specific subgroups:**
  - **younger women;**
  - **SCC histological type;**
  - **tumours located in the upper and middle third of the oesophagus;**
  - **cStage I.**

- **Older age at the time of diagnosis and higher tumour stage were associated with lower survival.**
- **Adenocarcinomas and abdominal location were associated with a better prognosis.**
- **Between 2004 and 2008, 29% of all patients with oesophageal cancer had undocumented stages in Belgium. This underreporting is also problematic for a lot of European countries; an improvement was noticed these last years in the Netherlands.**
- **This outcome indicator seems pertinent to compare all Belgian centres according to the volume of patients they treat per year.**

Appendix 6.8. OC14: 5-year overall survival

Appendix 6.8.1. Rationale

Oesophageal cancer is relatively uncommon in Western societies with varying incidence and mortality patterns during the past decade in Europe [89]. Oesophageal cancer is two to four times more common among men than women [82]. Worldwide, oesophageal cancer is the eighth most common malignancy (3.8% of all new cancers) and the sixth most common cause of cancer-related death (5.4% of all cancer deaths) [82]. These Figures encompass both adenocarcinoma and squamous cell carcinoma (SCC) types.

Because oesophageal cancer usually is not diagnosed until the disease has spread, the death rate is high. A survival benefit was suggested for women when compared with men [83]. The overall 5-year survival rate in patients amenable to curative treatment ranges from 5% to 30%. The occasional patient with very early stage of disease has a better chance of survival [90].

Appendix 6.8.2. Definition

Type of indicator

Outcome indicator.

Description

Proportion of patients diagnosed with an oesophageal cancer in a given year, surviving 5 years after incidence date.

Calculation

Overall survival rate is calculated using the Kaplan-Meier method. This estimator is specifically used for estimating the survival function from life-time data. An important advantage of the Kaplan–Meier curve is that the method can take into account some types of censored data, particularly right-censoring, which occurs if patients withdraw from the study (some subjects are still alive at the end of the study but were not followed for the entire span of the curve or some drop out of the study early).

Supplementary analyses

Subgroup analyses

- Subgroup analysis by sex, age and by combined stage

Risk adjustment

- Cox proportional hazard model with the following factors as covariates: age, sex, histological type, anatomical localisation, combined stage, year of incidence and hospital volume of oesophagectomies

Sensitivity analysis

- No sensitivity analysis

Data source(s)

Source database(s)

- BCR for source population
- IMA
- Crossroads bank of Social Security: mortality data

Administrative codes

- Diagnosis of oesophageal cancer: ICD10 code C15.0-C16.0 (BCR)
- Stage, histological type, anatomical site : BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3, Table 230)
  - Chemotherapy: nomenclature codes (IMA) (Appendix 8.3.2, Table 235)
  - Radiotherapy: nomenclature codes (IMA) (Appendix 8.3.3, Table 236)

Limitations

- No data to compute a proxy for comorbidity

Appendix 6.8.3. Results

National results

Oesophageal cancer mostly affects men, with a ratio 3:1. Whereas the mean age at diagnosis was 65 years among men, it was as high as 70 years among women. This unequal distribution of mean age at diagnosis led however to obtain a similarly very low overall survival at 5 years (18.9% both in women and in men) (Table 106). The lethality of oesophageal cancer is due to the high proportion of patients who were diagnosed with an advanced disease (≥ stage III) at an older age. Considering the age groups, younger patients were more likely to be alive 5 years after diagnosis than older patients (Table 107; Figure 72 and Figure 73). In each age group, survival rates were not significantly different between women and men, except for the category 60-69 years (p<0.0001) (Table 106).

In stage I, observed survival declined from 84.8% (1 year) to 56.3% (5 years) in men and from 84% to 62% in women. In stage II, the decline is more pronounced reaching 27% in men and 25% in women after 5 years. For stage IV, 5-year overall survival is low both for men (4.6%) and for women (3.8%). Women were more likely to have an undocumented combined stage (33.7% vs. 27.3%). Patients with undocumented cancer stages (N=1 679) had a 5-year overall survival that was between survival rates reported for stages III and IV (Table 108, Figure 74 and Figure 75).

Table 106 – Oesophageal cancer: Observed survival by sex

	N at risk*	Observed survival (%)				
		1 year	2 year	3 year	4 year	5 year
Men	4 396	52.2	32.9	25.2	21.5	18.9
Women	1 416	47.8	31.4	24.8	21.5	18.9

* One patient is lost to follow up since the day of incidence and was excluded for survival analyses.

Table 107 – Oesophageal cancer: Observed survival by sex and age group

	Men						Women					
	N at Risk*	Observed survival (%)					N at Risk	Observed survival (%)				
		1 year	2 year	3 year	4 year	5 year		1 year	2 year	3 year	4 year	5 year
0-49 years	383	66.1	43.3	34.2	30.4	27.8	75	80.0	57.3	52.0	47.8	38.7
50-59 years	1 046	58.7	38.3	30.1	26.4	23.3	247	54.7	39.3	30.0	26.6	24.4
60-69 years	1 242	57.5	37.3	29.1	25.1	21.5	322	60.2	37.9	30.7	27.3	24.1
70+ years	1 725	41.3	24.1	17.3	13.9	12.2	772	37.3	23.7	18.0	14.9	13.0

* One patient is lost to follow up since the day of incidence and was excluded for survival analyses.

Figure 72 – Oesophageal cancer: Observed survival in men by age group

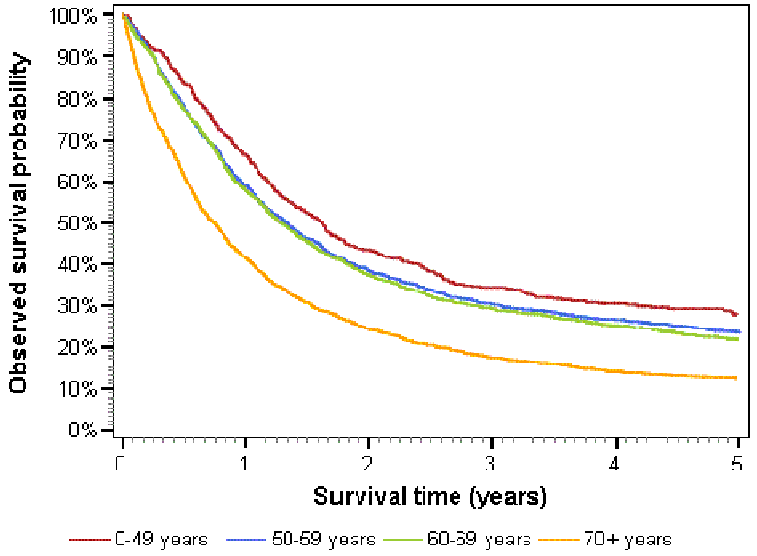


Figure 73 – Oesophageal cancer: Observed survival in women by age group

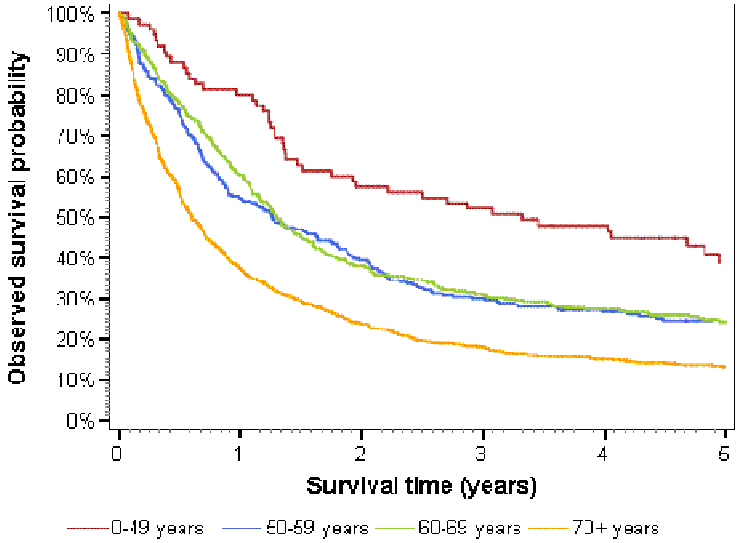


Table 108 – Oesophageal cancer: Observed survival by sex and combined stage (combStage)

	Men							Women						
	N at Risk*		Observed survival (%)					N at Risk		Observed survival (%)				
	N	%	1 year	2 year	3 year	4 year	5 year	N	%	1 year	2 year	3 year	4 year	5 year
Stage I	526	12.0	84.8	75.1	67.6	61.4	56.3	162	11.4	84.0	72.2	66.7	62.7	62.0
Stage II	747	17.0	65.7	48.1	35.7	30.3	27.0	260	18.4	61.5	42.3	33.1	28.3	25.0
Stage III	841	19.1	56.5	32.0	23.0	18.7	15.5	263	18.6	54.4	35.7	27.8	21.9	17.1
Stage IV	1 080	24.6	38.9	14.3	7.9	5.6	4.6	254	17.9	35.8	15.0	7.5	4.7	3.8
Stage X	1 202	27.3	38.4	22.4	17.2	14.8	12.6	477	33.7	30.8	18.0	13.6	12.6	10.0

* One patient is lost to follow up since the day of incidence and was excluded for survival analyses.

Figure 74 – Oesophageal cancer: Observed survival in men by combined stage (combStage)

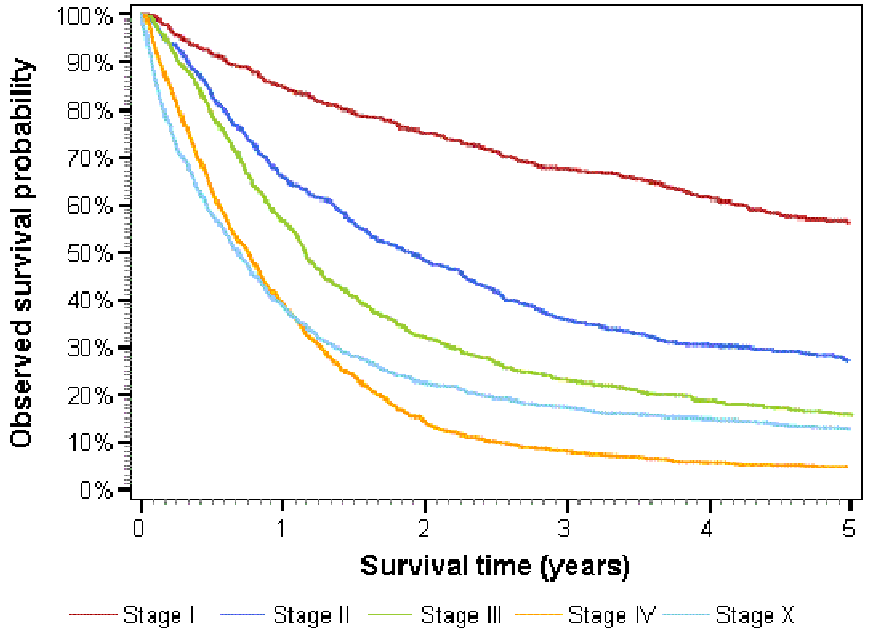
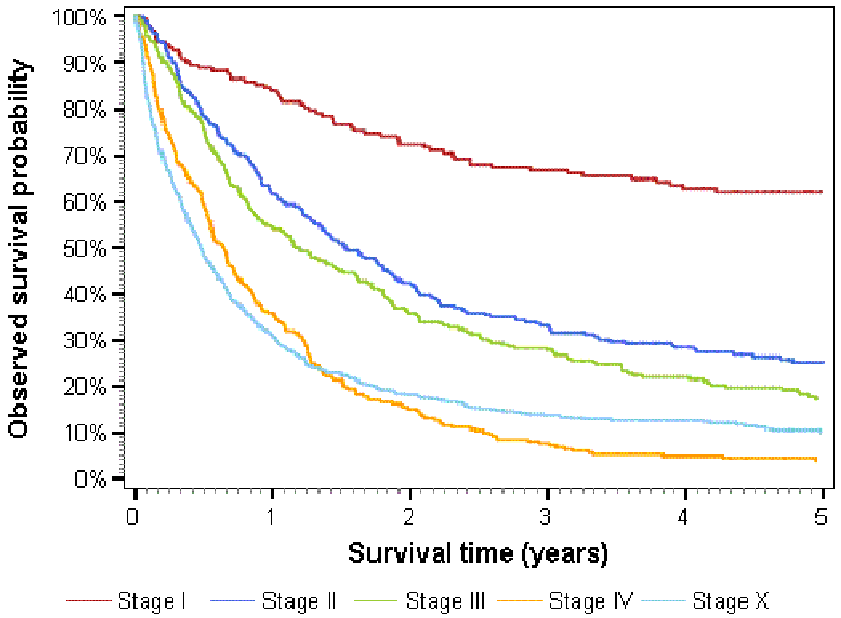


Figure 75 – Oesophageal cancer: Observed survival in women by combined stage (combStage)



Comparison between centres

Most centres treating less than 150 patients within 5 years (around 30 patients who received a medical or surgical treatment yearly) obtained very similar results, falling within 95% limits of the funnel plot, i.e. a 5-year observed survival of 30%. Variability was observed between medium-volume centres (around 30-50 patients per year) and the high-volume centre (around 140 patients per year) that reported slightly higher survival rates above the upper limits of the funnel plot (Figure 76). Adjusted for age, sex, and combined stage, the majority of low- and medium-volume centres fell between the limits of the funnel plot. Only 5 centres reported higher survival rates that fell above the 95% upper limit (Figure 77).

Restricting the population to those who underwent a surgical resection increased the mean value of observed survival at the national level (38%) (Figure 78). Only one centre fell above the 99% upper limit, reaching a 45% survival rate for operated patients.

Figure 79 shows the unadjusted 5-year survival rates for centres grouped according to the volume of patients they treated during the period 2004-2008. Twelve categories of centres were defined, from low-volume (category 1, less than 10 patients) to high-volume centres (category 12, more than 199 patients). The highest volume category was the only one that fell above the 99% upper limit, reaching a 5-year survival rate as high as 32.8%.

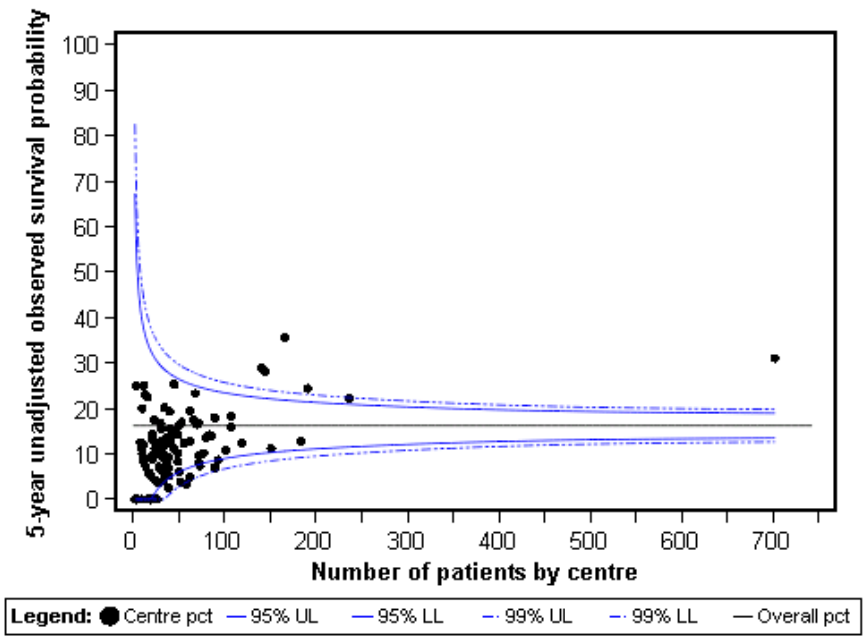
A similar figure was drawn to illustrate the unadjusted 5-year survival rates for centres grouped according to the volume of patients surgically treated during the period 2004-2008 (Figure 80). Ten categories of centres were represented, from low-volume (category 1, less than 10 patients) to the high-volume centres (category 12, more than 199 patients). The highest volume category was the only one that fell above the 99% upper limit, reaching a 5-year survival rate as high as 45.7%.

All Figures that adjusted observed survival rates for age, sex and combined stage illustrated the relationship between volume of patients (surgically) treated and their 5-year survival (Figure 81, Figure 82 and Figure 83). Only the highest volume centres fell above the upper limits of the plots.

Finally, demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of oesophagectomies (<6, 6-19, ≥20 per year) were included in a multivariate analysis to predict 5-year observed mortality (Table 117). Multivariate Cox regression analysis showed that older age, advanced stage, squamous cell histological type and hospital volume of oesophagectomies were independently and significantly correlated with 5-year observed mortality of all patients with an oesophageal cancer. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Both patients in high-volume and medium-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.65; 95%CI 0.59–0.71 and HR 0.83; 95%CI 0.77–0.89 respectively). The same significant association was reported for patients with oesophageal cancer who benefited from a surgical intervention (Table 118), since surgical patients in high-volume hospitals

had a decreased risk of death compared to patients in low-volume hospitals (HR 0.65; 95%CI 0.57–0.75).

Figure 76 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer, by centre

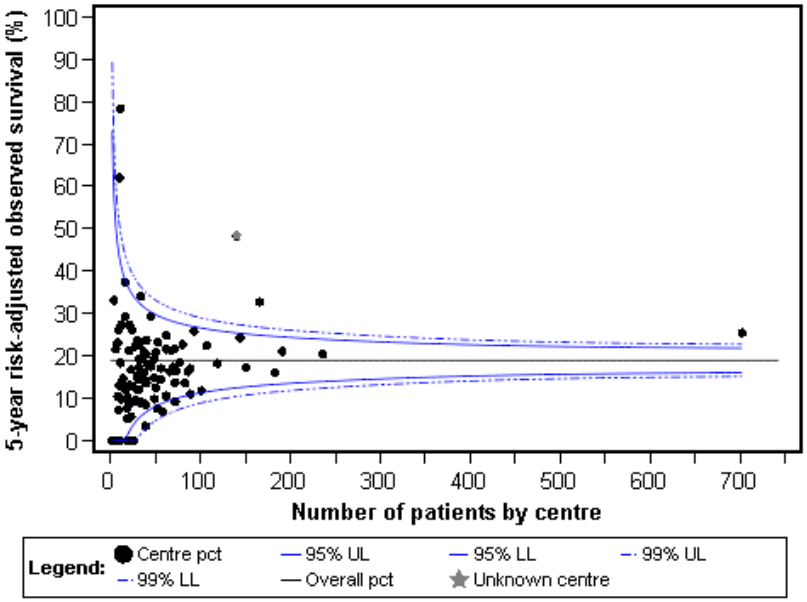


Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 109 – Number and proportion of outlying centres (unadjusted)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	2	1.83	2	1.83
Equal to 99%LL or lower than 95%LL	9	8.26	11	10.09
Between 95% control limits	93	85.32	104	95.41
Equal to 99%UL or upper than 95%UL	1	0.92	105	96.33
Upper than 99%UL	4	3.67	109	100.00

Figure 77 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer, by centre, adjusted for sex, age and combined stage

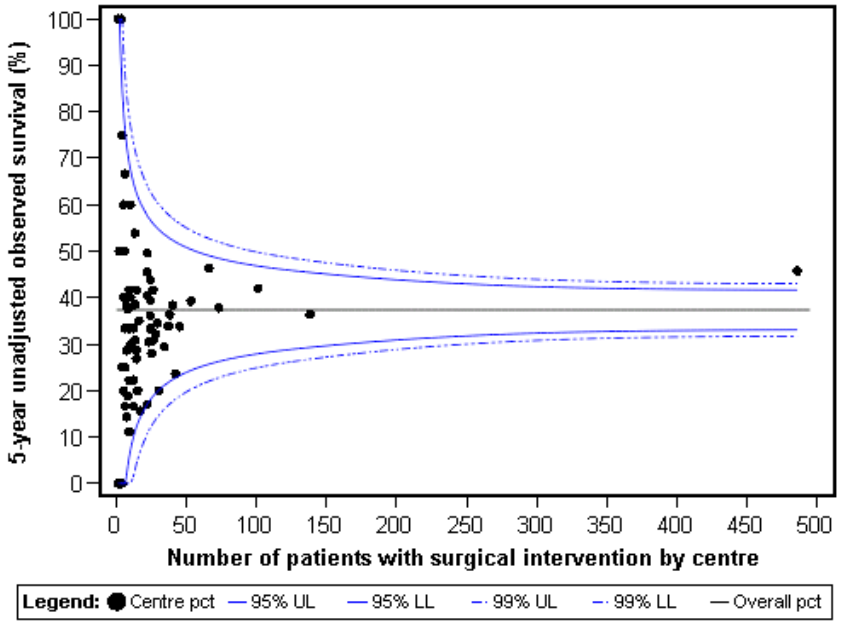


Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 110 – Number and proportion of outlying centres (adjusted for sex, age and combined stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	7	6.42	7	6.42
Between 95% control limits	96	88.07	103	94.50
Equal to 99%UL or upper than 95%UL	1	0.92	104	95.41
Upper than 99%UL	5	4.59	109	100.00

Figure 78 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer who underwent surgical intervention, by centre

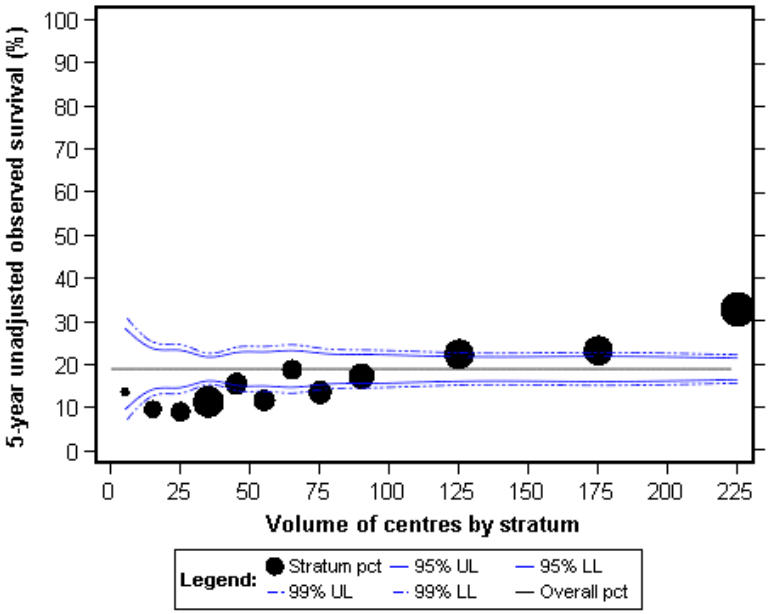


Note: For five centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 111 – Number and proportion of outlying centres (only patients with surgical intervention)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	2	2.17	2	2.17
Between 95% control limits	88	95.65	90	97.83
Equal to 99%UL or upper than 95%UL	1	1.09	91	98.91
Upper than 99%UL	1	1.09	92	100.00

Figure 79 – Oesophageal cancer: 5-year unadjusted observed survival in function of volume of centres with control limits*



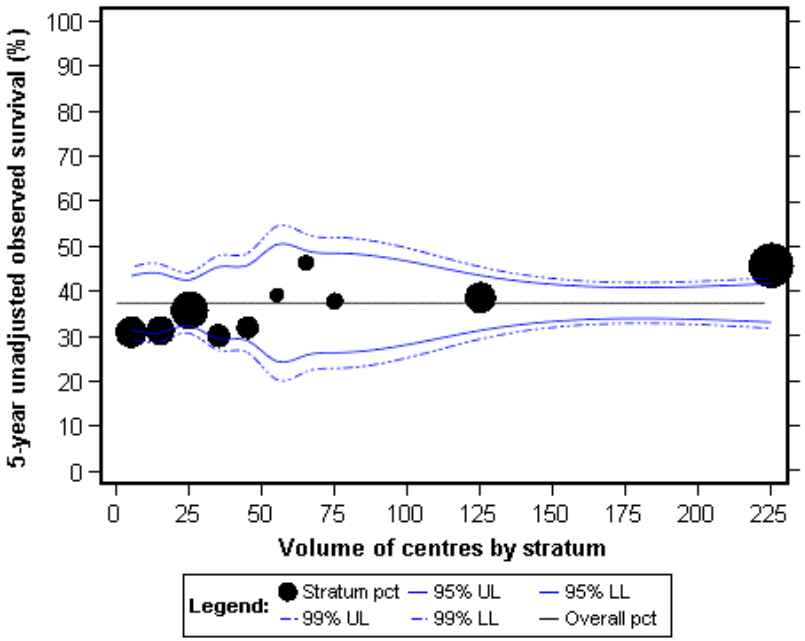
* Control limits were computed based on number of patients in each stratum

Table 112 – Unadjusted observed survival by categories of centres grouped according to the volume of patients

Category	Volume	N	Deaths	Observed survival (%)	Survexp_Max §
1	0-9 patients	66	57	13.64	60.00
2	10-19 patients	261	231	9.65	60.00
3	20-29 patients	311	279	9.09	60.00
4	30-39 patients	780	686	11.37	60.00
5	40-49 patients	398	333	15.56	60.00
6	50-59 patients	375	329	11.70	60.00
7	60-69 patients	320	257	18.87	60.00
8	70-79 patients	435	374	13.56	60.00
9	80-99 patients	520	428	17.33	60.00
10	100-149 patients	718	546	22.42	60.00
11	150-199 patients	691	524	23.28	60.00
12	>=200 patients	938	620	32.80	60.00

§ Survexp_max: Maximum theoretical follow up time for the first diagnosed patient. To be included in the funnel plot, Survexp_max of centres needed to be greater or equal to 60 months.

Figure 80 – Oesophageal cancer: 5-year unadjusted observed survival for patients who underwent surgical intervention in function of volume of centres with control limits*



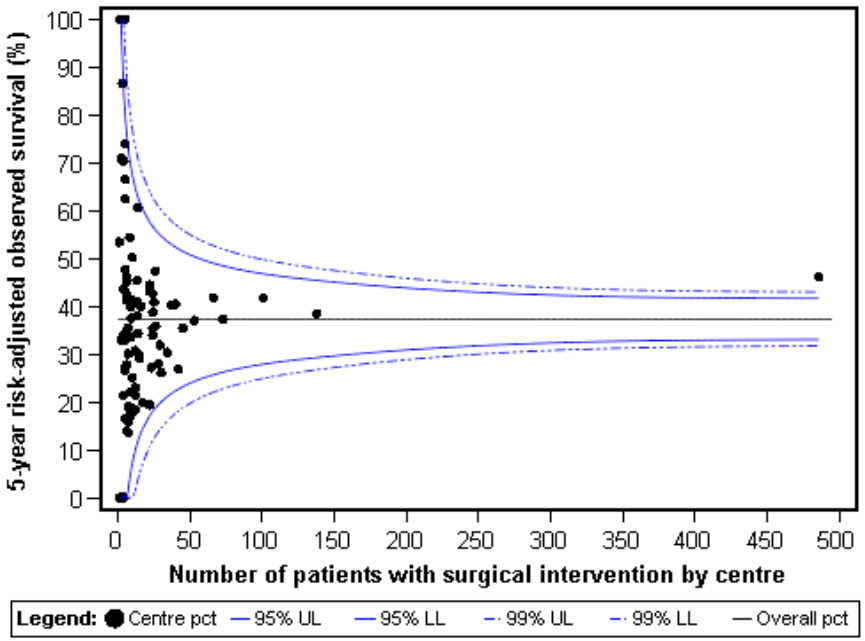
* Control limits were computed based on number of patients with surgical intervention in each stratum

Table 113 – 5-year adjusted observed survival for patients who underwent surgical intervention by volume of centres (risk-adjusted for sex, age and combined stage)

Category	Volume	N	Deaths	N survivors	Survival_sum §	Observed survival	Adjusted survival	Survexp_Max §
1	0-9 patients	246	165	81	89.88	30.92	33.66	60.00
2	10-19 patients	207	140	67	74.03	31.24	33.80	60.00
3	20-29 patients	341	216	125	128.8	35.78	36.26	60.00
4	30-39 patients	139	96	43	45.91	30.10	34.99	60.00
5	40-49 patients	127	85	42	45.56	31.92	34.43	60.00
6	50-59 patients	53	32	21	21.18	39.20	37.03	60.00
7	60-69 patients	66	34	32	28.56	46.28	41.85	60.00
8	70-79 patients	73	45	28	28.07	37.80	37.25	60.00
9	100-149 patients	239	145	94	87.92	38.58	39.93	60.00
10	>=200 patients	486	256	230	186.3	45.73	46.10	60.00

§ Survival_sum: Number of expected survivors from Cox regression model. Survexp_max: Maximum theoretical follow up time for the first diagnosed patient.

Figure 81 – Funnel plot of the 5-year observed survival for patients diagnosed with an oesophageal cancer who underwent surgical intervention, by centre, adjusted for sex, age and combined stage

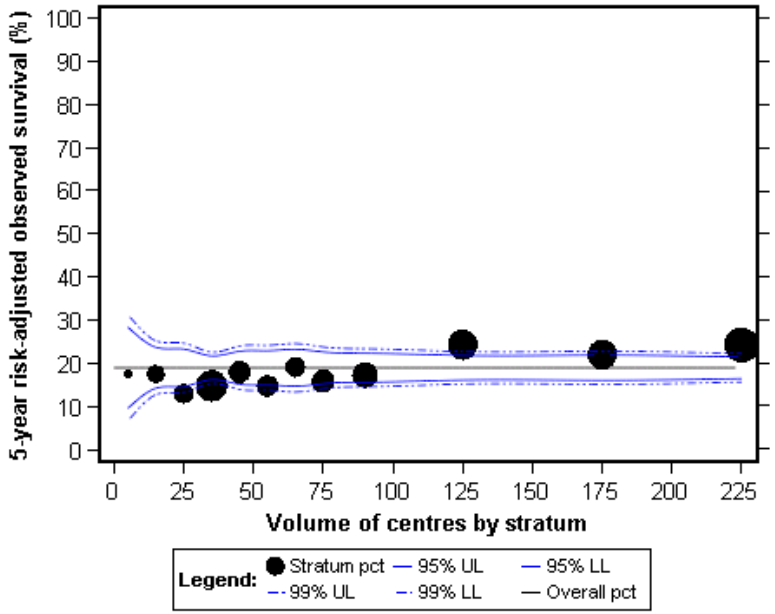


Note: For five centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 114 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Between 95% control limits	90	97.83	90	97.83
Upper than 99%UL	2	2.17	92	100.00

Figure 82 – Oesophageal cancer: 5-year risk-adjusted observed survival in function of volume of centres with control limits*(Risk-adjusted for sex, age and combined stage)



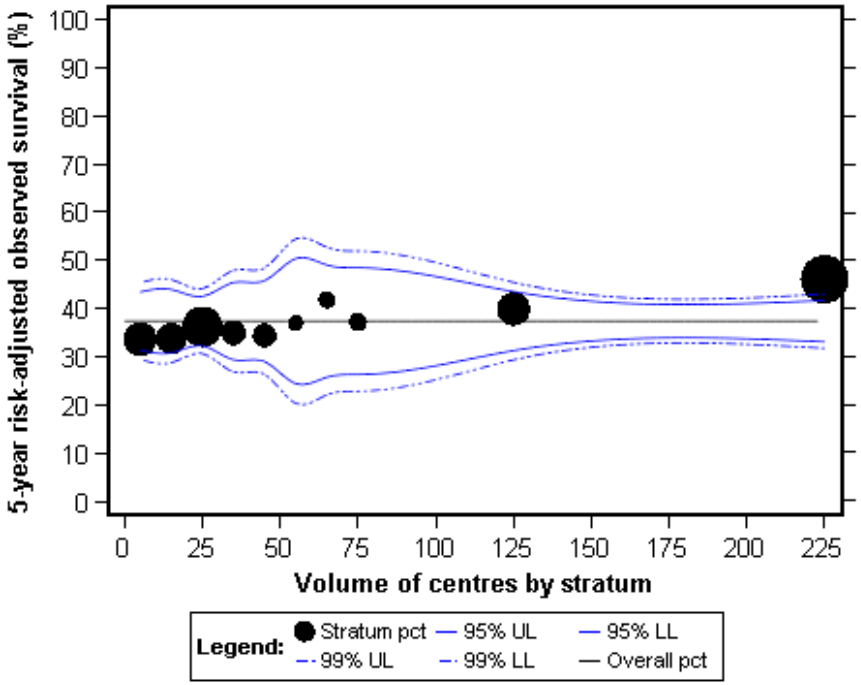
* Control limits were computed based on number of patients in each stratum

Table 115 – 5-year risk-adjusted observed survival by volume of centres (risk-adjusted for sex, age and combined stage)

Category	Volume	N	Deaths	N survivors	Survival_sum [§]	Observed survival	Adjusted survival	Survexp_Max [§]
1	0-9 patients	66	57	9	9.64	13.64	17.62	60.00
2	10-19 patients	261	231	30	32.26	9.65	17.55	60.00
3	20-29 patients	311	279	32	46.43	9.09	13.00	60.00
4	30-39 patients	780	686	94	119.7	11.37	14.82	60.00
5	40-49 patients	398	333	65	68.03	15.56	18.03	60.00
6	50-59 patients	375	329	46	58.69	11.70	14.79	60.00
7	60-69 patients	320	257	63	62.14	18.87	19.13	60.00
8	70-79 patients	435	374	61	72.31	13.56	15.92	60.00
9	80-99 patients	520	428	92	100.3	17.33	17.30	60.00
10	100-149 patients	718	546	172	133.3	22.42	24.34	60.00
11	150-199 patients	691	524	167	143.1	23.28	22.02	60.00
12	>=200 patients	938	620	318	247.6	32.80	24.23	60.00

[§] Survival_sum: Number of expected survivors from Cox regression model. Survexp_max: Maximum theoretical follow up time for the first diagnosed patient.

Figure 83 – Oesophageal cancer: 5-year risk-adjusted observed survival for patients who underwent surgical intervention in function of volume of centres with control limits* (Risk-adjusted on sex, age and combined stage)



* Control limits were computed based on number of patients with surgical intervention in each stratum

Table 116 – 5-year risk-adjusted observed survival in function of volume of centres grouped according to the volume of surgical patients (risk-adjusted on sex, age and combined stage)

Category	Volume	N	Deaths	N survivors	Survival_sum [§]	Observed survival	Adjusted survival	Survexp_Max [§]
1	0-9 patients	246	165	81	89.88	30.92	33.66	60.00
2	10-19 patients	207	140	67	74.03	31.24	33.80	60.00
3	20-29 patients	341	216	125	128.8	35.78	36.26	60.00
4	30-39 patients	139	96	43	45.91	30.10	34.99	60.00
5	40-49 patients	127	85	42	45.56	31.92	34.43	60.00
6	50-59 patients	53	32	21	21.18	39.20	37.03	60.00
7	60-69 patients	66	34	32	28.56	46.28	41.85	60.00
8	70-79 patients	73	45	28	28.07	37.80	37.25	60.00
9	80-99 patients	0						
10	100-149 patients	239	145	94	87.92	38.58	39.93	60.00
11	150-199 patients	0						
12	>=200 patients	486	256	230	186.3	45.73	46.10	60.00

[§] Survival_sum: Number of expected survivors from Cox regression model. Survexp_max: Maximum theoretical follow up time for the first diagnosed patient.

Table 117 – Oesophageal cancer: Univariate and multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality

	N*	5-year OS (%)	5-year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Sex						0.059			0.8879
Men (Ref)	4 396	18.9	81.1	1			1		
Women	1 416	18.9	81.1	1.067	[0.998-1.140]		0.995	[0.926-1.069]	
Age (years)						<0.001			<0.001
0-49 (Ref)	458	29.6	70.4	1			1		
50-59	1 293	23.5	76.5	1.228	[1.082-1.394]		1.200	[1.053-1.367]	
60-69	1 564	22.1	77.9	1.257	[1.111-1.422]		1.251	[1.102-1.421]	
70+	2 497	12.5	87.5	1.931	[1.716-2.172]		2.020	[1.787-2.283]	
Histology						<0.001			<0.001
SCC (Ref)	2 309	15.8	84.2	1			1		
AC	3 267	21.2	78.8	0.842	[0.793-0.893]		0.865	[0.811-0.922]	
Other	236	16.5	83.5	1.078	[0.930-1.248]		0.960	[0.822-1.122]	
Localisation						<0.001			
C15.0 + C15.3 Cervical part/ Upper third (Ref)	294	15.8	84.2	1					
C15.1 + C15.4 Thoracic part/ Middle third	476	18.4	81.6	0.95	[0.809-1.117]				
C15.2 + C15.5 Abdominal part/ Lower third	1 191	24.6	75.4	0.832	[0.721-0.959]				
C15.8 + C15.9 Overlapping lesion of oesophagus, Oesophagus unspecified	2 400	16.9	83.1	1.16	[1.014-1.326]				
C16.0 GOJ	1 451	18.1	81.9	1	[0.870-1.148]				
Combined stage						<0.001			0.001
Stage I (Ref)	688	57.6	42.4	1			1		
Stage II	1 007	26.5	73.5	2.385	[2.079-2.737]		2.319	[2.013-2.673]	
Stage III	1 104	15.9	84.1	3.243	[2.837-3.708]		3.325	[2.895-3.818]	
Stage IV	1 334	4.5	95.5	5.438	[4.772-6.195]		5.584	[4.877-6.394]	

	N*	5-year OS (%)	5-year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Unknown	1 679	11.9	88.1	4.800	[4.223-5.455]		4.409	[3.854-5.044]	
Year of incidence						<0.001			
2004 (Ref)	1 099	14.2	85.8	1					
2005	1 164	21.5	78.5	0.821	[0.750-0.900]				
2006	1 181	19.0	81.0	0.871	[0.796-0.953]				
2007	1 234	19.1	80.9	0.88	[0.805-0.962]				
2008	1 134	22.8	77.2	0.846	[0.771-0.928]				
Hospital volume of oesophagectomies						<0.001			<0.001
Low (<6 per year) (Ref)	3 674	14.2	85.8	1			1		
Medium (6-19 per year)	1 200	22.4	77.6	0.751	[0.698-0.809]		0.834	[0.774-0.899]	
High (20+ per year)	938	32.8	67.2	0.512	[0.470-0.559]		0.646	[0.591-0.707]	

* One patient is lost to follow up since the day of incidence and is excluded for survival analyses.

Table 118 – Univariate and multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality for patients with oesophageal cancer who underwent a surgical intervention

	N	5 year OS (%)	5 year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Sex						0.402			0.534
Men (Ref)	1 551	36.6	63.4	1			1		
Women	426	40.1	59.9	0.942	[0.820-1.083]		0.956	[0.828-1.103]	
Age (years)						<0.001			<0.001
0-49 (Ref)	204	46.9	53.1	1			1		
50-59	497	41.3	58.7	1.250	[0.998-1.564]		1.326	[1.056-1.661]	
60-69	637	41.0	59.0	1.249	[1.004-1.552]		1.367	[1.098-1.702]	
70+	639	27.6	72.4	1.959	[1.583-2.424]		2.354	[1.895-2.923]	
Histology						0.047			0.074
SCC (Ref)	512	37.3	62.7	1			1		
AC	1 402	37.8	62.2	1.014	[0.891-1.155]		0.93	[0.-11-1.067]	
Other	63	26.8	73.2	1.464	[1.074-1.996]		1.288	[0.942-1.762]	
Localisation						<0.001			
C15.0 + C15.3 Cervical part/ Upper third (Ref)	54	29.4	70.6	1					
C15.1 + C15.4 Thoracic part/ Middle third	140	39.1	60.9	0.821	[0.553-1.221]				
C15.2 + C15.5 Abdominal part/ Lower third	562	42.9	57.1	0.812	[0.573-1.151]				
C15.8 + C15.9 Overlapping lesion of oesophagus, Oesophagus unspecified	484	43.1	56.9	0.847	[0.596-1.205]				
C16.0 GOJ	737	29.4	70.6	1.184	[0.841-1.667]				
Combined stage						<0.001			<0.001
Stage I (Ref)	480	65.3	34.7	1			1		
Stage II	568	36.1	63.9	2.354	[1.955-2.836]		2.372	[1.966-2.863]	
Stage III	529	23.9	76.1	3.306	[2.751-3.972]		3.613	[3.000-4.351]	
Stage IV	234	12.4	87.6	4.924	[3.997-6.067]		5.702	[4.607-7.058]	

	N	5 year OS (%)	5 year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Unknown	166	38.8	61.2	2.357	[1.835-3.027]		2.136	[1.659-2.751]	
Year of incidence						0.007			
2004 (Ref)	367	29.4	70.6	1					
2005	421	40.6	59.4	0.763	[0.641-0.908]				
2006	414	40.0	60.0	0.762	[0.640-0.907]				
2007	413	36.2	63.8	0.82	[0.690-0.975]				
2008	362	42.9	57.1	0.1754	[0.627-0.907]				
Hospital volume of oesophagectomies						<0.001			<0.001
Low (<6 per year) (Ref)	861	32.7	67.3	1			1		
Medium (6-19 per year)	492	37.7	62.3	0.901	[0.784-1.036]		0.928	[0.806-1.068]	
High (≥20 per year)	624	43.7	56.3	0.684	[0.598-0.782]		0.655	[0.571-0.751]	

Appendix 6.8.4. Discussion

Oesophageal cancer remains highly lethal as documented in other international studies [81-83]. For example, Coupland et al. [81] investigated the incidence and survival of oesophageal and gastric cancers in England using data on 133 804 patients diagnosed between 1998 and 2007. Among patients with an upper and middle oesophageal cancer, 30.3% (95%CI 29.6- 31.0%) survived 1 year and 8.3% (95%CI 7.8-8.7%] survived five years after diagnosis. The results for the oesophageal squamous cell carcinoma group were similar to the upper and middle oesophageal cancer group. Among patients with a lower oesophageal cancer, 36.4% (95%CI 35.9-36.8%] survived 1 year and 9.4% (95%CI 9.1-9.8%] survived 5 years after diagnosis. The results for the oesophageal adenocarcinoma group were similar to the lower oesophageal cancer group. A more recent report from National Oesophago-gastric Cancer Audit (UK 2012) [30] reported the proportion of patients receiving a curative treatment (definitive chemo-radiation therapy, and surgery with or without neoadjuvant chemotherapy) estimated to survive 1, 2 and 3 years from date of diagnosis (unadjusted Kaplan-Meier estimates). Results were clearly higher than those reported for a global population whatever the treatment administered, both for oesophageal squamous cell carcinoma (73.1% [95%CI 69.9-76.0], 50.7% [95%CI 47.3-54.1] and 41.3% [95%CI 38.0-44.7] respectively) and for adenocarcinoma (78.2% [95%CI 76.4-79.8], 56.5% [95%CI 54.4-58.5] and 46.0% [95%CI 43.9-48.0] respectively).

Cox proportional hazard models were used to assess the influence of specific risk factors on the 5-year survival. Six risk factors were available for the regression model: patients' characteristics (age, sex), tumour characteristics (histological type, tumour localization and cancer stage) and the annual volume of oesophagectomies. Three volume cut-offs were defined: low-volume hospitals (<6 oesophagectomies/year), medium-volume hospitals (6-19 oesophagectomies/year) and high-volume hospitals (≥ 20 oesophagectomies/year). Age, combined stage, histological type and anatomical localization of the tumour were found to be prognostic factors for survival. The observed 5-year survival was 18.9% for the entire cohort. Younger patients, adenocarcinomas, tumours located in the abdominal part of the oesophagus and earlier cancer stages were associated with longer survival. A clear association was also found between the yearly volume of oesophagectomies performed by centre and the percentage of 5year survivors: 13.9%, 22.4% and 32.8% for patients treated in low-volume, medium-volume and high-volume hospitals, respectively. After case-mix adjustment, both patients in high-volume and medium-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.65; 95%CI 0.59–0.71 and HR 0.83; 95%CI 0.77–0.89 respectively). For patients who benefited from a surgical intervention, the percentage of survivors in high-volume hospitals was clearly higher compared to low-volume hospitals (43.7% vs. 32.7%), confirming the previous association between volume of oesophagectomies and 5-year overall survival (HR 0.65; 95%CI 0.57–0.75).

While several large studies already highlighted the association between high-volume and low 30-day mortality [27, 46, 87, 91-93], the association between high-volume and long-term survival was less intensively studied [25, 27, 62, 94]. Evidence was not so straightforward. Thompson et al. [94] found no relationship between hospital volume and survival but suggested that the link between hospital volume and long-term survival for patients undergoing surgery requires re-evaluation. Wouters et al. [25] showed a significant association between volume and 5-year overall survival for stage I and II disease, but not for more advanced cancer stages. They argued that more patients with stage IV disease were treated in the high-volume hospitals, corresponding with their status as tertiary referral centers. The very poor survival in this group of patients would influence the overall results significantly [25]. During a more recent period, Dikken et al. [27] revealed a volume-survival relation for patients who underwent an oesophagectomy, particularly after 2005. They explained that centralization of surgery was combined with prospective audits to identify hospitals with excellent performance in oesophagectomy. Such combination substantially improved quality of care and patients survival.

In Belgium, oesophagectomies are not concentrated in specialized centres, leading to a high dispersion. The highest volume centre reached a maximum of 486 oesophagectomies within a 5-year period, i.e. 97 oesophagectomies yearly. In the majority of the centres (95%), less than 10 patients underwent an oesophagectomy per year. However, in the current study, higher hospital volume of oesophagectomies was significantly associated with lower mortality and increased long-term survival when centres performing at least 20 oesophagectomies per year were compared to those performing less than 6 oesophagectomies per

year. Such positive association was found both for all patients with oesophageal cancer and for patients who underwent a surgical intervention.

The analysis did not reveal anything about quality of care. Some beneficial factors, supported by the literature, can be used to support the association between high volume and long-term survival. Above all, accurate cancer staging, better patient selection, improved patient preparation for surgery and appropriate experience in managing postoperative complications are related to the knowledge, experience, and judgment of the specialists, working in a multidisciplinary team [25].

Key points

- **Oesophageal cancer remains highly lethal due to the late onset of symptoms when disease is already in an advanced stage (9.8% at a European level).**
- **Belgium reported higher 5-year overall survival rates than other European countries, reaching 18.9% between 2004 and 2008.**
- **Younger patients, adenocarcinomas, tumours located in the abdominal part of the oesophagus and earlier cancer stages were associated with longer survival.**
- **Both patients in high-volume (≥20 oesophagectomies/year) and medium-volume hospitals (6-19 oesophagectomies/year) had a decreased risk of death compared to patients in low-volume hospitals (< 6 oesophagectomies/year [HR 0.65; 95%CI 0.59–0.71 and HR 0.83; 95%CI 0.77–0.89, respectively]).**
- **Patients operated in high-volume hospitals (≥20 oesophagectomies/year) had a decreased risk of death compared to patients in low-volume hospitals (< 6 oesophagectomies/year [HR 0.65; 95%CI 0.57–0.75]).**
- **The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence.**
- **This outcome indicator seems pertinent to compare all Belgian centres according to the volume of patients (surgically) treated per year.**

Appendix 6.9. OC15: Percentage of patients surgically treated in high-volume hospitals

Appendix 6.9.1. Rationale

There is evidence both from the international literature and from Belgian data that high hospital volume is associated with higher in-hospital survival as well as higher long-term survival [12, 46, 91-93]. Volume of surgical interventions reflects experience of surgeons and other practitioners in managing patients with oesophageal cancer. As such, it can also be considered as a surrogate for high-level processes of care. There is also evidence that centralization of oesophageal cancer resections in a limited number of hospitals within a country leads to substantial improvements in outcome (USA [87], the Netherlands [24, 46]).

Various definitions of hospital volume were found in the literature on hospital volume (e.g. the definition of high-volume ranged from 6 to 40 resections per year) [19]. International thresholds were retrieved in the literature: 6 oesophagectomies/year were defined by the US Agency for Healthcare Research and Quality (AHRQ) to 13/year threshold proposed by the US Leapfrog Group (a large coalition of private and public purchasers of health insurance in the USA, referring their patients to high-volume providers of oesophagectomies since 2000). In 2006, a minimum volume of 10 oesophagectomies per year was enforced by the Dutch Healthcare Inspectorate whereas in 2011 the Dutch Society of Surgery recommended a minimal volume of 20 oesophagectomies per year [27]. The latter cut-off was retained to define high-volume centres in Belgium for this report.

Appendix 6.9.2. Definition

Type of quality indicator

Process indicator

Description

Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals in a given year

Numerator

All patients with oesophageal cancer surgically treated in high-volume hospitals in a given year

Denominator

All patients with oesophageal cancer surgically treated in a given year

Appendix 6.9.3. Elaboration

Risk adjustment

- No risk adjustment

Sensitivity analyses

- No sensitivity analysis

Cut-offs to define low-, medium- and high-volume hospitals

- Low-volume hospital: < 6 oesophagectomies / year (<30 /5y)
- Medium-volume hospital: 6-19 oesophagectomies / year (>=30 and <100 /5y)
- High-volume hospital: ≥ 20 oesophagectomies / year (>=100 /5y)

According to Dikken et al. 2012 (NL): Clinically relevant volume categories were defined as very low (1–5/year), low (6–10/year), medium (11–20/year), and high (≥21/year).

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of oesophageal cancer: ICD10 code C15.0-C16.0 (BCR)
- Stage, histological type, anatomical site, year of incidence: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3, Table 230)

Appendix 6.9.4. Results

Proportion of patients surgically treated in high-volume hospitals

Between 2004 and 2008, 34.7% of the patients with oesophageal cancer were surgically treated in a high-volume centre (i.e. performing at least 20 oesophagectomies per year) (Table 119). This proportion remained quite stable, although it was somewhat lower in 2008 (29.8%).

Older patients were less likely to be surgically treated in a high-volume hospital, although the difference was not statistically significant (Table 120: 70+ vs. 70, OR = 0.88, 95%CI 0.71-1.09). No statistically significant difference was found between men and women (Table 121: OR = 1.12, 95%CI 0.87-1.45), or between squamous cell carcinoma and adenocarcinoma (Table 122).

Table 119 – Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals

	Numerator	Denominator	Proportion (%)
2004	112	317	35.3
2005	123	359	34.3
2006	134	365	36.7
2007	133	357	37.3
2008	97	326	29.8
Total	**599**	**1 724**	**34.7**

Table 120 – Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals by age group

	Numerator	Denominator	Proportion (%)
<50	76	188	40.4
50-59y	169	461	36.7
60-69y	195	573	34.0
70-79y	143	441	32.4
80+	16	61	26.2
Total	**599**	**1 724**	**34.7**

Table 121 – Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals by sex

	Numerator	Denominator	Proportion (%)
Men	483	1 369	35.3
Women	116	355	32.7
Total	**599**	**1 724**	**34.7**

Table 122 – Proportion of patients with oesophageal cancer surgically treated in high-volume hospitals: SCC and AC by TNM stage (combined stage)

	SCC			AC		
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)
Stage I	35	99	35.4	118	304	38.8
Stage II	47	177	26.6	114	318	35.8
Stage III	59	145	40.7	124	317	39.1
Stage IV	26	46	56.5	52	131	39.7
Stage X	1	40	2.5	5	97	5.2
Total	**168**	**507**	**33.1**	**413**	**1 167**	**35.4**

Patient and tumour characteristics according to volume

Table 123 presents the same type of information as above but presented differently. The percentages correspond to the distribution of (surgically treated) patient characteristics (age, sex, …) *within each volume category*. Comparing these percentages across volume allows to compare the case mix between the different volume categories. This table shows that the proportion of women is slightly higher in low-volume centres than in high-volume centres (22.9% vs 19.6%), and that the proportion of older patients (+70 years old) is also higher in low-volume centres (36.8% vs 27.4%). The type of tumour is also different: while in small centers 45.3% of the tumours is located at the junction, this is the case in 28.4% in high-volume centres. There are also relatively more adenocarcinomas in low-volume centres (74.2% vs 69.9%). All these factors have been accounted for in the volume-outcome analyses presented in the other sections.

Striking are the differences in the reporting of the stage to the BCR: while in high-volume centres the percentage of missing stage is only 1.3%, these percentages attain 10.6% and 13.6% in low- and medium-volume centres. The problem lies mainly in the reporting of the clinical stage (50.1% clinical stage not reported in low-volume centres, versus 10.1% in high-volume centres), Funnel plots depict the variability between centres to report clinical and pathological stage to the BCR (Figure 84, Figure 85 and Figure 86).

Table 123 – Oesophageal cancer: Differences in case mix of patients who underwent surgical intervention between low-, medium- and high-volume centres

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (>19 per year)	Total
N of hospitals	86	9	2	97
N of patients	861	492	624	1 977 §
Sex (%)				
Men	77.1	78.3	80.5	78.5
Women	22.9	21.8	19.6	21.6
Age (mean)	64.8	63.3	62.2	63.6
<50y (%)	8.4	11.0	12.5	10.3
50-59y (%)	22.7	26.4	27.6	25.1
60-69y (%)	32.2	31.9	32.5	32.2
70+ (%)	36.8	30.7	27.4	32.3
Type of tumour (%)				
Oesophageal	54.7	65.5	71.6	62.7
Junction	45.3	34.6	28.4	37.3
Histological type (%)				
AC	74.2	66.5	69.9	70.9
SCC	22.5	30.5	26.9	25.9
Other	3.3	3.0	3.2	3.2
Clinical stage (%)				
0*	0.7	0.0	0.0	0.2
I*	21.6	19.4	21.6	21.2
II*	37.4	35.1	30.3	33.7
III*	32.8	32.7	37.1	34.7
IV*	7.4	12.9	11.1	10.2
X	50.1	49.6	10.1	37.3
Pathological stage (%)				
I*	27.6	28.8	30.9	28.9
II*	34.6	37.1	32.8	34.7
III*	27.5	26.2	28.8	27.5
IV*	10.4	7.8	7.5	8.9
X	21.7	21.8	25.3	22.9
Combined stage (%)				
I*	26.1	26.8	26.8	26.5
II*	32.6	34.1	27.9	31.4
III*	29.4	26.4	31.0	29.2
IV*	12.0	12.7	14.3	12.9
X	10.6	13.6	1.3	8.4

§ Patients treated with oesophagectomy and/or gastrectomy (in contrast to 1724 who only underwent oesophagectomy).

Table 124 – Oesophageal cancer: Differences in case mix between low, medium and high volume centres, all patients (operated or not)

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (>19 per year)	Total
N of hospitals	101	9	2	112
N of patients	3 675	1 200	938	5 813
Sex (%)				
Men	74.3	76.7	79.6	75.6
Women	25.7	23.3	20.4	24.4
Age (mean)	67.6	65.9	63.2	66.6
<50y (%)	6.6	8.6	12.3	7.9
50-59y (%)	20.9	23.7	25.7	22.2
60-69y (%)	25.9	27.8	29.9	26.9
70+ (%)	46.7	40.0	32.2	43.0
Type of tumour (%)				
Oesophageal	74.9	76.1	74.0	75.0
Junction	25.1	23.9	26.0	25.0
Histological type (%)				
AC	54.4	35.3	64.7	56.2
SCC	41.3	41.3	31.5	39.7
Other	4.3	3.5	3.8	4.1
Clinical stage (%)				
0*	0.3	0.2	0.1	0.2
I*	9.2	11.4	18.0	11.7
II*	23.2	27.6	25.5	24.6
III*	27.7	29.0	32.2	29.0
IV*	39.7	31.9	24.2	34.5
X	47.1	45.3	12.3	41.1
Pathological stage (%)				
I*	26.2	32.4	31.7	29.2
II*	30.2	32.0	31.9	31.1
III*	25.4	23.1	27.7	25.4
IV*	18.2	12.5	8.7	14.3
X	74.0	60.7	46.2	66.8
Combined stage (%)				
I*	13.5	19.6	22.3	16.6
II*	23.4	27.7	23.9	24.4
III*	26.6	25.7	28.1	26.7
IV*	36.6	27.1	25.8	32.3
X	35.2	27.7	5.8	28.9

* Unknown stage (X) is excluded to calculate the percentages

Figure 84 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer with unknown clinical stage (cStage), by centre

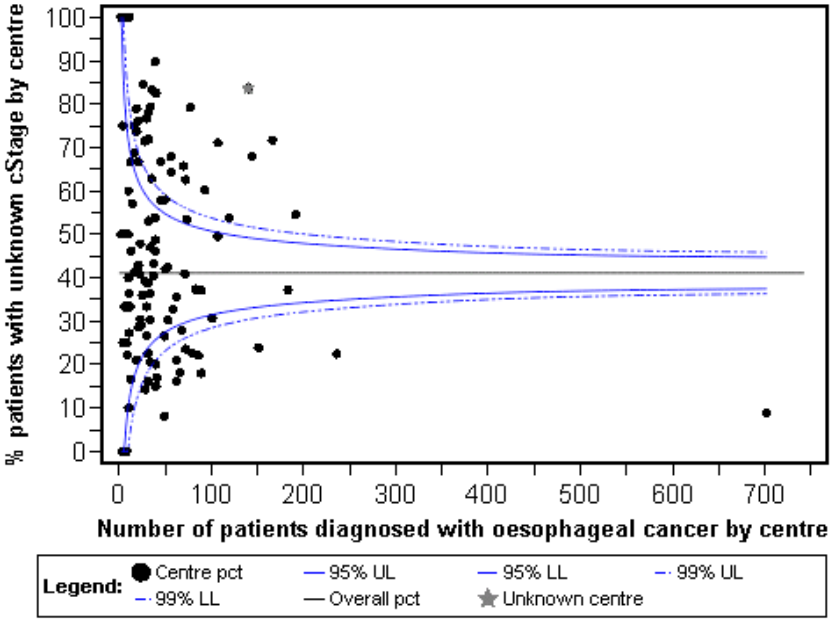


Table 125 – Number and proportion of outlying centres (oesophageal cancer with unknown clinical stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	17	15.18	17	15.18
Equal to 99%LL or lower than 95%LL	7	6.25	24	21.43
Between 95% control limits	52	46.43	76	67.86
Equal to 99%UL or upper than 95%UL	5	4.46	81	72.32
Upper than 99%UL	31	27.68	112	100.00

Figure 85 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer who underwent surgical intervention with unknown pathological stage (pStage), by centre

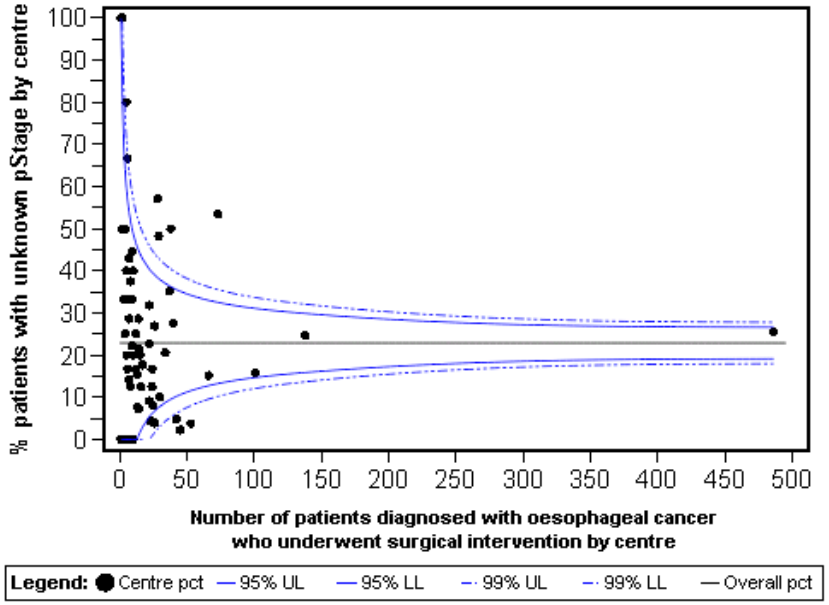


Table 126 – Number and proportion of outlying centres (oesophageal cancer with unknown pathological stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	3	3.09	3	3.09
Equal to 99%LL or lower than 95%LL	4	4.12	7	7.22
Between 95% control limits	82	84.54	89	91.75
Equal to 99%UL or upper than 95%UL	2	2.06	91	93.81
Upper than 99%UL	6	6.19	97	100.00

Figure 86 – Funnel plot of the proportion of patients diagnosed with oesophageal cancer with unknown combined stage (combStage), by centre

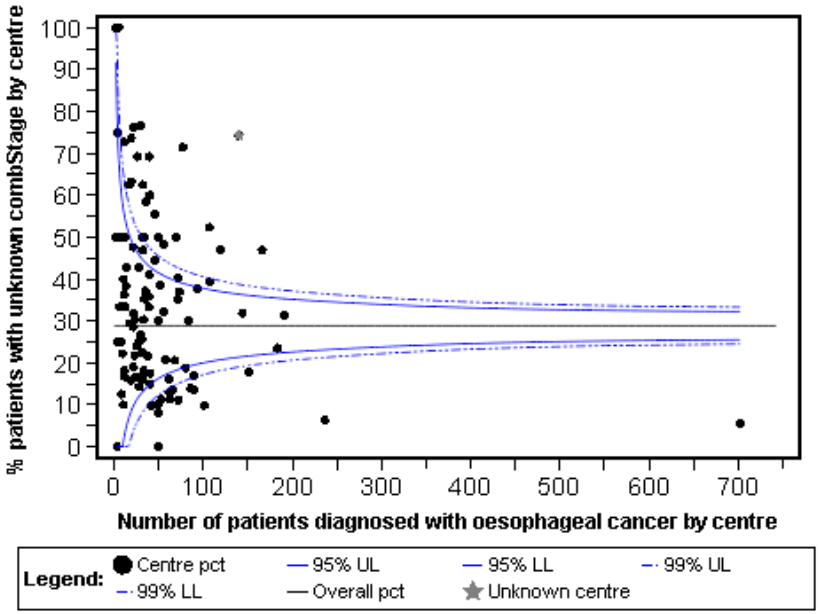


Table 127 – Number and proportion of outlying centres (oesophageal cancer with unknown combined stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	15	13.39	15	13.39
Equal to 99%LL or lower than 95%LL	3	2.68	18	16.07
Between 95% control limits	62	55.36	80	71.43
Equal to 99%UL or upper than 95%UL	6	5.36	86	76.79
Upper than 99%UL	26	23.21	112	100.00

Appendix 6.9.5. Discussion

Centralisation of care for patients with oesophagogastric cancer was recommended in the 2012 guidelines [8]. This recommendation was based on the evidence available from the scientific literature. In the period 2004-2008, 111 and 114 out of 115 acute Belgian hospitals delivered a medico-surgical treatment for patients with oesophageal and gastric cancer, respectively. During this period, only about one third of patients with oesophageal cancer was treated in a high-volume hospital (defined as treating at least 20 patients with oesophageal cancer per year), with a significant decrease in 2008 (29.8%). Comparison of case-mix between the hospitals grouped by volume shows that patients operated in low- or high-volume centres are different: there were slightly more women in low-volume centers, more older patients, more junction tumour and more adenocarcinomas. These factors have been accounted for in the volume-outcome analyses.

First, it is clear that the care for patients with oesophagogastric cancer was not centralised at all in the period 2004-2008, and very probably still is not. With the volume definitions that were used for the present report (high: ≥20 patients/year; medium: 6-19 patients/year; low: <6 patients/year), only two high-volume hospitals were identified for oesophageal cancer and only one for gastric cancer. Only about 35% and 5% of patients with oesophageal

and gastric cancer, respectively, were treated at a high-volume centre. Second, clear differences were found in the case-mix according to hospital volume. For oesophageal cancer, high-volume centres treated more men, younger patients, more adenocarcinomas and less stage IV tumours. For gastric cancer, high-volume centres treated more women, younger patients, and less stage IV tumours. These results suggest that high-volume centres treated patients with more favourable characteristics. Third, for patients with oesophagogastric cancer that underwent surgery, hospital volume had a significant impact on postoperative mortality (for oesophageal cancer) and 5-year survival (for oesophageal and gastric cancer). For all patients with oesophagogastric cancer whatever their treatment, hospital volume had a significant impact on 5-year survival (for oesophageal and gastric cancer). Fourth, the results of the process indicators that were measurable with administrative data did not provide an explanation for this volume-outcome relationship. Furthermore, where the case-mix suggested that high-volume centres were treating patients with more favourable characteristics, the volume-outcome relationship persisted after correction for age, sex, stage and histological type.

A big caveat with these results is the absence of information on comorbidity. It is still possible that the differences in outcome according to volume can be explained by differences in comorbidity, i.e. that high-volume centres are treating patients with less comorbidity. To further explore this, comorbidity of cancer patients (e.g. with the WHO performance status) should be registered in a consistent way and it should be clearly defined what degree of comorbidity is considered to be clinically relevant. Currently, the Belgian Cancer Registry records the WHO performance score at diagnosis of all patients. However, less than half of all files reported this information between 2004 and 2008. Another option would be to construct a comorbidity score based on IMA data.

Despite this caveat, these results cannot be ignored and confirm the recommendation that was previously published, i.e. to centralise the care for patients with upper gastrointestinal cancer. This was supported in consensus by the experts that were involved in this project. However, this report does not allow to recommend on how to organise this centralisation. No search for an ideal volume cut-off point or for essential characteristics of centres or care providers was done. The discussion about these organisational issues should be done using this report as a starting point. The appropriate methodology for this discussion should be decided on first. Important questions to be answered are: is a minimal level of activity and experience needed? Can the results on process and outcome indicators be used to deliver accreditation to centres? Are structural prerequisites (e.g. availability of radiotherapy facilities) recommended? The only available example of a similar discussion in the field of oncology in Belgium is breast cancer. Regulations were introduced by a Royal Decree on July 20th 2007. To be recognized as a breast clinic, a centre has to surgically treat at least 150 new patients per year since 2010.

A major finding of the present report was also the high number of missing stages reported to the BCR. Between 2004 and 2008, 50.1% of clinical stages were not reported in low-volume centres, versus 10.1% in high-volume centres (for surgically treated patients). The high proportion of missing stages was already reported previously in 2 KCE reports concerning other cancer types [4, 5]. It is difficult to find a good explanation for the underreporting of information that is actually that basic. Probably, the explanation is multifactorial. In some cases, the medical file probably contained insufficient information to decide on the final stage. In other cases, the necessary information was probably available, but no final decision regarding the stage was recorded on file or paper. Finally, in some cases all necessary information and the final stage was probably available in the medical file, but never communicated to the Cancer Registry. Anyhow, the high number of missing stages weakens the results of this report, since this information was needed for the elaboration or calculation of several indicators. During the discussion with clinical experts, it became clear that reporting of cancer stage should be included as a quality indicator. Furthermore, actions should be undertaken to improve the registration of the cancer stage. Linking the reimbursement of the multidisciplinary discussion to the registration of the cancer stage could be a solution.

Key Points

- **A minority of the patients operated for an oesophageal cancer is treated in high-volume centres: 34.7% over 2004-2008, with a significant decrease in 2008 (29.8%).**
- **Comparison of case-mix between the hospitals grouped by volume shows that patients operated in low- or high-volume centres are different: there were slightly more women in low-volume centers, more older patients, more junction tumour and more adenocarcinomas. These factors have been accounted for in the volume-outcome analyses.**
- **Also striking are the differences in reporting the cancer stage to the BCR: 50.1% of clinical stages are not reported in low-volume centres, versus 10.1% in high-volume centres.**

Appendix 6.10. GC1: Discussion at multidisciplinary meeting

Appendix 6.10.1. Rationale

According to the updated guidelines, all patients diagnosed with gastric cancer should be discussed at a multidisciplinary meeting (strong recommendation, low level of evidence).

Multidisciplinary team meetings (MDT) have been implemented in many countries as the predominant model of cancer care to ensure that all patients receive timely diagnosis and treatment, that patient management is evidence-based, and that there is continuity of care [48]. The positive impact of multidisciplinary team care in the management of gastro-oesophageal cancer was reported at least in two publications from UK [49, 50]. Stephens et al. reported that multidisciplinary team management resulted in improved staging, lower operative mortality, and improved 5-year survival when compared to a group of patients undergoing R0 resection by surgeons who were working independently. Davies et al. concluded that MDT significantly improved staging accuracy for gastro-oesophageal cancer and ensured that correct management decisions were made for the majority of patients. Moreover, multidisciplinary care tend to enable the construction of clinical pathways and to develop formal programs with a unified vision for therapy and palliation [51]. Such MDT have to be encouraged and generalized in the management of patients with gastric cancer.

Appendix 6.10.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting.

Numerator

All patients diagnosed with gastric cancer in a given year discussed at the MDT meeting within 1 month after incidence date.

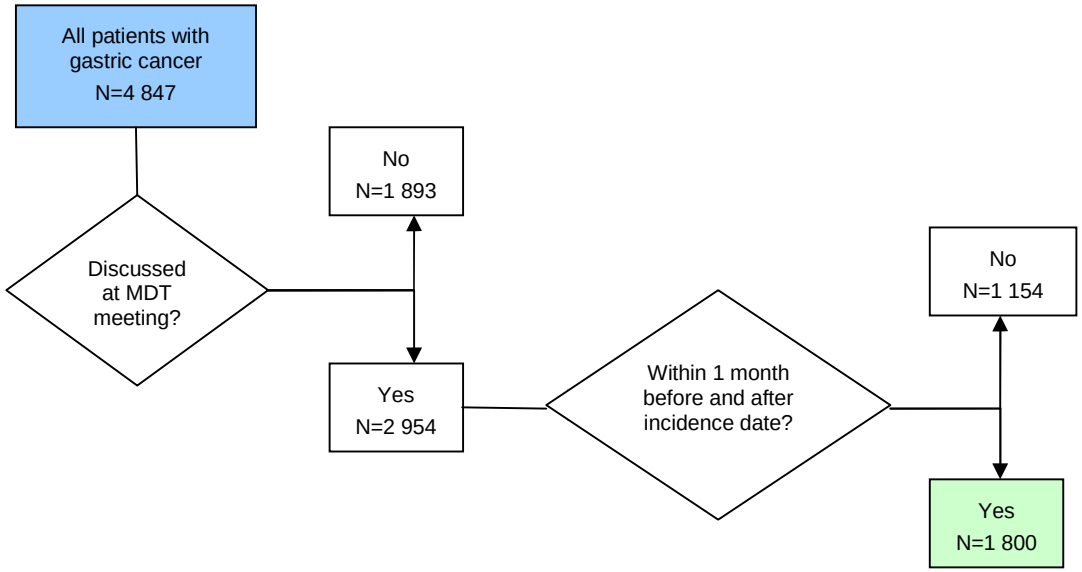
Denominator

All patients diagnosed with gastric cancer in a given year.

Appendix 6.10.3. Elaboration

Due to the algorithm used to define the incidence date, it is possible that the date of the actual diagnosis precedes the reported incidence date. Therefore, some patients will have acts, including the multidisciplinary team meeting, that are billed before the incidence date. To allow these acts to be accounted for, the operational numerator of the present indicator was: “All patients diagnosed with oesophageal cancer in a given year discussed at the MDT meeting within 1 month before and after incidence date”.

Flowchart



Supplementary analyses

Subgroup analysis

- Analysis by stage, age, sex an type of treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Supplementary analysis within 1 month before and (1) 3 months or (2) 6 months after incidence date

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD-10 code C16.1 (BCR)
- MDT meeting: nomenclature codes (IMA) (Appendix 8.1.1, Table 215)

Appendix 6.10.4. Results

National results

Overall, between 2004 and 2008, 37% of patients with gastric cancer were discussed at the MDT meeting within one month after incidence date (Table 128). The proportion slightly increased from 33.0% in 2004 to 41.3% in 2008. No clear increase was found in relation with the cStage. Patients with cStage II gastric cancer were most often discussed at the MDT (61.3%) (Table 129). Of the patients without a registered cStage, only 25.8% were discussed at the MDT meeting.

No clear differences were found in the proportion of patients discussed at the MDT meeting across the different age categories, although the proportion tended to be lower in the 50- category (34.2%; 50- vs. 50+: OR = 0.87, 95%CI 0.69 to 1.11) and was significantly lower in the 80+ category (33.9%; 80+ vs. 80-: OR = 0.81; 95%CI 0.71 to 0.92) (Table 130). The proportion tended to be higher in men than in women, without reaching statistical significance (Table 131: 38 vs. 36%; OR = 1.09, 95%CI 0.96 to 1.23). However, this difference disappeared with stratification by age group (Table 132).

When the proportion was calculated according to the treatment type, patients receiving no major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were less likely to be discussed at a multidisciplinary team meeting (Table 133: OR = 0.56, 95%CI 0.49 to 0.64).

If the time period was extended until 3 months after incidence date, 52.7% of patients with gastric cancer were discussed at the MDT meeting (Table 134). The proportion only slightly increased further to 56.1% if the time period was extended until 6 months after incidence date. However, specifically looking at the data for 2008, approximately 62% of patients with gastric cancer were discussed at a multidisciplinary team meeting within 6 months after incidence date.

Table 128 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date)

	Numerator	Denominator	Proportion (%)
2004	326	988	33.0
2005	340	1 009	33.7
2006	383	1 006	38.1
2007	370	921	40.2
2008	381	923	41.3
Total	**1 800**	**4 847**	**37.1**

Table 129 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date) by clinical stage

	Numerator	Denominator	Proportion (%)
0	2	4	50.0
I	223	456	48.9
II	165	269	61.3
III	160	288	55.6
IV	460	770	59.7
X	790	3 060	25.8
Total	**1 800**	**4 847**	**37.1**

Table 130 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date) by age

	Numerator	Denominator	Proportion (%)
<50	114	333	34.2
50-59y	187	463	40.4
60-69y	376	919	40.9
70-79y	591	1 562	37.8
80+	532	1 570	33.9
Total	**1 800**	**4 847**	**37.1**

Table 131 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date) by sex

	Numerator	Denominator	Proportion (%)
Men	1 068	2 814	38.0
Women	732	2 033	36.0
Total	**1 800**	**4 847**	**37.1**

Table 132 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date): sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	56	166	33.7	58	167	34.7	0.96 (0.59-1.54)
50-59y	114	279	40.9	73	184	39.7	1.05 (0.71-1.56)
60-69y	253	612	41.3	123	307	40.1	1.05 (0.79-1.41)
70-79y	383	981	39.0	208	581	35.8	1.15 (0.92-1.43)
80+	262	776	33.8	270	794	34.0	0.99 (0.80-1.23)
Total	**1 068**	**2 814**	**38.0**	**732**	**2 033**	**36.0**	

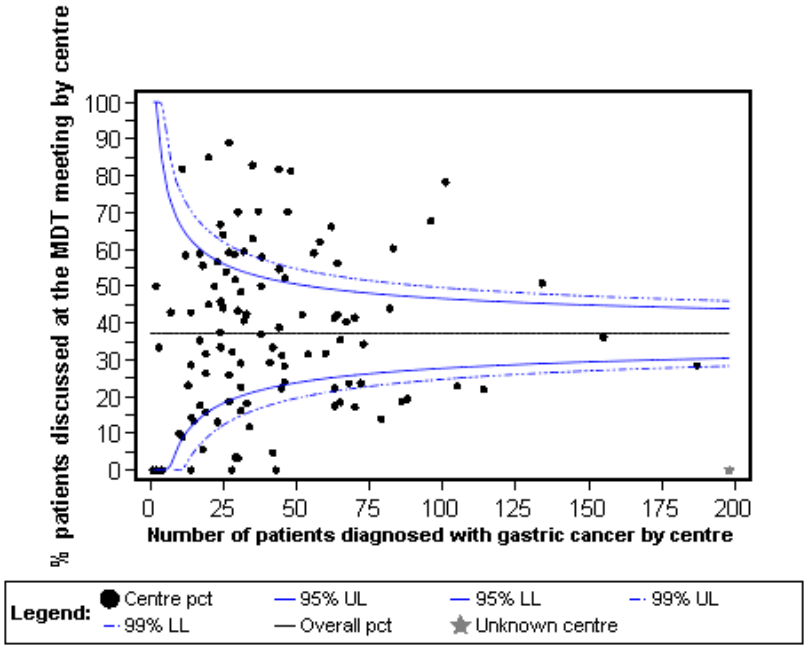
Table 133 – Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting (within 1 month after incidence date) by type of treatment

	Numerator	Denominator	Proportion (%)
Surgery alone	631	1 611	39.2
Tx < Surgery	35	81	43.2
Tx < Surgery < Tx	86	179	48.0
Surgery < Tx	234	538	43.5
Primary CT and/or RT	345	794	43.5
No major treatment	469	1 644	28.5
Total	**1 800**	**4 847**	**37.1**

Table 134 – Sensitivity analyses: Proportion of patients diagnosed with gastric cancer discussed at the MDT meeting within 1 month after, 3 months after, and 6 months after incidence date

	Numerator	Denominator	Proportion (%) 2004-2008	Proportion (%) 2004	Proportion (%) 2008
1 month	1 800	4 847	37.1	33.0	41.3
3 months	2 554	4 847	52.7	46.7	58.2
6 months	2 721	4 847	56.1	48.5	62.2

Figure 87 – Funnel plot of the proportion of patients diagnosed with gastric cancer discussed at the MDT meeting, by centre (2004-2008)



Comparison between centres

An important variability was found across the 115 centres included in the analysis (Figure 87). Twenty-six centres had a proportion below the 95%LL (Table 135). Only 6 centres discussed at least 80% of their patients with gastric cancer in a multidisciplinary meeting, none of the centres discussed at least 90% of their patients. If only the two most recent years were considered (2007-2008), the variability slightly improved, although this may have been due to lower sample sizes (Figure 88 and Table 136). Extending the time period until 3 months after the incidence date also had a minor impact on variability (Figure 89 and Table 137).

Patients that were unable to be attributed to a centre ('centre X' in Figure 87) were not discussed in a multidisciplinary meeting.

Table 135 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	17	14.78	17	14.78
Equal to 99%LL or lower than 95%LL	9	7.83	26	22.61
Between 95% control limits	63	54.78	89	77.39
Equal to 99%UL or upper than 95%UL	4	3.48	93	80.87
Upper than 99%UL	22	19.13	115	100.00

Figure 88 – Funnel plot of the proportion of patients diagnosed with gastric cancer discussed at the MDT meeting, by centre (2007-2008)

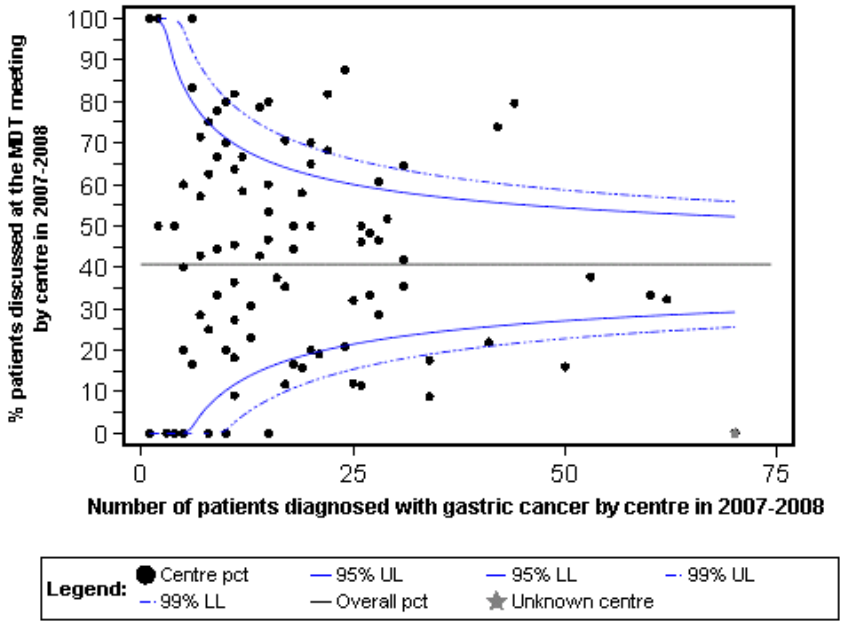


Table 136 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	8	7.21	8	7.21
Equal to 99%LL or lower than 95%LL	10	9.01	18	16.22
Between 95% control limits	74	66.67	92	82.88
Equal to 99%UL or upper than 95%UL	8	7.21	100	90.09
Upper than 99%UL	11	9.91	111	100.00

Figure 89 – Funnel plot of the proportion of patients diagnosed with gastric cancer discussed at the MDT meeting within 3 months after incidence date, by centre (2004-2008)

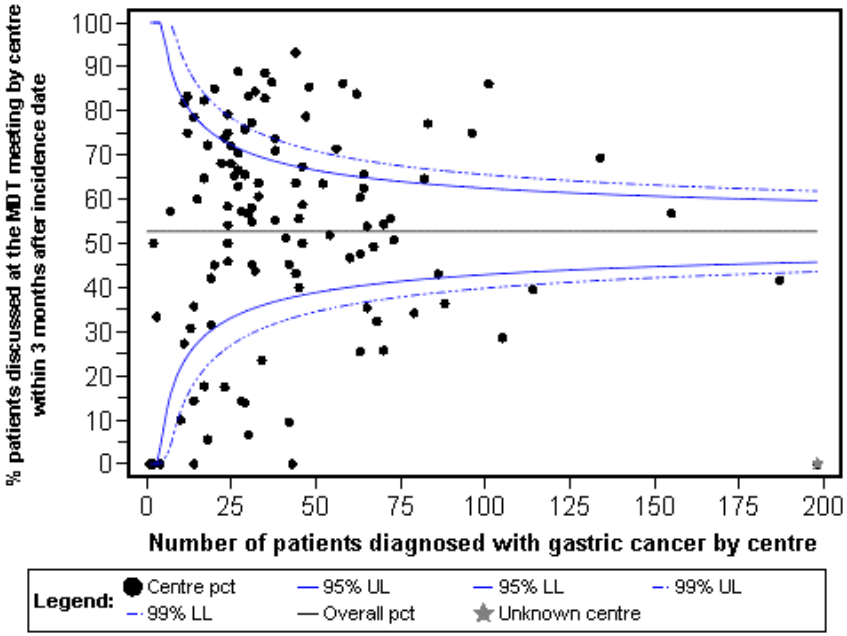


Table 137 – Number and proportion of outlying centres (2004-2008) (timeframe 3 months)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	22	19.13	22	19.13
Equal to 99%LL or lower than 95%LL	1	0.87	23	20.00
Between 95% control limits	62	53.91	85	73.91
Equal to 99%UL or upper than 95%UL	9	7.83	94	81.74
Upper than 99%UL	21	18.26	115	100.00

Appendix 6.10.5. Discussion

Since gastric cancer demands a specialized approach, a discussion of the therapeutic options in a multidisciplinary setting is necessary. Specific nomenclature codes for a multidisciplinary oncologic consultation became available on February 1st 2003. Between 2004 and 2008, only 37% of the patients with oesophageal cancer were discussed in a multidisciplinary consultation within 1 month before and 1 month after the incidence date, although the proportion increased to 56% if the time period was extended until 6 months after incidence date. Patients aged 80 years and above were less likely to be discussed in a multidisciplinary consultation. In comparison with other cancer types, 74% of the patients with breast cancer were discussed in a multidisciplinary consultation within 1 month before and 6 months after the incidence date between 2003 and 2006 [4]. For patients with testicular cancer, the proportion was 58% between 2003 and 2006 [5]. Compared with oesophageal cancer, the proportion was clearly lower. This can be explained by the more straightforward treatment of gastric cancer.

Contrary to oesophageal cancer (see indicator OC1: Appendix 6.1), no clear increase with stage was found. However, as for oesophageal cancer, only about one fourth of patients without a registered cStage were discussed at a multidisciplinary team meeting within one month after incidence date. Furthermore, only about 28% of patients not receiving major treatment (i.e. chemotherapy, radiotherapy and/or surgery) were discussed at a multidisciplinary team meeting. Of course, it is difficult to conclude that these patients did not receive major treatment because they were not discussed or that they were not discussed because it was already decided not to give major treatment.

In the literature, few studies are available that allow a comparison with other countries. According to the Dutch Institute for Clinical Auditing (DICA) [28], 91% of the patients with gastric cancer were discussed in a preoperative multidisciplinary consultation, while 93% were discussed in a postoperative multidisciplinary consultation. In the UK, 72% of the local units had combined MDT meetings with the specialist centre [29]. These concern all patients with oesophagogastric cancer.

The variability between the Belgian centres was considerable. There are several possible explanations for this. First, the absence of a nomenclature code for a multidisciplinary meeting for a particular patient does not necessarily mean that no multidisciplinary meeting was held. Some centres might not charge multidisciplinary meetings and in turn, they do not appear in the IMA database. Second, some centres organize several MDT meetings for each patient and only charge the last meeting, which is often months after the incidence date (with the first meeting being within 1 month after incidence date). This may have lead to an underestimation of the real proportion. In fact, this was confirmed during the validation phase for this indicator for oesophageal cancer. Third, discussion at a multidisciplinary team meeting is not obligatory in Belgium. However, besides the reimbursement of the act, additional financial incentives have been set up in 2009 through the hospital financing. The financing of a data manager, psycho-oncologists, etc. has become dependent upon the number of registered multidisciplinary consultations. It is therefore expected that the proportion of patients discussed at a multidisciplinary consultation will significantly increase.

Key points

- **Between 2004 and 2008, only 37% of the patients with gastric cancer were discussed in a multidisciplinary consultation within 1 month after the incidence date, although the proportion increased to 56% if the time period was extended until 6 months after incidence date.**
- **The proportion slightly increased from 33.0% in 2004 to 41.3% in 2008.**
- **The following subgroups were less likely to be discussed in a multidisciplinary consultation:**
  - **Patients aged 80 years;**
  - **Patients without an unknown cStage;**
  - **Patients not receiving major treatment (i.e. chemotherapy, radiotherapy and/or surgery).**
- **Variability between the Belgian centres was considerable.**

Appendix 6.11. GC2: Staging CT thorax/abdomen

Appendix 6.11.1. Rationale

According to the updated guidelines [8], in patients with newly diagnosed gastric cancer, CT scan of the chest and abdomen should always be performed (strong recommendation, low level of evidence). As for patients with oesophageal cancer, the main contribution of CT scan to the staging of gastric cancer is the detection of distant metastases [54, 95]. If metastatic disease is detected with CT scan, curative treatment is excluded and additional staging with EUS is unnecessary.

Appendix 6.11.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen.

Numerator

All patients diagnosed with gastric cancer in a given year undergoing a CT thorax/abdomen within 1 month before and after incidence date.

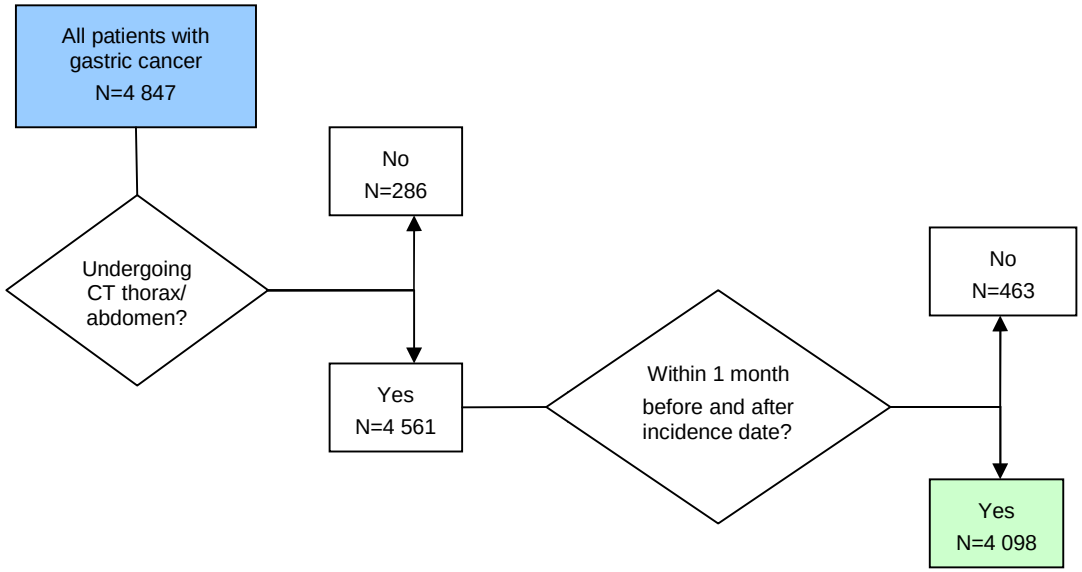
Denominator

All patients diagnosed with gastric cancer in a given year.

Appendix 6.11.3. Elaboration

Due to the algorithm used to define the incidence date, it is possible that the date of the actual diagnosis preceded the reported incidence date. Therefore, some patients will have acts, including CT scan, that are billed before the incidence date. Above this, some patients underwent a diagnostic CT prior but close to the incidence date. To allow these acts to be accounted for, the operational numerator of the present indicator was: “All patients diagnosed with gastric cancer in a given year undergoing a CT thorax/abdomen within 1 month before and after incidence date”.

Flowchart



Supplementary analyses

Subgroup analysis

- Analysis by age, sex, clinical stage and type of treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Supplementary analysis between 1 month before and 3 months after incidence date

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD-10 code C16.1 (BCR)
- CT thorax/abdomen: nomenclature codes (IMA) (0, Table 216)

Limitations

- Until 2010, specific nomenclature codes by anatomical location were not available. The nomenclature code for CT thorax and abdomen also includes neck.

Appendix 6.11.4. Results

National results

Overall, between 2004 and 2008, 84.5% of the patients with gastric cancer received a CT thorax/abdomen within 1 month before and 1 month after incidence date (Table 138). The proportion slightly increased between 2004 (83.3%) and 2008 (86.6%). Patients in the age category 60-69 years most frequently received a CT thorax/abdomen (88.7%). Patients younger than 50 years (78.1%; 50- vs. 50+: OR = 0.63; 95%CI 0.47 to 0.83) or aged 80 years and above (79.6%; 80+ vs. 80-: OR = 0.59, 95%CI 0.50 to 0.69) were least likely to receive a CT thorax/abdomen (Table 139). The proportion was higher in men than in women (Table 140: 87.0% vs. 81.2%; OR = 1.54, 95%CI 1.32 to 1.81). However, after stratification by age group, this difference only remained statistically significant for the age categories 60-69 years (OR = 1.92, 95%CI 1.25 to 2.96) and 80 years and above (OR = 1.31, 95%CI 1.02 to 1.69) (Table 141).

The proportion appeared to increase with cStage (Table 142). Patients with an unknown cStage were less likely to receive a staging CT thorax/abdomen (cStage X vs. cStage 0-IV: OR = 0.46, 95%CI 0.38 to 0.56).

Patients receiving no major treatment (i.e. surgery, chemotherapy and/or radiotherapy) were less likely to receive a staging CT thorax/abdomen (Table 143: OR = 0.25, 95%CI 0.21 to 0.29).

If the time period was extended until 3 months after incidence date, 88.3% of patients with gastric cancer received a CT thorax/abdomen (Table 144).

Table 138 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date)

	Numerator	Denominator	Proportion (%)
2004	823	988	83.3
2005	841	1 009	83.3
2006	867	1 006	86.2
2007	768	921	83.4
2008	799	923	86.6
Total	**4 098**	**4 847**	**84.5**

Table 139 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date), by age

	Numerator	Denominator	Proportion (%)
<50	260	333	78.1
50-59y	400	463	86.4
60-69y	815	919	88.7
70-79y	1 373	1 562	87.9
80+	1 250	1 570	79.6
Total	**4 098**	**4 847**	**84.5**

Table 140 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date), by sex

	Numerator	Denominator	Proportion (%)
Men	2 447	2 814	87.0
Women	1 651	2 033	81.2
Total	**4 098**	**4 847**	**84.5**

Table 141 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date) : sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	137	166	82.5	123	167	73.7	1.69 (0.97-2.97)
50-59y	247	279	88.5	153	184	83.2	1.56 (0.89-2.76)
60-69y	557	612	91.0	258	307	84.0	1.92 (1.25-2.96)
70-79y	871	981	88.8	502	581	86.4	1.25 (0.90-1.72)
80+	635	776	81.8	615	794	77.5	1.31 (1.02-1.69)
Total	**2 447**	**2 814**	**87.0**	**1 651**	**2 033**	**81.2**	

Table 142 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date), by clinical stage

	Numerator	Denominator	Proportion (%)
0	3	4	75.0
I	392	456	86.0
II	242	269	90.0
III	268	288	93.1
IV	709	770	92.1
X	2 484	3 060	81.2
Total	**4 098**	**4 847**	**84.5**

Table 143 – Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen (1 month before and after incidence date) by treatment

	Numerator	Denominator	Proportion (%)
Surgery alone	1 433	1 611	89.0
Tx < Surgery	68	81	84.0
Tx < Surgery < Tx	166	179	92.7
Surgery < Tx	501	538	93.1
Primary CT and/or RT	751	794	94.6
No major treatment	1 179	1 644	71.7
Total	**4 098**	**4 847**	**84.5**

Table 144 – Sensitivity analysis: Proportion of patients diagnosed with gastric cancer undergoing a CT thorax/abdomen within 1 month before and 1 month after incidence date and 1 month before and 3 months after incidence date

	Numerator	Denominator	Proportion (%)
1 month	4 098	4 847	84.5
3 months	4 278	4 847	88.3

Comparison between centres

The variability between the 115 centres included in the analysis was limited (Figure 90). Only 6 centres had a proportion below the 95%LL (Table 145). In 18 centres, less than 80% of patients with gastric cancer received a CT thorax/abdomen. In 11 centres, all patients with gastric cancer received a CT thorax/abdomen.

Of the 198 patients that were unable to be attributed to a centre, only 32% received a CT thorax/abdomen.

Figure 90 – Funnel plot of the proportion of patients diagnosed with gastric cancer undergoing a CT neck/thorax/abdomen within 1 month before and one month after incidence, by centre (2004-2008)

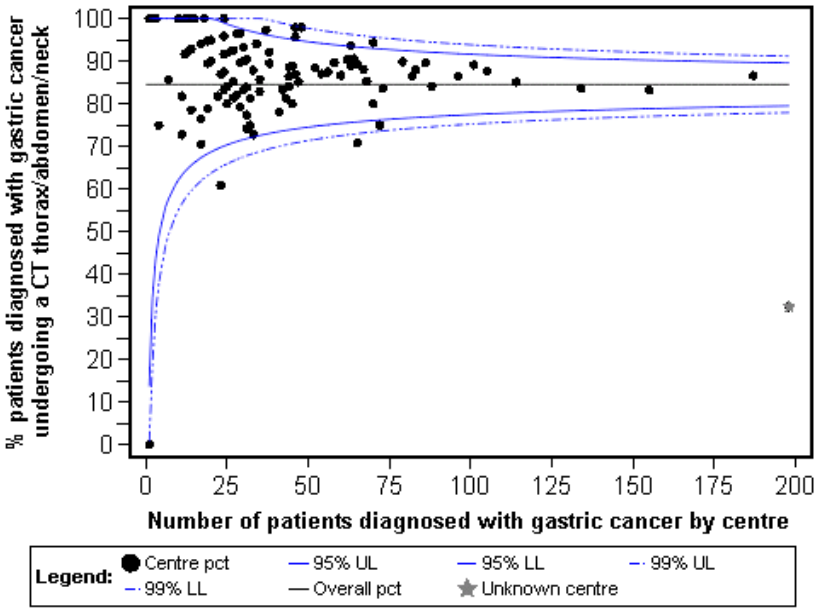


Table 145 – Number and proportion of outlying centres (2004-2008)

Observed %	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	3	2.61	3	2.61
Equal to 99%LL or lower than 95%LL	3	2.61	6	5.22
Between 95% control limits	102	88.70	108	93.91
Equal to 99%UL or upper than 95%UL	7	6.09	115	100.00

Appendix 6.11.5. Discussion

CT thorax/abdomen is one of the key diagnostic interventions during the staging phase of patients with gastric cancer. In principle, all patients with gastric cancer should receive a CT, corresponding to a target value of 100% for this indicator. Eleven centres reached this target, the national average was 84.5%. Patients aged 50 years and below or 80 years and above, and women were less likely to receive a CT scan, although the gender difference only remained statistically significant for the age categories 60-69 years and 80 years and above.

In the literature, few studies are available that allow a comparison with other countries. According to the Dutch Institute for Clinical Auditing (DICA) [28], 84% of patients with gastric cancer received a staging CT thorax and 94% received a staging CT abdomen. In the UK, 89% of patients with oesophagogastric cancer underwent a CT-scan as part of their staging investigations [29]. The proportion was also lower in patients aged 80 years and above and in patients with a ECOG score of 3 and 4.

Key points

- **Between 2004 and 2008, 84.5% of the patients with gastric cancer received a staging CT thorax/abdomen within 1 month before and 1 month after incidence date.**
- **The following subgroups were less likely to receive a staging CT thorax/abdomen:**
  - **Patients aged below 50 years and above 80 years;**
  - **Women aged 60-69 years or above 80 years (compared to men in the same age category);**
  - **Patients with an unknown cStage;**
  - **Patients not receiving major treatment.**

Appendix 6.12. GC4: Neoadjuvant treatment before a gastrectomy for gastric cancer beyond the mucosa

Appendix 6.12.1. Rationale

Neoadjuvant chemotherapy is associated with a survival benefit compared with surgery alone in patients with locally advanced gastric cancer eligible for potentially curative surgery (moderate level of evidence [96]). The benefit seems to be larger in T_{3-4} tumours (low level of evidence [96]). If after multidisciplinary discussion neoadjuvant treatment is considered for a locally-advanced gastric tumour, neoadjuvant chemotherapy is recommended (strong recommendation, moderate level of evidence).

Appendix 6.12.2. Definition

Type of indicator

Process indicator.

Description

Proportion of patients with gastric cancer beyond the mucosa ($T_{2-4}\,N_{Any}\,M_0$) who received neoadjuvant treatment before their surgical intervention.

Numerator

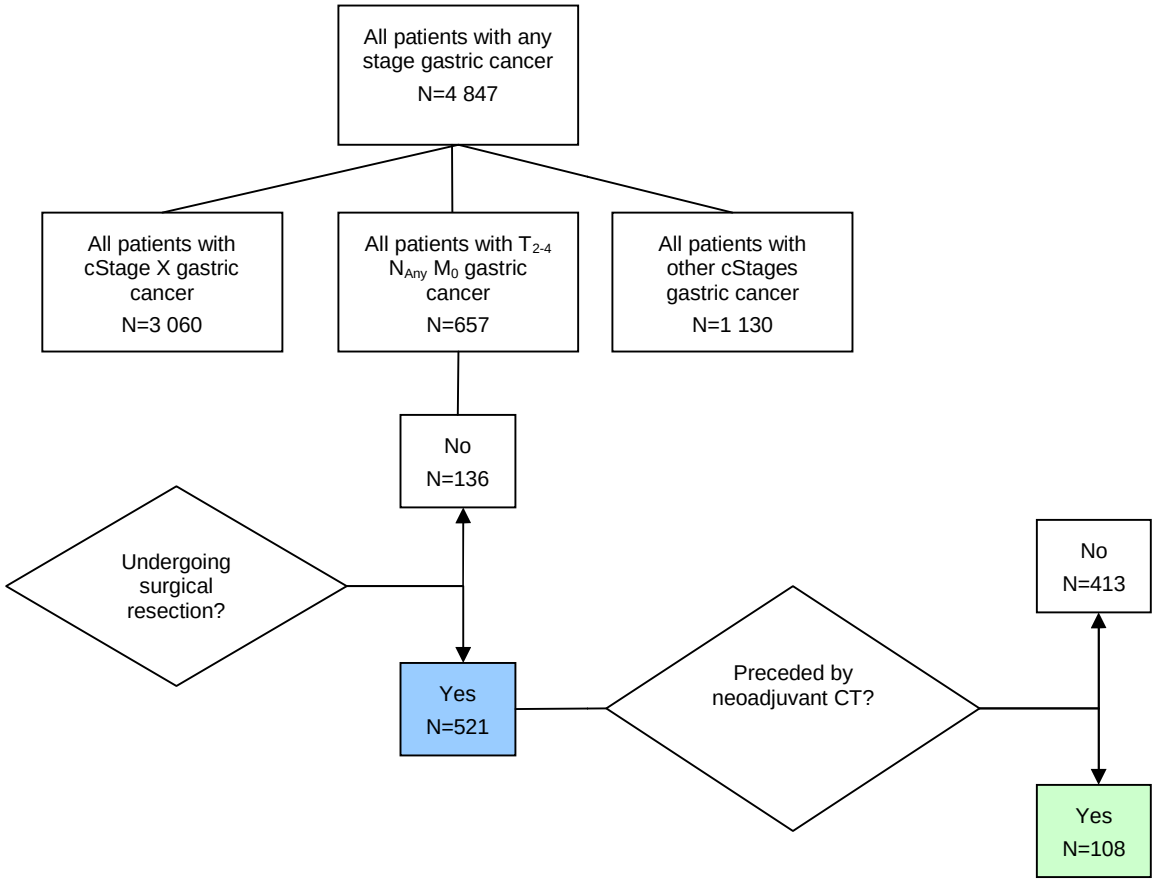
Proportion of patients with gastric cancer beyond the mucosa ($T_{2-4}\,N_{Any}\,M_0$) who received neoadjuvant chemotherapy before their surgical intervention.

Denominator

Proportion of patients with gastric cancer beyond the mucosa ($T_{2-4}\,N_{Any}\,M_0$) who underwent a surgical intervention.

Appendix 6.12.4. Elaboration

Flowchart



Supplementary analyses

Subgroup analyses

- Subgroup analyses by clinical stage, histological type, age group, sex and neoadjuvant treatment

Risk adjustment

- No risk adjustment needed

Sensitivity analysis

- Same analysis without T_4

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD10 code C16.1-C16.9 (BCR)
- Cancer stages: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3, Table 233)
  - Chemotherapy: Pharmanet codes (IMA) (Appendix 8.3.2, Table 235)

Appendix 6.12.5. Results

National results

Overall, between 2004 and 2008, of all patients with gastric cancer beyond the mucosa (known stage T_{2-4} N_{any} M_0) who underwent surgical resection, 20.7% received neoadjuvant treatment (Table 146). This proportion increased over time, from 8.4% in 2004 to 37.8% in 2008 (Table 146). When patients with T_4 tumours were excluded, the proportion only slightly decreased (from 20.7% to 19.6%) (Table 147).

The proportion of patients who received neoadjuvant treatment was clearly higher among patients with more advanced stages (stage III-IV vs. I-II: 34.9% vs. 11.6%; OR = 4.08, 95%CI 2.55 to 6.56) (Table 148).

As the majority of patients had adenocarcinoma, no subgroup analysis could be done by histological type (Table 149).

Clear differences were also found in the proportion of patients with T_{2-4} N_{any} M_0 gastric cancer treated with neoadjuvant treatment according to age. The proportion decreased from 31.7% before 70 years to 12.4% after 70 years (OR = 3.26, 95%CI 2.04 to 5.22). Only two of the 98 patients older than 80 years received neoadjuvant treatment (Table 150).

No significant differences were observed in the proportion of patients receiving neoadjuvant treatment according to sex (OR 0.99 [95%CI 0.63 – 1.57]) (Table 151 and Table 152).

Table 146 – Proportion of patients with a gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention, by incidence year

	Numerator	Denominator	Proportion (%)
2004	7	83	8.4
2005	14	98	14.3
2006	13	107	12.1
2007	29	114	25.4
2008	45	119	37.8
Total	**108**	**521**	**20.7**

Table 147 – Sensitivity analysis - Proportion of patients with a gastric cancer beyond the mucosa who received neoadjuvant treatment before their surgical intervention (T_{2-4} N_{any} M_{0-1a} / without T_4)

	Numerator	Denominator	Proportion (%)
with T4	108	521	20.7
without T4	93	474	19.6

Table 148 – Subgroup analysis: Proportion of patients with a gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention, by TNM clinical stage

	Numerator	Denominator	Proportion (%)
I	7	134	5.2
II	30	184	16.3
III	59	175	33.7
IV	12	28	42.9
Total	**108**	**521**	**20.7**

Table 149 – Subgroup analysis: Proportion of patients with a gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention, by histological type

	Numerator	Denominator	Proportion (%)
Carcinoma	108	521	20.7
Squamous cell carcinoma	0	0	0.0
Adenocarcinoma	107	507	21.1
Other specified carcinoma	0	13	0.0
Unspecified carcinoma	1	1	100.0
Unspecified malignant neoplasm	0	0	0.0
Total	**108**	**521**	**20.7**

Table 150 – Subgroup analysis: Proportion of patients with a gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention, by age

	Numerator	Denominator	Proportion (%)
<50	21	42	50.0
50-59y	15	62	24.2
60-69y	35	120	29.2
70-79y	35	199	17.6
80+	2	98	2.0
Total	**108**	**521**	**20.7**

Table 151 – Subgroup analysis: Proportion of patients with a gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention, by sex

	Numerator	Denominator	Proportion (%)
Men	67	324	20.7
Women	41	197	20.8
Total	**108**	**521**	**20.7**

Table 152 – Subgroup analysis: Proportion of patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant treatment before their surgical intervention: sex differences, stratified by age group

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR
<50	11	23	47.8	10	19	52.6	0.82 (0.20-3.31)
50-59y	7	34	20.6	8	28	28.6	0.65 (0.17-2.41)
60-69y	20	84	23.8	15	36	41.7	0.44 (0.18-1.09)
70-79y	28	130	21.5	7	69	10.1	2.43 (0.94-6.53)
80+	1	53	1.9	1	45	2.2	0.85 (0.02-32.05)
Total	**67**	**324**	**20.7**	**41**	**197**	**20.8**	

Comparison between centres

Figure 91Figure 91 shows the variability between centres for the use of neoadjuvant treatment, based on the 2004-2008 data. The highest volume centre surgically treated a total of 33 patients with a known cStage (T_{2-4} N_{any} M_0) between 2004 and 2008. As the majority of the very small volume centers contributed very few data, 89.3% of them fell within the expected limits of the funnel plot. Only 6 centres (6.45%) were above the 99% upper limit (Table 153).

Restricting the analyses to the two last available years (2007 and 2008) did not change the global picture (Figure 92). Globally, 73 centres were identified that surgically treated patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0); 90.4% of these centres fell within the 95% limits of the funnel plot and 6.85% of the centres were situated above the 95% upper limit (Table 154).

Figure 91 – Funnel plot of the proportion of patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant chemotherapy before their gastrectomy, by centre (2004-2008)

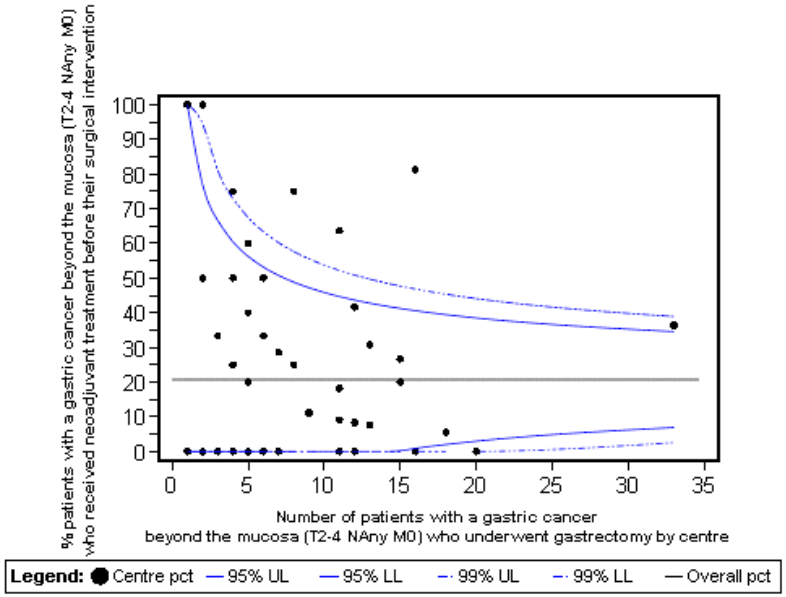


Table 153 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	2	2.15	2	2.15
Between 95% control limits	83	89.25	85	91.40
Equal to 99%UL or upper than 95%UL	2	2.15	87	93.55
Upper than 99%UL	6	6.45	93	100.00

Figure 92 – Funnel plot of the proportion of patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who received neoadjuvant chemotherapy before their gastrectomy, by centre (2007-2008)

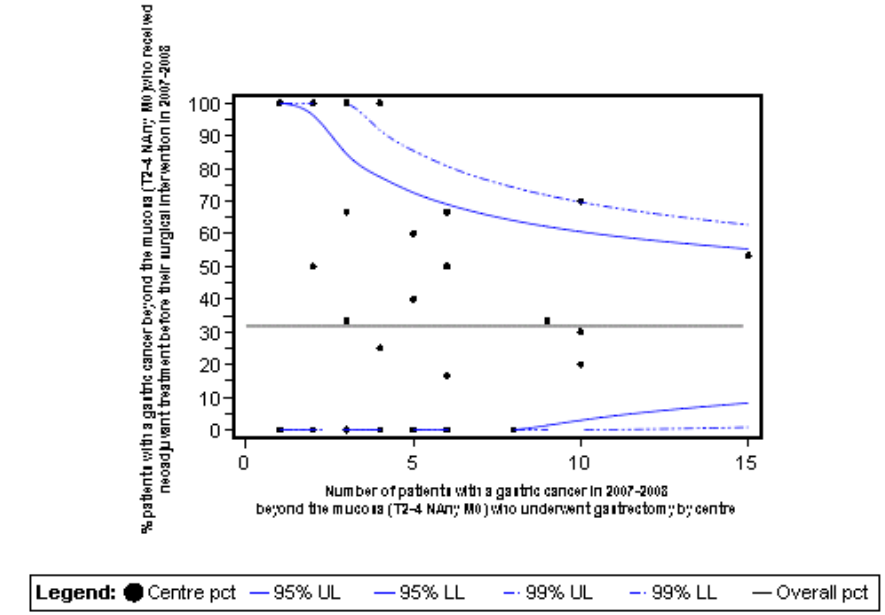


Table 154 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Between 95% control limits	66	90.41	66	90.41
Equal to 99%UL or upper than 95%UL	5	6.85	71	97.26
Upper than 99%UL	2	2.74	73	100.00

Appendix 6.12.6. Discussion

The updated Belgian guidelines recommended the use of neoadjuvant chemotherapy for patients with locally-advanced gastric cancer if the multidisciplinary team considered this approach beneficial for the patient [8]. Neoadjuvant chemotherapy is increasingly used in Belgium, since nearly 40% of patients with T_{2-4} N_{any} M_0 gastric cancer received chemotherapy before their surgery in 2008. This therapy is proportionally more used in patients with advanced stages (T_{3-4} tumours), who are expected to obtain a larger benefit in terms of survival [96]. As observed for oesophageal cancer, very few patients older than 70 years received neoadjuvant treatment compared to their younger counterparts. In 2008, the proportion of patients with gastric cancer who received neoadjuvant treatment remained lower than for oesophageal cancer (40% vs. 50%). Various possible hypotheses can be suggested. The more plausible reason is that patients with gastric cancer are older, on average, than patients with oesophageal / junctional cancer (mean age at diagnosis: 71 vs. 65 years in men and 73 vs. 70 years in women), and the difference could reflect increased levels of frailty within this patient group. The main evidence for the effectiveness of combined therapy for gastric cancer was also published later potentially reflecting the speed of uptake.

In the Netherlands, where perioperative chemotherapy is recommended for patients with resectable gastric cancer (higher than stage I), eligible for surgery owing their condition and their comorbidities [97], 54% of patients for whom a potentially curative resection was planned underwent preoperative treatment in 2011 (virtually always with chemotherapy, using the MAGIC schema). In this patient group the percentage of radical resections was fairly high (80%) [28].

In the UK, the National Oesophago-Gastric Cancer Audit [29] that prospectively collected data from patients diagnosed with gastric cancer between 1 October 2007 and 30 June 2009 from 30 Cancer Networks in England reported that 90% of patients with gastric cancer planned to have curative surgery had neoadjuvant chemotherapy. Patients who had a combination of surgery and chemotherapy were on average younger and fitter than those having surgery only, which was expected given that patient selection is based on their ability to cope with the physiological impact of both the chemotherapy and the surgery. However, around 1 in 5 patients did not complete their neoadjuvant treatment. The main reasons for incomplete treatment were acute chemotherapy toxicity and progressive disease [29].

One major limitation in our analysis is the lack of TNM staging reporting. For gastric cancer patients, cStage remained unreported for 3 060 patients (63.1%) that restricted our baseline sample to 657 patients with T_{2-4} N_{any} M_0 and only 521 who underwent a gastrectomy. Such underreporting was already shown for breast cancer (between 2004-2006, cStage was not documented in 48% of the breast cancer patients) [4]. With such a small sample, it is difficult to refine our analysis and to show, for example, any association between volume of centres and this process indicator. Using 5-year data, the majority of the very small-volume centers (89.2%) contribute very few data (due to the low number of patients who were reported with T_{2-4} N_{any} M_0 gastric cancer) and hence are *de facto* within the expected limits of the funnel plot. Only 6 centres (6.45%) were beyond the 99% upper limit. It is not possible to identify a predominant therapeutic strategy adopted for this group of patients.

Key points

- **Overall, between 2004 and 2008, of all patients with gastric cancer beyond the mucosa (T_{2-4} N_{any} M_0) who underwent surgical resection, 20.7% received neoadjuvant treatment (nearly 40% in 2008).**
- **In general, a high proportion of patients did not receive neoadjuvant treatment before a curative resection, whatever the underlying reasons (not documented).**
- **Between 2004 and 2008, neoadjuvant treatment was more common in patients with cStage III or IV gastric cancer.**
- **Patients with gastric cancer aged 70 years and above were less likely to receive neoadjuvant treatment.**
- **A large variability between centres was observed in the use of neoadjuvant treatment. However, this variability was largely within the expected limits of chance.**

Appendix 6.13. GC6: Gastric resection mortality rate

Appendix 6.13.1. Rationale

Although randomized trials are lacking to support this, surgical resection should be considered standard treatment for patients with resectable gastric cancer (strong recommendation, low level of evidence) [8]. However, gastric surgery is associated with an important postoperative mortality rate. In a recent Cochrane review, McCulloch et al. reported a postoperative mortality of 9.7-13.5% after extended lymph node dissection and of 3.9-6.8% after limited lymph node dissection based on randomized comparisons [98]. In contrast, non-randomized studies found a postoperative mortality of 4.1-5% after extended lymph node dissection and of 5.4-7.9% after limited lymph node dissection. The high postoperative mortality in the randomized studies was explained by the inferior quality of the surgery and patient selection.

As for oesophageal cancer, several studies have shown a relationship between patient outcomes (e.g. 30-day mortality) and surgeon or hospital volume for gastric cancer surgery [54, 66, 67]. However, this relationship is less profound than for oesophageal cancer surgery [66].

Appendix 6.13.2. Definition

Type of indicator

Outcome indicator

Description

Gastric resection mortality rate within 30 days.

Numerator

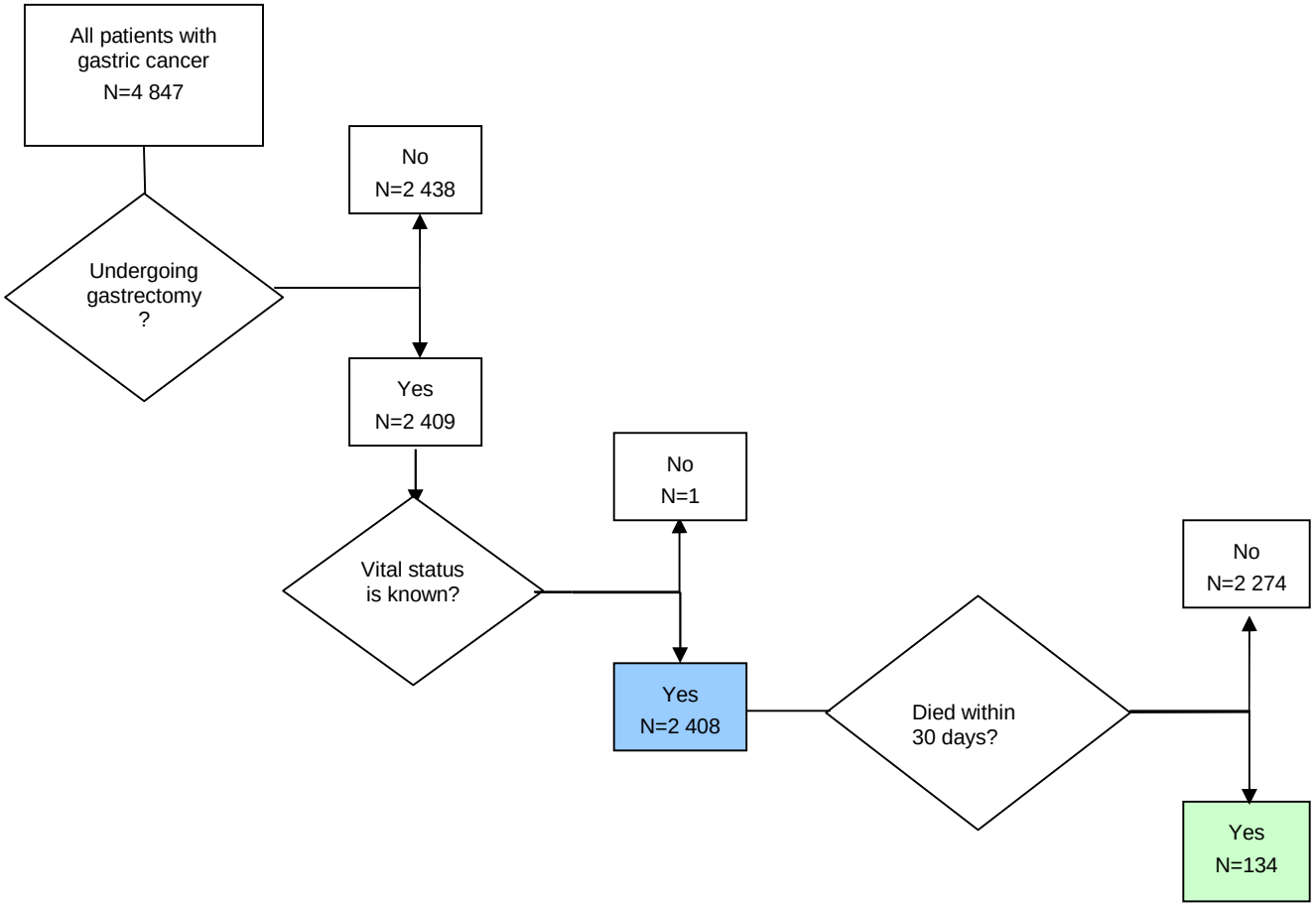
All patients with gastric cancer beyond the mucosa treated with gastrectomy in a given year dying within 30 days after surgery.

Denominator

All patients with gastric cancer beyond the mucosa treated with gastrectomy in a given year.

Appendix 6.13.3. Elaboration

Flowchart



Note: For 3 patients who are lost to follow-up, it is known that they were still alive after 30 (or 60 or 90 days) after surgery and they are as such taken into account in the calculations. Because the follow-up period is less than 30 days after surgery for the fourth patient, this patient is not taken into account for the calculations (not in the numerator, nor in the denominator).

Supplementary analyses

Subgroup analyses

- By age, sex, neoadjuvant treatment

Risk adjustment

- To be adjusted for sex, age, stage, histological type, comorbidity (WHO), hospital volume

Sensitivity analysis

- Analysis at 60 days and 90 days
- Logistic regression model with the following factors as covariates: age, sex, stage, comorbidity (WHO), year of intervention and hospital volume of gastrectomies

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD-10 code C16.1 (BCR)
- Stage: combined stage (BCR)
- Gastrectomy: nomenclature codes (IMA) (Appendix 8.3, Table 233). Because a data check revealed that nomenclature codes for oesophagectomy are used for gastrectomy, both nomenclature codes for oesophagectomy and codes for gastrectomy were taken into account for the calculations.
- Mortality data: Crossroads bank of Social Security

Limitations

- Comorbidity data other than WHO performance status are not available at the BCR or in the IMA data accessible by the BCR.

Appendix 6.13.4. Results

National results

Overall, between 2004 and 2008, 5.6% of the 2 408 patients with gastric cancer that underwent gastric resection and for whom the vital status was known died within 30 days after surgery (Table 155). The proportion varied between 2004 and 2008, and was the lowest in 2006 (4.1%) and exceptionally high in 2005 (8.3%). No clear difference was found according to sex (Table 156 and Table 158). However, the 30-day mortality clearly increased with age (Table 157: 80+ vs. 80-, OR = 2.89, 95%CI 1.99 to 4.18).

Patients treated with neoadjuvant therapy in general tended to have a lower 30-day mortality, although the difference did not reach statistical significance (Table 159: OR = 0.66, 95%CI 0.32 to 1.31). Similar trends were found for patients treated with neoadjuvant chemotherapy (Table 160: OR = 0.59, 95%CI 0.29 to 1.16).

When the period was extended to 60 and 90 days, the postoperative mortality rose to 8.7% and 12.0%, respectively (Table 161).

Univariate analysis showed that age, stage and incidence year were significantly predictive for the 30-day mortality (Table 162) and 90-day mortality (Table 163). Hospital volume was not found to be a prognostic factor. In a multivariate analysis with adjustment for sex, age, histological type, combined stage and hospital volume, both age and stage remained significantly predictive for both outcomes.

Table 155 – Gastric resection mortality rate within 30 days, by incidence year

	Numerator	Denominator	Proportion (%)
2004	27	488	5.5
2005	44	528	8.3
2006	21	516	4.1
2007	19	454	4.2
2008	23	422	5.5
Total	**134**	**2 408**	**5.6**

Table 156 – Gastric resection mortality rate within 30 days, by sex

	Numerator	Denominator	Proportion (%)
Men	81	1 444	5.6
Women	53	964	5.5
Total	**134**	**2 408**	**5.6**

Table 157 – Gastric resection mortality rate within 30 days, by age group

	Numerator	Denominator	Proportion (%)
<50	4	194	2.1
50-59y	8	279	2.9
60-69y	11	523	2.1
70-79y	52	866	6.0
80+	59	546	10.8
Total	**134**	**2 408**	**5.6**

Table 158 – Gastric resection mortality rate within 30 days: sex differences, stratified by age

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	2	103	1.9	2	91	2.2	0.88 (0.09-8.97)
50-59y	6	170	3.5	2	109	1.8	1.96 (0.35-14.30)
60-69y	7	350	2.0	4	173	2.3	0.86 (0.22-3.55)
70-79y	34	549	6.2	18	317	5.7	1.10 (0.59-2.06)
80+	32	272	11.8	27	274	9.9	1.22 (0.69-2.17)
Total	**81**	**1 444**	**5.6**	**53**	**964**	**5.5**	

Table 159 – Gastric resection mortality rate within 30 days, by neoadjuvant therapy or not

	Numerator	Denominator	Proportion (%)
Neoadjuvant therapy	10	259	3.9
No neoadjuvant therapy	124	2 149	5.8
Total	**134**	**2 408**	**5.6**

Table 160 – Gastric resection mortality rate within 30 days, by neoadjuvant chemotherapy or not

	Numerator	Denominator	Proportion (%)
Neoadjuvant chemotherapy	10	290	3.4
No neoadjuvant chemotherapy	124	2 158	5.7
Total	**134**	**2 408**	**5.6**

Table 161 – Sensitivity analysis: Gastric resection mortality rate within 60 and 90 days

	Numerator	Denominator	Proportion (%)
30 days	134	2 408	5.6
60 days	210	2 408	8.7
90 days	288	2 408	12.0

Table 162 – Univariate and multivariate analysis using logistic regression model to predict the risk of 30-day mortality after a gastrectomy (N=2 408)

				Unadjusted odds ratio			Adjusted odds ratio*		
	N of patients with a gastrectomy	N of events (30-days mortality)	% of events (30-days mortality)	OR	95%CI	p-value	OR	95%CI	p-value
Sex						0.907			0.479
Men (Reference)	1 444	81	5.6	1			1		
Women	964	53	5.5	0.979	[0.686-1.389]		0.876	[0.607-1.264]	
Age						<0.001			<0.001
<50y	194	4	2.1	0.174	[0.062-0.485]		0.159	[0.056-0.449]	
50-59y	279	8	2.9	0.244	[0.115-0.518]		0.226	[0.106-0.483]	
60-69y	523	11	2.1	0.177	[0.092-0.342]		0.168	[0.086-0.326]	
70-79y	866	52	6.0	0.527	[0.357-0.778]		0.514	[0.346-0.765]	
>=80y (Reference)	546	59	10.8	1			1		
Histological type						0.949			0.577
Adenocarcinoma (Reference)	2 285	127	5.6	1			1		
Other	123	7	5.7	1.026	[0.469-2.245]		1.261	[0.559-2.846]	
combStage						0.002			<0.001
I	751	27	3.6	0.480	[0.281-0.819]		0.421	[0.244-0.725]	
II	443	17	3.8	0.513	[0.279-0.946]		0.433	[0.233-0.804]	
III	504	34	6.7	0.931	[0.559-1.549]		0.808	[0.481-1.358]	
IV (Reference)	416	30	7.2	1			1		
X	294	26	8.8	1.248	[0.722-2.159]		1.134	[0.646-1.990]	
Incidence year						0.024			
2004 (Reference)	488	27	5.5	1					

	N of patients with a gastrectomy	N of events (30-days mortality)	% of events (30-days mortality)	Unadjusted odds ratio OR	95%CI	p-value	Adjusted odds ratio* OR	95%CI	p-value
2005	528	44	8.3	1.552	[0.945-2.549]				
2006	516	21	4.1	0.724	[0.404-1.299]				
2007	454	19	4.2	0.746	[0.409-1.361]				
2008	422	23	5.5	0.984	[0.555-1.744]				
Hospital volume						0.162			0.291
Low (<=5 per year) (Reference)	945	59	6.2	1			1		
Medium (6-19 per year)	1 349	73	5.4	0.859	[0.603-1.224]		0.902	[0.629-1.294]	
High (20+ per year)	114	2	1.8	0.268	[0.065-1.113]		0.326	[0.077-1.368]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Table 163 – Univariate and multivariate analysis using logistic regression model to predict the risk of 90-day mortality after a gastrectomy (N=2 408)

				Unadjusted odds ratio			Adjusted odds ratio*		
	N of patients with a gastrectomy	N of events (30-days mortality)	% of events (30-days mortality)	OR	95%CI	p-value	OR	95%CI	p-value
Sex						0.350			0.087
Men (Reference)	1 444	180	12.5	1			1		
Women	964	108	11.2	0.886	[0.687-1.142]		0.793	[0.608-1.034]	
Age						<0.001			<0.001
<50y	194	8	4.1	0.148	[0.071-0.309]		0.128	[0.061-0.271]	
50-59y	279	16	5.7	0.209	[0.122-0.360]		0.183	[0.106-0.318]	
60-69y	523	38	7.3	0.269	[0.183-0.397]		0.239	[0.160-0.355]	
70-79y	866	103	11.9	0.464	[0.348-0.619]		0.433	[0.322-0.582]	
>=80y (Reference)	546	123	22.5	1			1		
Histological type						0.839			0.608
Adenocarcinoma (Reference)	2 285	274	12.0	1			1		
Other	123	14	11.4	0.943	[0.533-1.668]		1.170	[0.642-2.134]	
combStage						<0.001			<0.001
I	751	56	7.5	0.372	[0.257-0.539]		0.317	[0.216-0.464]	
II	443	40	9.0	0.459	[0.304-0.692]		0.38	[0.249-0.580]	
III	504	68	13.5	0.721	[0.504-1.031]		0.616	[0.425-0.893]	
IV (Reference)	416	74	17.8	1			1		
X	294	50	17.0	0.947	[0.638-1.405]		0.855	[0.566-1.291]	
Incidence year						0.005			
2004 (Reference)	488	68	13.9	1					

	N of patients with a gastrectomy	N of events (30-days mortality)	% of events (30-days mortality)	Unadjusted odds ratio OR	95%CI	p-value	Adjusted odds ratio* OR	95%CI	p-value
2005	528	80	15.2	1.103	[0.778-1.565]				
2006	516	51	9.9	0.677	[0.460-0.997]				
2007	454	37	8.1	0.548	[0.359-0.836]				
2008	422	5	1.2	0.868	[0.589-1.278]				
Hospital volume						0.138			0.403
Low (<=5 per year) (Reference)	945	124	13.1	1			1		
Medium (6-19 per year)	1 349	156	11.6	0.866	[0.673-1.114]		0.908	[0.699-1.178]	
High (20+ per year)	114	8	7.0	0.500	[0.238-1.051]		0.614	[0.286-1.317]	

* Multivariate analyses with adjustment for sex, age, histological type, combined stage and hospital volume.

Comparison between centres

The unadjusted funnel plot shows little variability between the 111 centres that were included in the analysis (Figure 93). However, after adjustment for age and combined stage, the variability becomes more pronounced (Figure 94). Adjusted for age and combined stage, 26 centres had a 30-day mortality above 10%, and 6 centres even had a 30-day mortality above 20%. Eight centres had an adjusted 30-day mortality above the 95%UL (Table 165). In contrast, 42 centres had an adjusted 30-day mortality below 1%.

Multivariate analysis showed that centres performing at least 20 gastrectomies per year had a lower 30-day mortality than those performing less than 6 gastrectomies per year, although the effect was not statistically significant (adjusted OR 0.326, 95%CI 0.077 to 1.368) (Table 162).

Figure 93 – Funnel plot of the 30-day mortality rate after a gastrectomy, by centre

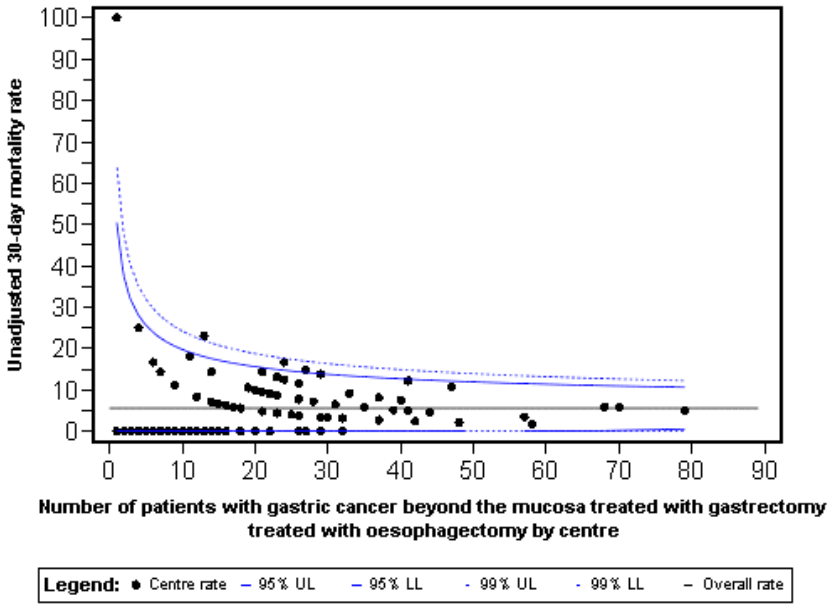
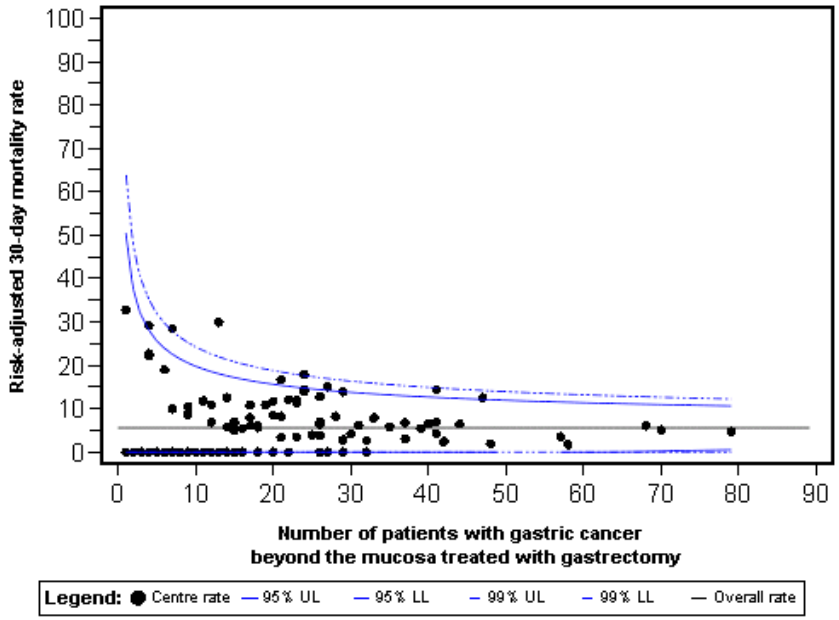


Figure 94 – Funnel plot of the 30-day mortality rate after a gastrectomy, by centre, adjusted for age and combined stage



Note: Due to a low sample size for most centres and low percentages of deaths, one should be careful with the interpretation of adjusted rates; small changes might have a significant impact on the adjusted rate (observed rate / expected rate).

Table 164 – Number and proportion of outlying centres – observed rate

Observed rate	Frequency	Percent	Cumulative frequency	Cumulative percent
Between 95% control limits	107	96.40	107	96.40
Equal to 99%UL or upper than 95%UL	2	1.80	109	98.20
Upper than 99%UL	2	1.80	111	100.00

Table 165 – Number and proportion of outlying centres – adjusted rate

Adjusted rate	Frequency	Percent	Cumulative frequency	Cumulative percent
Between 95% control limits	103	92.79	103	92.79
Equal to 99%UL or upper than 95%UL	5	4.50	108	97.30
Upper than 99%UL	3	2.70	111	100.00

Appendix 6.13.5. Discussion

Overall, a 30-day mortality of 5.6% and a 90-day mortality of 12% were found for the 2 408 patients with gastric cancer (diagnosed between 2004 and 2008) that underwent gastric resection. Age and (combined) stage were found to be independent risk factors for both 30-day and 90-day mortality. However, due to a low sample size for most centres and a low number of events, the adjusted rates should be interpreted with caution. Indeed, small changes in the number of events might have a significant impact on the ratio observed / expected rate.

According to the Dutch Institute for Clinical Auditing (DICA) [28], 30-day mortality was 6.7% in 297 patients surgically treated for gastric cancer. DICA started in 2011 aiming at the registration of patients with oesophagogastric cancer with the intention to be surgically treated. In the UK, the National Oesophago-Gastric Cancer Audit reported a 30-day mortality of 4.5% and a 90-day mortality of 6.9% in 1 412 patients undergoing gastrectomy (diagnosed between October 2007 and June 2009) [29].

About the relation between hospital volume and 30-day mortality, the literature is less consistent than for oesophageal cancer. In a population-based cohort of 3 866 patients who underwent surgery for oesophageal or gastric cancer between 1998 and 2008, hospital volume was independently and significantly correlated with 30-day mortality. However, the analysis was not done separately for gastrectomy [62]. In another population-based study of 1 864 patients undergoing gastrectomy for primary gastric cancer between 1999 and 2001, high-volume centres (> 15 gastrectomies/year) had an in-hospital mortality rate of 1.0% [99]. Treatment in a high-volume hospital decreased the odds of mortality (OR = 0.22, 95%CI 0.05 to 0.89). Gruen et al. performed a systematic review and meta-analysis of 14 studies involving 179 540 patients and found a significant effect on perioperative mortality of doubling the hospital case volume (unadjusted OR = 0.88; 95%CI 0.86 to 0.91) [100]. This relation was confirmed by the 2 included studies that reported adjusted mortality risks.

In Belgium, in the large majority of the centres (93%), less than 10 patients underwent a gastrectomy per year between 2004 and 2008. Consequently, in the current study, higher hospital volume was not statistically associated with lower 30-day mortality after gastrectomy. In other studies that did find an association between gastrectomy in high volumes and good outcomes, the lower limit of high-volume surgery varied from 20 per year up to 264 per year [91, 92]. For example, in the US Hannan et al. reported that the highest-volume hospitals (and surgeons) had an absolute risk-adjusted mortality rate that was 7.1% lower ($p < 0.0001$) than the lowest-volume hospitals, although the overall mortality rate for the procedure was only 6.2%.

In the literature, various definitions are used to evaluate postoperative mortality. Most commonly, 30-day and in-hospital mortality are used. However, in particular the in-hospital mortality is dependent on discharge practice. To avoid this, extending the follow-up to 90 days may be an option, at the risk of including patients who die from rapidly progressive disease. However, for elective surgery with curative intent, staging examinations should exclude patients with advanced disease and 90-day mortality may serve as an outcome indicator for both surgical care and preoperative selection [74].

Key points

- **For patients with gastric cancer diagnosed between 2004 and 2008 and treated with gastric resection, a 30-day mortality of 5.6% and a 90-day mortality of 12% were found.**
- **Age and stage were found to be independent risk factors for both 30-day and 90-day mortality.**

Appendix 6.14. GC9: Proportion of patients with metastatic gastric cancer that received combination chemotherapy

Appendix 6.14.1. Rationale

According to the updated guidelines, combination chemotherapy is recommended in patients with locally advanced or metastatic cancer of the stomach with good performance status (strong recommendation, high level of evidence) [8]. A recently updated Cochrane review found an improved survival after combination chemotherapy compared with single agent chemotherapy (median survival 8.3 versus 6.7 months) [101].

Appendix 6.14.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients with metastatic gastric cancer that received combination chemotherapy.

Numerator

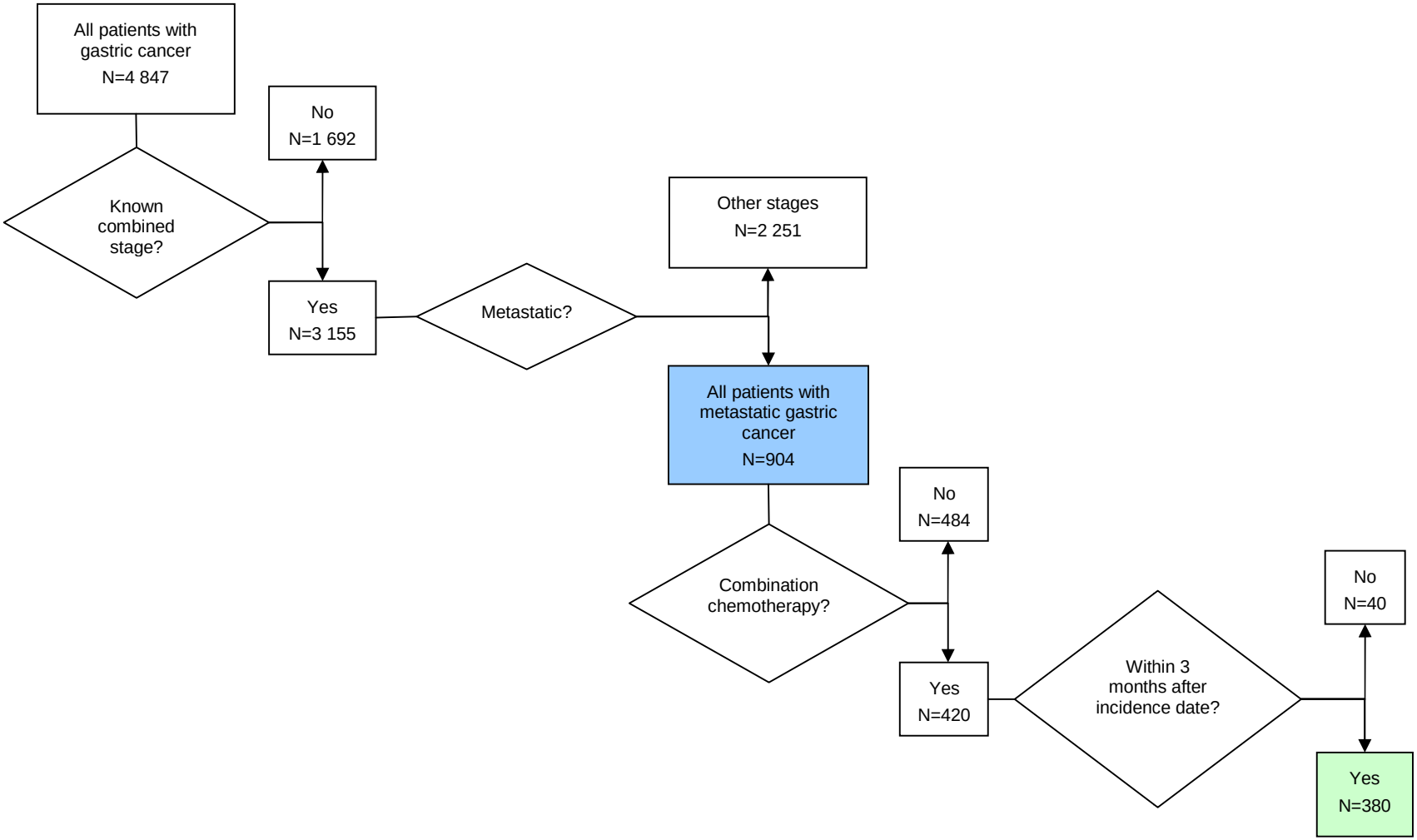
All patients diagnosed with metastatic gastric cancer in a given year that received a combination of at least 2 different chemotherapeutic agents within 1 month before and 3 months after incidence date.

Denominator

All patients diagnosed with metastatic gastric cancer in a given year.

Appendix 6.14.3. Elaboration

Flowchart



Supplementary analyses

Subgroup analyses

- Analysis for age and sex

Risk adjustment

- Not necessary

Sensitivity analysis

- Analysis within 6 months after incidence date

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD-10 code C16.1 (BCR)
- Stage: combined stage (BCR)
- Chemotherapy: Pharmanet data, ATC codes (Appendix 8.3.2, Table 235)

Appendix 6.14.4. Results

National results

Overall, of all patients diagnosed with metastatic gastric cancer between 2004 and 2008, 42% received combination chemotherapy within 1 month before and 3 months after incidence date (Table 166). The proportion slightly increased between 2004 (40.4%) and 2008 (47.9%).

A clear decrease with age was found (Table 167). Patients aged 70 years and above were significantly less likely to receive combination chemotherapy (OR = 0.17, 95%CI 0.13 to 0.23). In addition, women were less likely to receive combination chemotherapy than men (Table 168: OR = 0.75, 95%CI 0.57-1.00). However, after stratification by age category this gender difference only remained significant for the age category 70-79 years (Table 169).

When the time period was extended until 6 months after incidence date, the proportion slightly increased to 45.1% (Table 170).

Table 166 – Proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 months after incidence)

	Numerator	Denominator	Proportion (%)
2004	78	193	40.4
2005	67	179	37.4
2006	77	194	39.7
2007	77	169	45.6
2008	81	169	47.9
Total	**380**	**904**	**42.0**

Table 167 – Proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 months after incidence), by age

	Numerator	Denominator	Proportion (%)
<50	50	75	66.7
50-59y	78	109	71.6
60-69y	128	209	61.2
70-79y	108	305	35.4
80+	16	206	7.8
Total	**380**	**904**	**42.0**

Table 168 – Proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 months after incidence), by sex

	Numerator	Denominator	Proportion (%)
Men	249	557	44.7
Women	131	347	37.8
Total	**380**	**904**	**42.0**

Table 169 – Proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 mon ths after incidence): sex differences, stratification by age

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	26	34	76.5	24	41	58.5	2.30 (0.76-7.15)
50-59y	47	64	73.4	31	45	68.9	1.25 (0.50-3.14)
60-69y	85	138	61.6	43	71	60.6	1.04 (0.56-1.96)
70-79y	79	199	39.7	29	106	27.4	1.75 (1.02-3.02)
80+	12	122	9.8	4	84	4.8	2.18 (0.62-8.36)
Total	**249**	**557**	**44.7**	**131**	**347**	**37.8**	

Table 170 – Sensitivity analysis: Proportion of patients with metastatic gastric cancer that received combination chemotherapy within 1 month before and 3 months and 6 months after incidence

	Numerator	Denominator	Proportion (%)
3 months	380	904	42.0
6 months	408	904	45.1

Comparison between centres

The variability between the 105 centres included in the analysis is limited (Figure 95). Only 3 centres had a proportion below the 95%LL (Table 171). In 14 centres, no patient received combination chemotherapy. On the contrary, in 9 centres all patients received combination chemotherapy.

Figure 95 – Funnel plot of the proportion of patients with metastatic gastric cancer that received combination chemotherapy (within 1 month before and 3 months after incidence date), by centre

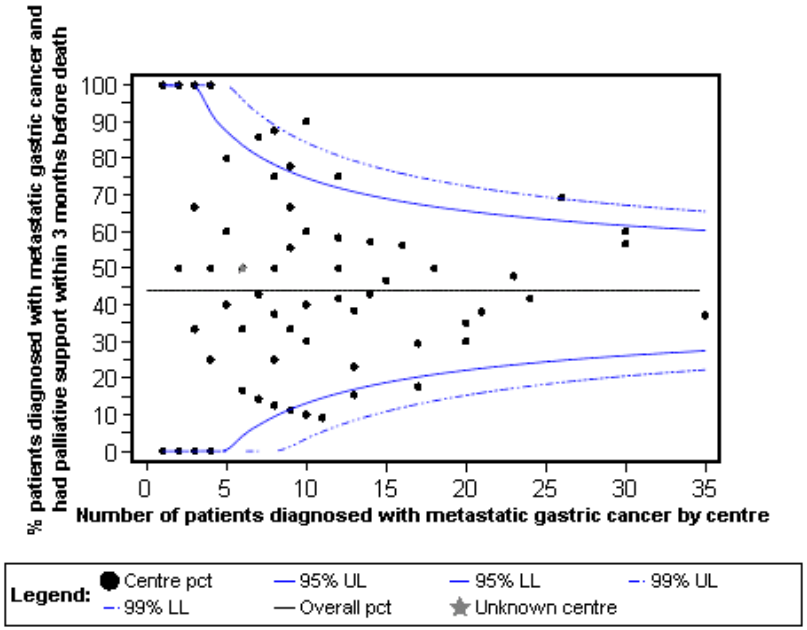


Table 171 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	3	2.86	3	2.86
Between 95% control limits	97	92.38	100	95.24
Equal to 99%UL or upper than 95%UL	4	3.81	104	99.05
Upper than 99%UL	1	0.95	105	100.00

Appendix 6.14.5. Discussion

Of all patients with metastatic gastric cancer diagnosed between 2004 and 2008, 42% received combination chemotherapy within 1 month before and 3 months after incidence date. Patients aged 70 years and above, and especially women within this age category, were less likely to receive combination chemotherapy. However, data on comorbidity were not available to explore these results further. No important variability was found between centres, but this can at least partially be explained by the low sample sizes per centre and the resulting large 95% and 99% limits.

In the National Oesophago-Gastric Cancer Audit, 25.2% of the 4 082 patients with gastric cancer diagnosed between October 2007 and June 2009 and treated with palliative intent underwent palliative chemotherapy [30]. Palliative chemotherapy was more commonly used amongst younger patients and those with good performance status. A lower proportion of women than men received palliative chemotherapy (17.4% vs. 27.1%, p<0.001).

In a US pattern of care study, 1 000 patients with gastric cancer (C16.1 – C16.9) were included [31]. Of the patients with stage IV disease or unknown stage, 22.1% received chemotherapy only.

Key points

- **Between 2004 and 2008, 42% of patients with metastatic gastric cancer received combination chemotherapy.**
- **Patients aged 70 years and above, and especially women within this age category, were less likely to receive combination chemotherapy.**
- **No important variability was found between centres.**

Appendix 6.15. GC10: Palliative support – gastric cancer

Appendix 6.15.1. Rationale

Although no specific recommendation was formulated, the updated guideline clearly states that patients with gastric cancer should have access to a specialist (outpatient and/or inpatient) palliative care team, in particular in relation to comfort and symptom control, and quality of life [8].

Appendix 6.15.2. Definition

Type of indicator

Process indicator

Description

Proportion of patients with metastatic gastric cancer who received palliative support.

Numerator

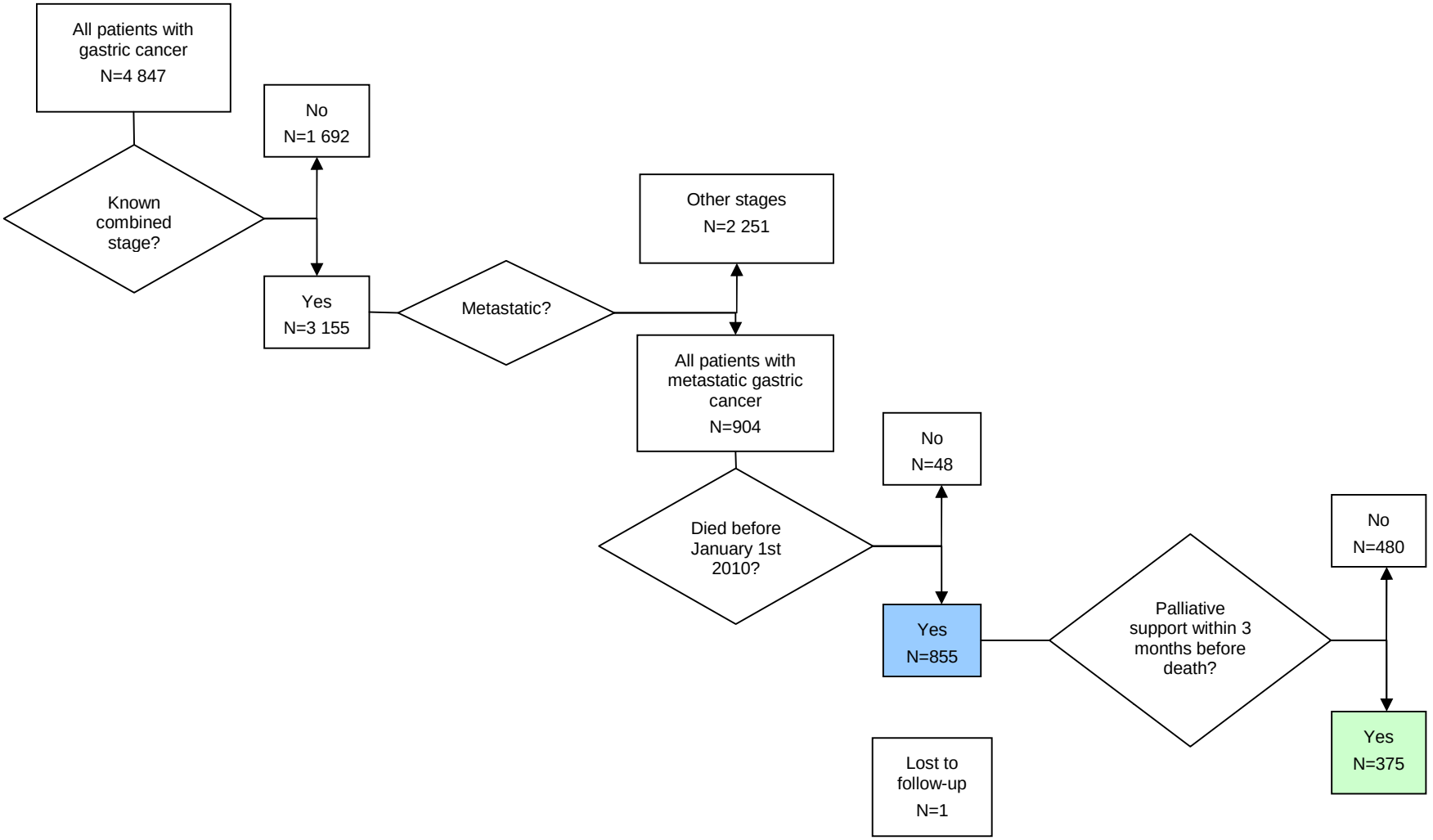
All patients with metastatic gastric cancer that died in a given year and had palliative support within 3 months before death.

Denominator

All patients with metastatic gastric cancer that died in a given year.

Appendix 6.15.3. Elaboration

Flowchart



Supplementary analyses

Risk adjustment

- Not necessary

Sensitivity analysis

- Not necessary

Subgroup analysis

- Geographical presentation of results (by province)

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD-10 code C16.1 (BCR)
- Stage: combined stage (BCR)
- Palliative support: nomenclature codes (Appendix 8.3.5)

Limitations

- Not all nomenclature codes related to palliative care are available to the BCR

Appendix 6.15.4. Results

National results

Overall, of all patients diagnosed with metastatic gastric cancer between 2004 and 2008 that died before January 1st 2010, 43.9% received palliative support within 3 months before death (Table 172). No clear time trend was found, although the highest rate was clearly found for 2009 (55.3%).

Important differences were found across the Belgian provinces, with the highest rates found in Namur (63.2%) and the lowest in Brussels (27.3%) and Liège (27.5%) (Table 173). Younger patients were more likely to receive palliative support than older patients (60- vs. 60+: OR = 1.58, 95%CI 1.11 to 2.25) (Table 174).

No important difference was found between men and women (male vs. female: OR = 0.92, 95%CI 0.69 to 1.23) (Table 175 and Table 176).

Table 172 – Proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death) by year of death

	Numerator	Denominator	Proportion (%)
2004	44	98	44.9
2005	72	166	43.4
2006	64	153	41.8
2007	73	178	41.0
2008	80	184	43.5
2009	42	76	55.3
Total	**375**	**855**	**43.9**

Table 173 – Proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death) by province / region

	Numerator	Denominator	Proportion (%)
Antwerpen	78	163	47.9
Brussels Capital Region	18	66	27.3
Vlaams-Brabant	32	64	50.0
Brabant Wallon	7	17	41.2
West-Vlaanderen	83	155	53.5
Oost-Vlaanderen	68	152	44.7
Hainaut	23	68	33.8
Liège	19	69	27.5
Limburg	28	65	43.1
Luxembourg	7	17	41.2
Namur	12	19	63.2
Total	**375**	**855**	**43.9**

Note: Province where the patient lives (not where the hospital is located).

Table 174 – Proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death), by age

	Numerator	Denominator	Proportion (%)
<50	33	65	50.8
50-59y	56	103	54.4
60-69y	83	197	42.1
70-79y	122	289	42.2
80+	81	201	40.3
Total	**375**	**855**	**43.9**

Table 175 – Proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death), by sex

	Numerator	Denominator	Proportion (%)
Men	228	529	43.1
Women	147	326	45.1
Total	**375**	**855**	**43.9**

Table 176 – Proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death): sex differences, stratified by age

	Men			Women			
	Numerator	Denominator	Proportion (%)	Numerator	Denominator	Proportion (%)	OR (95%CI)
<50	13	29	44.8	20	36	55.6	0.65 (0.22-1.95)
50-59y	34	60	56.7	22	43	51.2	1.25 (0.53-2.96)
60-69y	54	133	40.6	29	64	45.3	0.82 (0.43-1.57)
70-79y	78	188	41.5	44	101	43.6	0.92 (0.55-1.54)
80+	49	119	41.2	32	82	39.0	1.09 (0.59-2.02)
Total	**228**	**529**	**43.1**	**147**	**326**	**45.1**	

Comparison between centres

The variability between the 105 centres included in the analysis was limited (Figure 96 and Figure 97). Six centres had a proportion below the 95%LL (Table 177). In 28 centres, more than 50% of the patients received palliative support within 3 months before death. In contrast, in 14 centres no patient received palliative support.

Figure 96 – Funnel plot of the proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death), by centre (2004-2008)

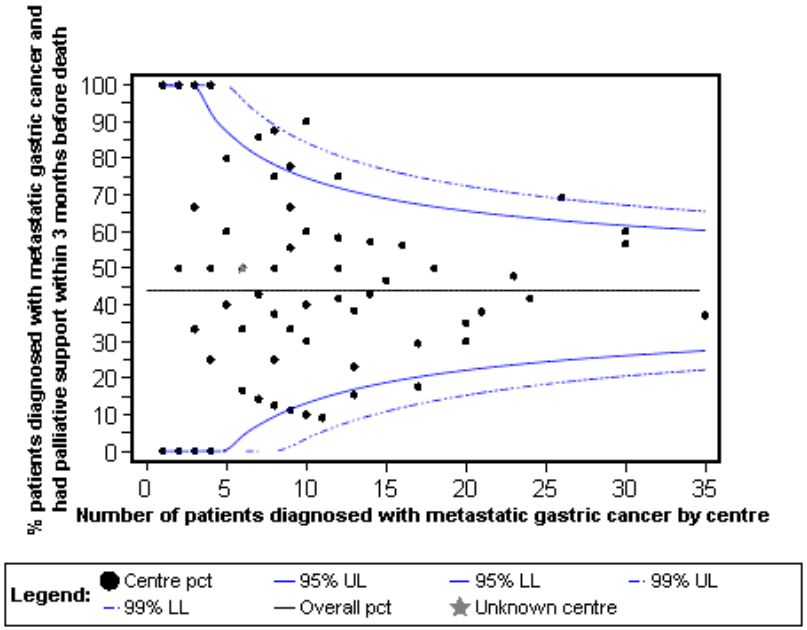


Table 177 – Number and proportion of outlying centres (2004-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	6	5.71	6	5.71
Between 95% control limits	92	87.62	98	93.33
Equal to 99%UL or upper than 95%UL	5	4.76	103	98.10
Upper than 99%UL	2	1.90	105	100.00

Figure 97 – Funnel plot of the proportion of patients with metastatic gastric cancer who received palliative support (within 3 months before death), by centre (2007-2008)

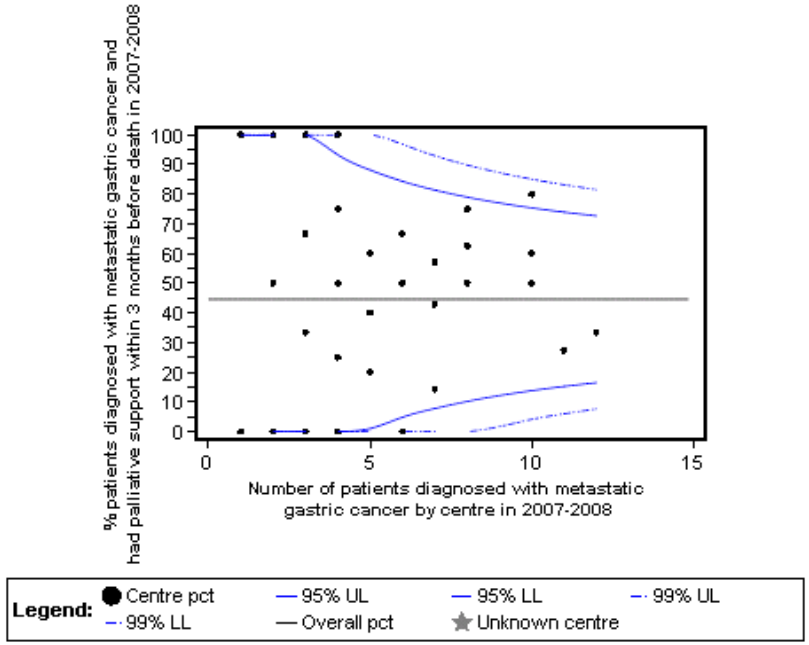


Table 178 – Number and proportion of outlying centres (2007-2008)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	1	1.15	1	1.15
Between 95% control limits	84	96.55	85	97.70
Equal to 99%UL or upper than 95%UL	2	2.30	87	100.00

Appendix 6.15.5. Discussion

Overall, 43.9% of the patients with metastatic gastric cancer diagnosed between 2004 and 2008 and that died before January 1st 2010, received palliative support within 3 months before death. In contrast to oesophageal cancer, younger patients were more likely to receive palliative support than older patients. Variability was considerable between the Belgian provinces, but limited between the individual centres, probably due to the low sample sizes per centre and the resulting large 95% and 99% limits. Importantly, not all nomenclature codes for palliative care were available for this report, and thus the reported proportions are probably slight underestimations. For example, no data were available on palliative home visits and in-hospital palliative care teams. To correctly evaluate this indicator, prospective registration is probably a better option.

In 2009, the Christian Sick Funds published a series of reports about end of life [32]. Of the 40 965 members of the Christian Sick Funds older than 40 years that died between July 1st 2005 and June 30th 2006, 27% had cancer. Of these 42% received palliative care (defined as lump sum palliative home care, stay in palliative hospital unit, contact with multidisciplinary palliative care team, or stay in palliative day care centre), which corresponds well to our results.

In the literature, few studies are available that allow a comparison with other countries. In the UK, an agreed protocol for managing patients whose treatment plan is best supportive care was available in 28 of the audited NHS organizations (21%) [30]. These data concern all patients with oesophagogastric cancer.

The interpretation of these results is hampered by the fact that a centre not necessarily has impact on the palliative care of its patients and that the awareness about the available structures and their reimbursement modalities in the palliative care setting is suboptimal. Sometimes, palliative care is coordinated by the general practitioner or provided in another centre than wee the patient was initially treated. Therefore, this indicator should not be used to compare the quality of care between centres (although it remains valid to evaluate the quality of care on a national level).

Key points

- **Between 2004 and 2008, 44% of the patients with metastatic gastric cancer received palliative support within 3 months before death.**
- **Variability was considerable between Belgian provinces.**
- **This indicator should not be used to compare the quality of care between centres, but can serve to evaluate the quality of care on a national level.**

Appendix 6.16. GC12: 5-year relative survival

Appendix 6.16.1. Rationale

Cancer survival is an indicator of the effectiveness of a country's health care system in the area of cancer screening, early detection and treatment. The health care system can improve the survival of certain cancers through early detection and appropriate treatment [80]. Problems with the observed survival rate are due to the fact that not all deaths among cancer patients will be due to the primary cancer in question. To avoid this problem of comparability, relative survival rates are calculated [80]. Five-year relative survival compares the 5-year survival rate of patients diagnosed with gastric cancer to the national 5-year survival rate of patients with the same age and sex (supposed to have approximately the same comorbidities but not the cancer). The difference between the two rates can thus be attributed to the gastric cancer.

Appendix 6.16.2. Definition

Type of indicator

Outcome indicator.

Description

Five-year survival rates computed after the gastric cancer incidence date by combined stage.

Appendix 6.16.3. Elaboration

Calculation

Relative survival rate is calculated as the observed rate of persons diagnosed with gastric cancer surviving five years after incidence date, divided by expected survival rate in the general population.

Supplementary analyses

Subgroup analyses

- Analysis by age, sex, stage, histological type, anatomical location and type of treatment (surgery or no surgery).

Risk adjustment

- See observed survival.

Sensitivity analysis

- No sensitivity analysis needed

Data source(s)

Source database(s)

- BCR for source population
- Crossroads bank of Social Security: mortality data

Administrative codes

- Diagnosis of gastric cancer: ICD10 code C16.1 (BCR)
- Stage: BCR

Appendix 6.16.4. Results

National results

The number of men with gastric cancer slightly exceeds the number of women, but the difference is smaller than for oesophageal cancer. Women seem to have a little advantage on their male counterparts in relative survival, from 1 to 5 years after the incidence date. At 5 years, proportions reported in both groups remained very low (around 30%) (Table 179), mainly due to the high proportion of patients who were diagnosed with advanced disease (≥ stage III) at an older age. Considering the age groups, younger patients were more likely to be alive 5 years after their diagnosis than older patients (Table 180). In all age groups, survival rates were higher in women than in men, whatever the follow-up period, even for the oldest ones (≥80 years) (Table 180, Figure 98 and Figure 99).

Five-year relative survival, i.e. survival corrected for age- and gender-specific background mortality, was slightly higher than 5-year overall survival in both sex groups (22.3% in men and 25.3% in women, respectively). This is particularly true for stages I and II where the differences are the largest, indicating that other causes of mortality play a role during a 5-year period after incidence date. In stages III and IV, the majority of deaths were caused by the presence of the gastric cancer, since 5-year relative and overall survival cancer were very close (Table 181 and Table 189).

Women were more likely to have an undocumented combined stage (38.7% vs. 32.2%). Men with undocumented cancer stages had a 5-year relative survival that was between the survival rates reported for stages III and IV, whereas for women, the picture is less clear. After two years, the relative survival for all those with undocumented stages was between survival rates reported for stages II and III (Table 181, Figure 100 and Figure 101).

In 72% of all gastric cancers, the anatomical localization was not specified (Table 182). Around 15% of gastric tumours were located in the pyloric antrum. In men, tumours located in the pyloric antrum had a better prognosis at 5-year (37.7%) than tumours located in the body of stomach (31.9%) or in the fundus (32.7%) (Table 182 and Figure 102). A higher proportion of men were diagnosed with an adenocarcinoma than with another histological type (93.9% vs. 6.9%). The 5-year relative survival was close for both types (28.2% vs. 30.6% of survivors; p<0.44) (Table 183 and Figure 104). In women also, tumours located in the pyloric antrum had a better prognosis at 5-year (38.4%) than tumours located in the body of stomach (18.1%) or in the fundus (32.6%) (Table 182 and Figure 103). A high proportion of adenocarcinoma was diagnosed (90.0% vs. 10%). The 5-year relative survival of women with an adenocarcinoma was significantly lower than survival for women with another histological type (28.9% vs. 53.3%; p<0.0001) (Table 183 and Figure 105), and similar to survival of men with adenocarcinoma (28.9% vs. 28.2%; p=0.60). On the contrary, women with another histological type were more likely to be alive at 5 years than men with another histological type (53.3% vs. 30.6%; p<0.0001) (Table 183, Figure 104 and Figure 105).

In Belgium, 5-year relative survival was higher than rates reported in Europe, both for resected cancers (47.2%) and for non-resected cancers (16.4% in women and 7.9% in men) (Table 184).

Table 179 – Gastric cancer: Relative survival by sex

	No at risk	Relative Survival (%)				
		1 year	2 year	3 year	4 year	5 year
Men	2 814	50.8	38.7	31.8	29.3	28.4
Women	2 033	51.6	40.5	35.3	33.0	31.4

Table 180 – Gastric cancer: Relative survival by sex and age group

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
0-49 years	166	5.9	69.5	53.9	49.2	45.4	44.7	167	8.2	72.5	60.5	53.9	50.8	50.8
50-59 years	279	9.9	61.4	46.9	38.5	34.9	32.0	184	9.1	63.8	50.4	44.6	41.9	39.0
60-69 years	612	21.7	57.4	43.8	36.4	34.0	33.1	307	15.1	56.8	44.1	38.5	35.6	34.2
70-79 years	981	34.9	50.7	39.0	30.6	28.1	26.5	581	28.6	56.2	44.0	39.3	35.5	32.7
80+ years	776	27.6	36.1	26.4	21.7	19.1	19.8	794	39.1	37.7	28.6	23.3	22.8	21.4

Figure 98 – Gastric cancer: Relative survival in men by age group

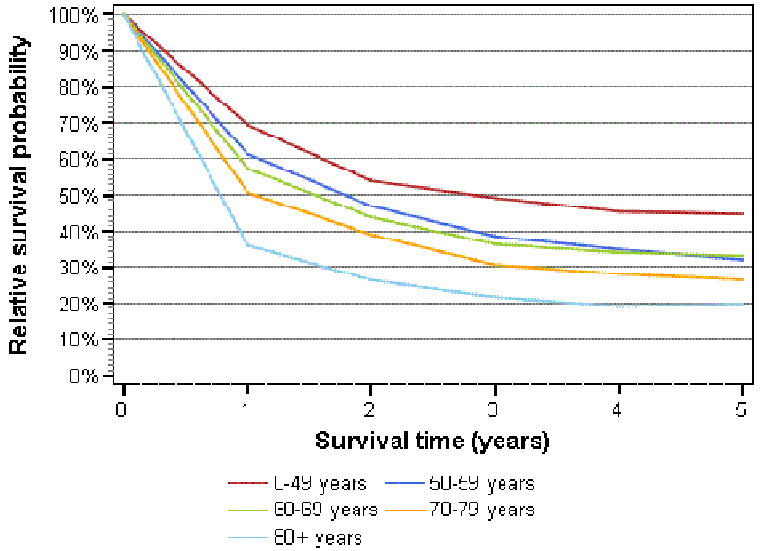


Figure 99 – Gastric cancer: Relative survival in women by age group

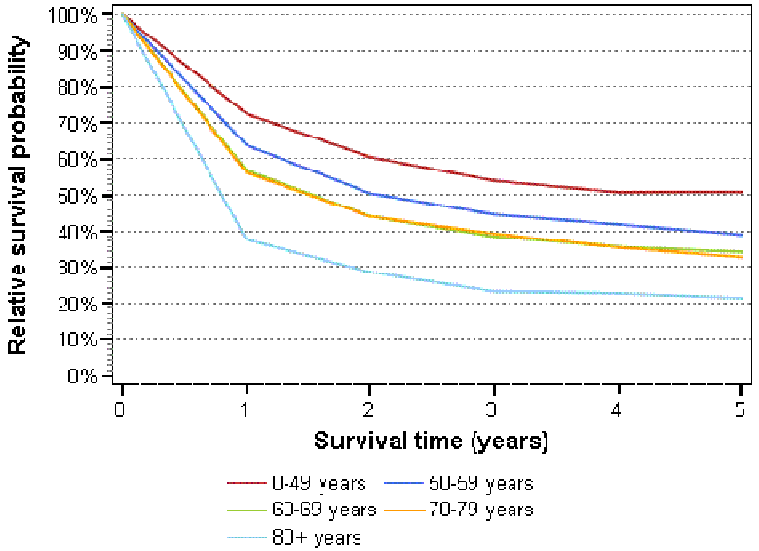


Table 181 – Gastric cancer: Relative survival by sex and combined stage (combStage)

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
Stage I	525	18.7	85.9	81.2	77.1	74.5	73.5	386	19.0	83.3	77.8	75.7	73.8	72.6
Stage II	299	10.6	82.5	71.2	59.6	54.6	51.6	207	10.2	72.1	61.4	53.4	48.1	43.8
Stage III	375	13.3	60.1	41.6	28.6	22.9	21.8	222	10.9	56.8	37.3	25.6	22.1	20.4
Stage IV	709	25.2	29.7	11.9	6.0	4.9	4.3	432	21.2	28.9	11.4	6.0	3.8	3.2
Stage X	906	32.2	32.0	22.8	17.6	16.4	16.0	786	38.7	41.5	33.7	29.9	28.7	27.2

Figure 100 – Gastric cancer: Relative survival in men by combined stage (combStage)

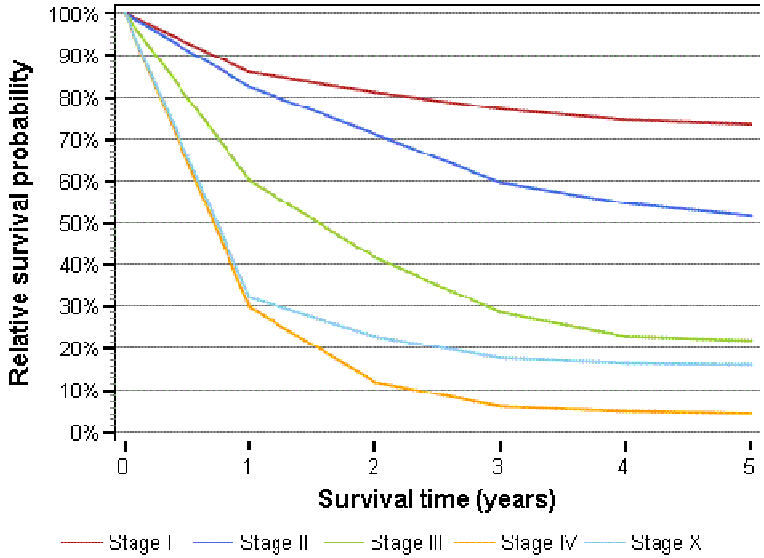


Figure 101 – Gastric cancer: Relative survival in women by combined stage (combStage)

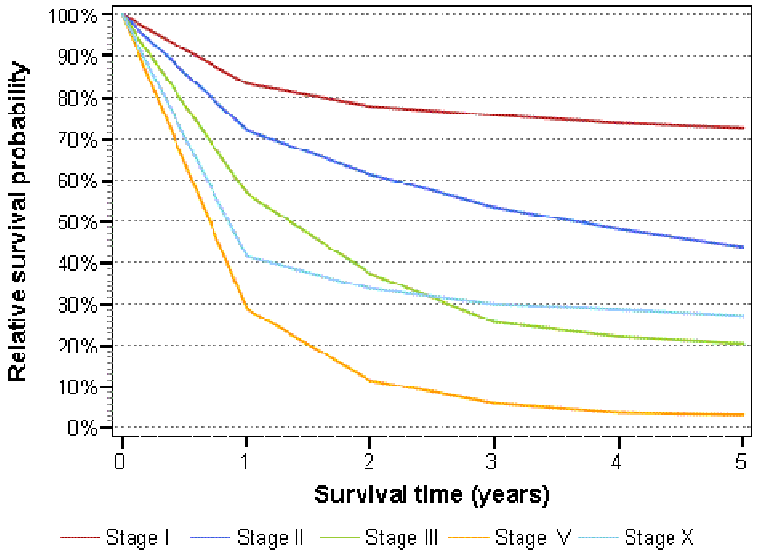


Table 182 – Gastric cancer: Relative survival by sex and sublocalisation

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
Fundus of stomach	120	4.3	47.5	37.6	35.4	31.3	32.7	80	3.9	51.2	39.4	36.8	33.1	32.6
Body of stomach	107	3.8	60.5	44.0	33.1	32.5	31.9	86	4.2	48.9	31.6	26.2	19.4	18.1
Pyloric antrum	395	14.0	63.1	49.6	42.2	37.5	37.7	319	15.7	60.1	47.2	42.4	40.6	38.4
Pylorus	34	1.2	*	*	*	*	*	30	1.5	*	*	*	*	*
Lesser curvature of stomach NOS	76	2.7	58.0	47.5	43.3	38.2	35.2	62	3.0	75.7	62.6	50.7	48.1	47.0
Greater curvature of stomach NOS	32	1.1	*	*	*	*	*	26	1.3	*	*	*	*	*
Stomach, unspecified	2 050	72.9	47.8	35.9	29.1	27.1	26.0	1 430	70.3	48.7	38.3	33.4	31.3	29.7

Figure 102 – Gastric cancer: Relative survival in men by sublocalisation

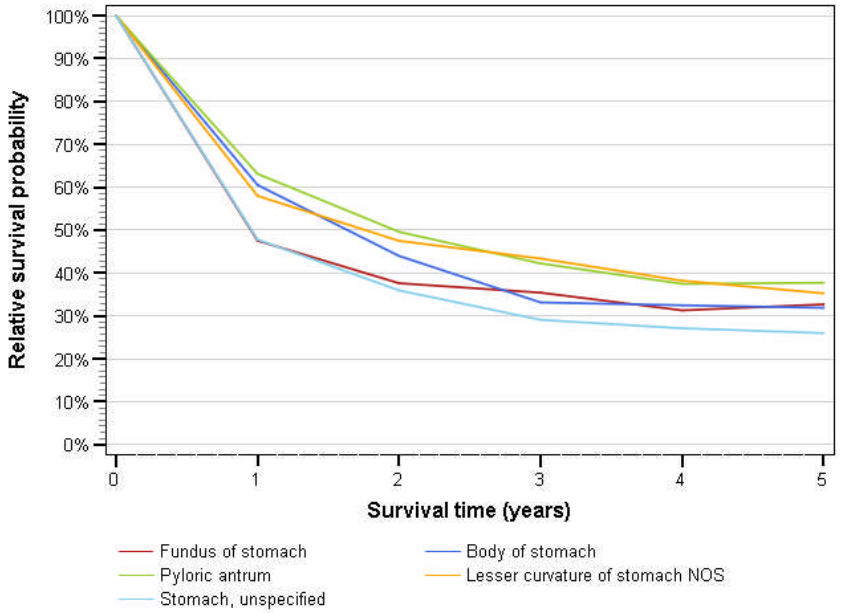


Figure 103 – Gastric cancer: Relative survival in women by sublocalisation

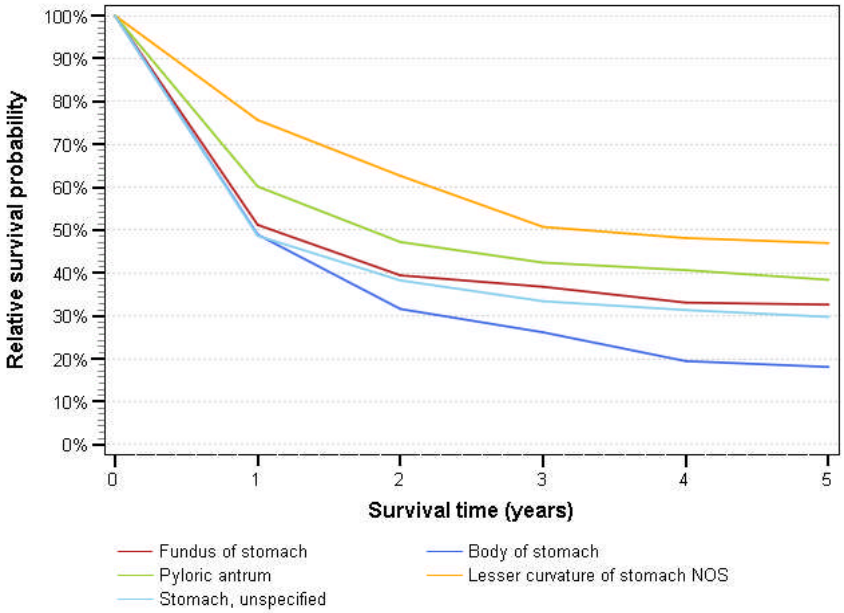


Table 183 – Gastric cancer: Relative survival by sex and histological type

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
Adenocarcinoma	2 619	93.1	50.9	38.5	31.6	29.1	28.2	1 830	90.0	49.7	38.1	32.7	30.6	28.9
Other	195	6.9	48.8	41.4	34.6	31.3	30.6	203	10.0	68.1	61.0	57.8	54.2	53.3

Figure 104 – Gastric cancer: Relative survival in men by histological type

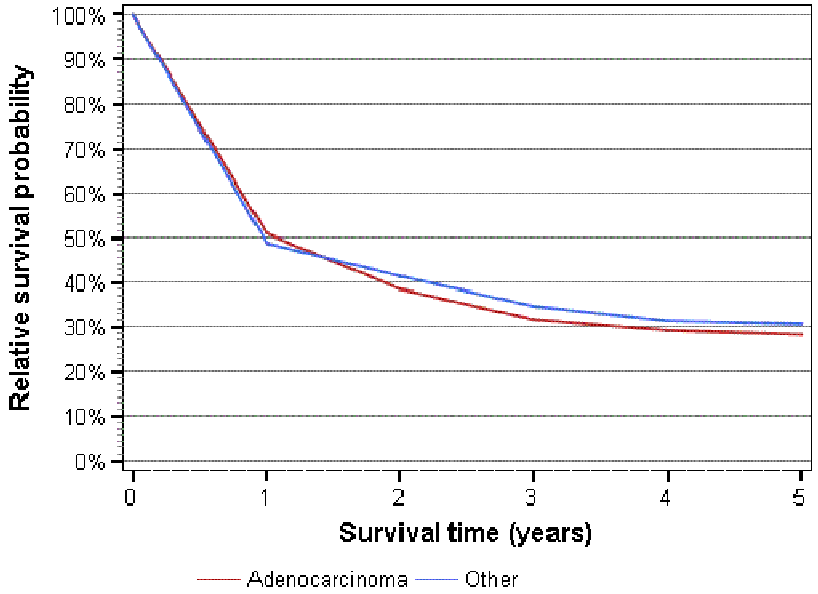


Figure 105 – Gastric cancer: Relative survival in women by histological type

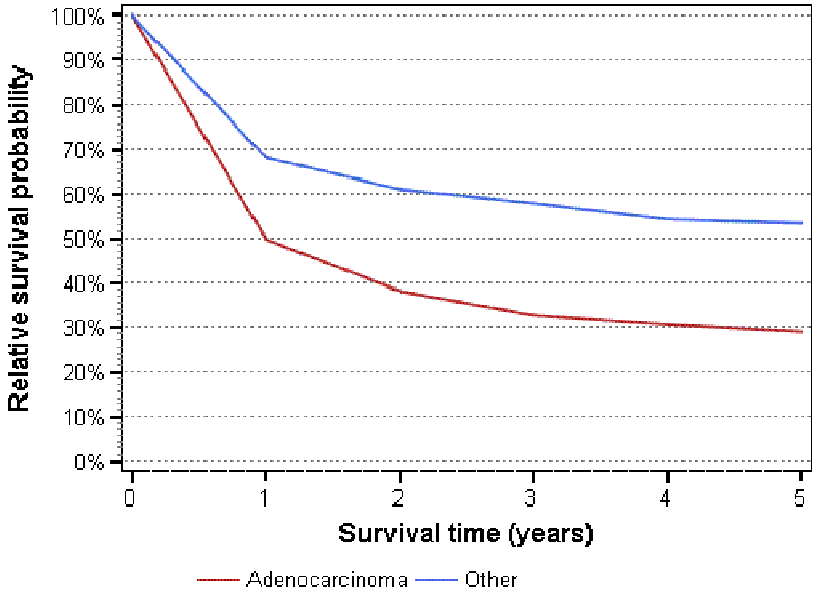


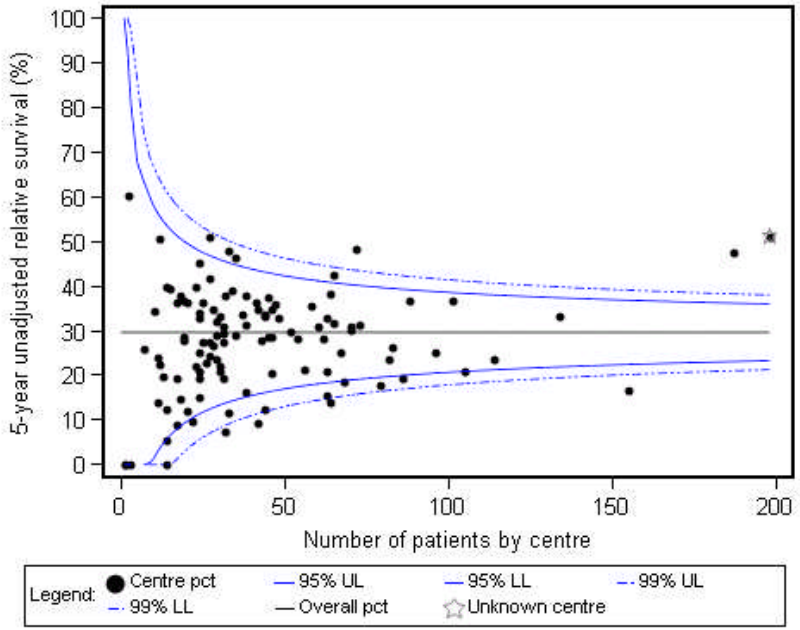
Table 184 – Gastric cancer: Relative survival by sex and type of treatment (surgery vs. no surgery)

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
Surgery	1 444	51.3	74.0	61.3	52.1	48.4	47.2	965	47.5	72.5	59.6	52.5	49.7	47.2
No surgery	1 370	48.7	25.6	14.2	9.8	8.5	7.9	1 068	52.5	32.1	22.5	19.1	17.3	16.4

Comparison between centres

Figure 106 presents the 5-year relative survival rates for the centres in which patients with gastric cancer were treated. While four centres reported lower survival rates than the 99% lower limit, 9 additional centres reported lower rates than the 95% lower limit (Table 185). Most of these centres clearly recorded a very low volume of gastric cancer patients (maximum 15 patients who received a medical or surgical treatment yearly). However, one of them recorded a higher yearly volume, i.e. around 30 patients. Two centres fell above the 99% upper limit, reporting higher survival rates than the nationwide value. One of them treated 15 patients per year while the other one recorded the highest volume of patients in the period 2004-2008 (38 patients per year). Restricting the patients' population to only those who underwent a surgical intervention increased the mean 5-year relative survival from 30% to 45% (Figure 107). In that scenario, 85.3% of the centres fell between the 95% limits, revealing no high variability. The highest volume hospital fell above the 99% upper limit, indicating a significantly higher 5-year relative survival compared with the other centres.

Figure 106 – Funnel plot of the 5-year relative survival for patients diagnosed with a gastric cancer, by centre

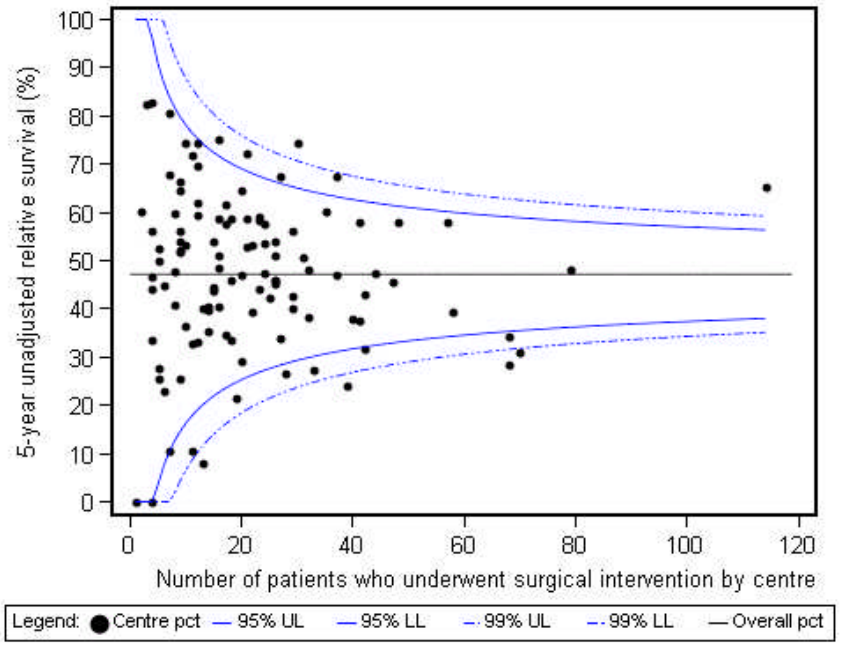


Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 185 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	4	3.57	4	3.57
Equal to 99%LL or lower than 95%LL	9	8.04	13	11.61
Between 95% control limits	92	82.14	105	93.75
Equal to 99%UL or upper than 95%UL	4	3.57	109	97.32
Upper than 99%UL	3	2.68	112	100.00

Figure 107 – Funnel plot of the 5-year relative survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre



Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 186 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	4	3.57	4	3.57
Equal to 99%LL or lower than 95%LL	6	5.50	10	9.17
Between 95% control limits	93	85.32	103	94.50
Equal to 99%UL or upper than 95%UL	4	3.57	107	98.17
Upper than 99%UL	2	1.83	109	100.00

Appendix 6.16.5. Discussion

Despite a declining trend, gastric cancer remains relatively frequent in most Western countries, accounting for nearly 20% of all digestive tract cancers diagnosed in the European Union. The prognosis remains poor and there has been no major improvement in survival over the past 20 years [43, 102].

The Eurocare-4 Study analysed relative survival in gastric cancer cases diagnosed in 1995–1999 and recorded from 47 European population-based cancer registries. All survival estimates referred to the period 2000–2002 [43]. Five-year relative survival of patients with gastric cancer ranged from 33% in Germany to 17% in England and Scotland. Five-year relative survival also exceeded 30% in Austria, Belgium, Italy and Spain, and it was close to or below 20% in the Netherlands, the UK and Ireland and all populations from Eastern Europe included in this analysis. Intermediate levels between 20% and 30% were seen in the North European countries, France, Switzerland and Slovenia. With few exceptions, survival tended to be higher amongst female than amongst male cancer patients [43].

A sub-study on 17 cancer registries reported a major difference between resected and non-resected gastric cancers. The 5-year relative survival rates varied around 25-35% for resected cancers, but were drastically lower, on average 2.7%, for non-resected cases [102]. According to the authors, differences in the distribution of stage at diagnosis among resected cases can play a role, but heterogeneity of surgical practices is also likely to explain some of the variations. In Belgium, 5-year relative survival was higher than those reported in Europe, both for resected cancers (47.2%) as for non-resected cancers (16.4% in women and 7.9% in men).

Morphology is also an important prognostic factor. Undifferentiated and epidermoïd carcinomas and signet ring cell adenocarcinomas had a worse prognosis than adenocarcinomas [102]. In our study, adenonocarcinomas were the more frequent tumours (92%), and also the more aggressive ones, leading to a poor prognosis (around 28%). In men, 21.5% of the other histologic types were carcinoids (compared with 42.9% in women). In general, type 1 carcinoids are not too aggressive. Other types of gastric carcinoids that are quite aggressive (but this is a small subgroup) are more frequently diagnosed in men. Gastric linitis plastica occured for 32.8% of the other histologic group in men and for 27.1% in women. This tumour had a poorer prognosis, leading surgeons to question the interest of the surgical resection [103].

The anatomical location of the gastric tumour also deserves careful attention. The proportion of cancers located in the distal stomach versus the cardia, which is strongly related to prevalence of infection with the gastric bacterium Helicobacter pylori, is an important determinant of survival rates [104]. Distal gastric cancer could have a better prognosis than cardia cancer [105]. In Belgium, the anatomical location was not documented in 72% of patients. Trends can only be searched in a minority of patients. For patients with documented site, tumours located in the pylorus (antrum) had the best prognosis.

In the Netherlands, Dikken et al. [85] conducted a trend analysis, showing no improvements in relative survival between 1989 and 2008, both for M0 gastric cardia carcinoma (5-year survival, from 19% to 20.6%) or metastatic tumours (2 year-survival, from 4.2% to 6.0%). Whereas the increased survival for oesophageal carcinoma reported during this period in the Netherlands can be attributed to centralisation of surgery and an increased use of multimodality therapy, these factors were poorly acknowledged in treating gastric cancer in the Netherlands [85]. There were hardly any high-volume gastrectomies to conduct a properly powered volume-outcome analysis for gastrectomy. Furthermore, in the study period multimodality therapy has been administered more frequently in oesophageal as compared to cardia carcinoma. This might explain why for

gastric cardia cancer, relative survival did not significantly increase [85]. Such evolution cannot currently be estimated for Belgium, since results were only available for 5 years between 2004 and 2008. A that short period cannot be used to reliably idenitfy trends.

It is important to stress that relative survival has to be documented by cancer stage. However, 35% of all patients with gastric cancer had undocumented stages. These patients had a 5-year relative survival that was between survival rates reported for stages II and IV. In the Netherlands, the percentage of patients with an unknown stage was higher in the former period (around 20% in 1989-1993) and slightly decreased (15% between 2004 and 2008), with a corresponding increase in the proportion of stage IV patients [85]. In the EUROCARE-4 study, high proportions of missing information concerning stage at diagnosis and anatomical site hampered more detailed analyses [102]. Surgical resection was therefore used as proxy of stage [102].

Finally, this outcome indicator seems to be pertinent to compare all Belgian centres according to the volume of patients they treat per year. While the great majority of the centres were low-volume centres, reporting survival rates that fell between the limits of the funnel plot, two identified centres fell above the 99% upper limit, reporting higher survival rates than the nationwide value. One of them treated 15 patients per year while the other one recorded the highest volume of patients in the period 2004-2008 (38 patients per year). The association between high volume and survival is less clear than it was shown for oesophageal cancer patients. However, few hospital treated a high volume of gastric cancer patients to highlight a real difference.

Key points

- **Belgium reported higher 5-year survival rates than the majority of European countries, reaching 30% between 2004 and 2008.**
- **In Belgium, a survival advantage was observed for specific subgroups:**
  - **women;**
  - **younger individuals;**
  - **other histologic types than adenocarcinomas;**
  - **tumours located in the distal part of the stomach;**
  - **combined stage I;**
- **Older age at the time of diagnosis and higher tumour stage were associated with lower survival.**
- **Adenocarcinomas and proximal gastric cancers were associated with a worse prognosis.**
- **Between 2004 and 2008, 35% of all patients with gastric cancer had undocumented stages and for 72% of patients the anatomical location of the tumour was undocumented in Belgium. This underreporting is also problematic for a lot of European countries; an improvement was noticed these last years in the Netherlands.**
- **This outcome indicator seems pertinent to compare all Belgian centres according to the volume of patients they treat per year, but the association volume-outcome is less clear than it was for oesophageal cancer.**

Appendix 6.17. GC13: 5-year overall survival

Appendix 6.17.1. Rationale

Incidence rates of gastric cancer vary considerably across Europe. Gastric cancer is currently the fourth most common malignancy in the world, after cancers of the lung, breast and colorectum. Age-standardized incidence rates are about twice as high in men as in women. Gastric cancer is the second leading cause of cancer death in both sexes worldwide [82], and it remains difficult to be cured primarily because most patients present with advanced disease.

Appendix 6.17.2. Definition

Type of indicator

Outcome indicator.

Description

Proportion of patients diagnosed with a gastric cancer in a given year, surviving 5 years after incidence date.

Appendix 6.17.3. Elaboration

Calculation

Overall survival rate is calculated using the Kaplan-Meier method. This estimator is specifically used for estimating the survival function from life-time data. An important advantage of the Kaplan–Meier curve is that the method can take into account some types of censored data, particularly right-censoring, which occurs if patients withdraw from the study (some subjects are still alive at the end of the study but were not followed for the entire span of the curve or some drop out of the study early).

Supplementary analyses

Subgroup analyses

- Subgroup analysis by sex, age and by combined stage.

Risk adjustment

- Cox proportional hazard model with the following factors as covariates: age, sex, histological type, anatomical localisation, combined stage, year of incidence and hospital volume of gastrectomies.

Sensitivity analysis

- No sensitivity analysis.

Data source(s)

Source database(s)

- BCR for source population
- IMA
- Crossroads bank of Social Security: mortality data

Administrative codes

- Diagnosis of gastric cancer: ICD10 code C16.1 (BCR)
- Stage, histological type, anatomical site, year of incidence: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Table 233)
  - Chemotherapy: nomenclature codes (IMA) (Table 235)
  - Radiotherapy: nomenclature codes (IMA) (Table 236)

Limitations

- No data to compute a proxy for comorbidity.

Appendix 6.17.4. Results

National results

Gastric cancer affects slightly more men than women (Table 187). Gastric cancer is most frequently diagnosed in men and women of 70 years or older. The mean age at diagnosis was 71 years in men and 73 years in women. This distribution of mean age at diagnosis led to obtain a similarly very low overall survival at 5 years, although women had a little survival advantage on their male counterparts (Table 187). Gastric cancer remains difficult to cure, primarily because most patients present with advanced disease. Considering the age groups, younger patients were more likely to be alive 5 years after their diagnosis than older patients (Table 188; Figure 108 and Figure 109).

In all age groups, survival rates were higher in women than in men, whatever the follow-up period, even for the oldest ones (≥80 years) (Table 188).

In stage I, observed survival declined from 81.9% (1 year) to 57.9% (5 years) in men and from 79.5% to 58.3% in women. In stage III, the decline was more pronounced to reach 17.6% in men and 17.1% in women after 5 years. For stage IV, 5-year overall survival is low both for men (3.7%) and women (2.8%). Patients with undocumented cancer stages (N=1 692) have a 5-year observed survival close to 12% in men and 21% in women (Table 189, Figure 110 and Figure 111).

Table 187 – Gastric cancer: Observed survival by sex

	No at risk	Observed Survival (%)				
		1 year	2 year	3 year	4 year	5 year
Men	2 814	48.0	34.9	27.4	24.1	22.3
Women	2 033	49.0	36.9	30.8	27.7	25.3

Table 188 – Gastric cancer: Observed survival by sex and age group

	Men							Women						
	No at Risk		Observed Survival (%)					No at Risk		Observed Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
0-49 years	166	5.9	69.3	53.6	48.8	45.1	44.3	167	8.2	72.3	60.2	53.6	50.4	50.4
50-59 years	279	9.9	60.9	46.2	37.6	33.9	30.8	184	9.1	63.6	50.0	44.0	41.2	38.1
60-69 years	612	21.7	56.4	42.3	34.5	31.7	30.3	307	15.1	56.4	43.3	37.5	34.4	32.6
70-79 years	981	34.9	48.4	35.6	26.7	23.4	21.0	581	28.6	54.7	41.8	36.3	32.0	28.7
80+ years	776	27.6	31.6	20.2	14.4	11.0	9.5	794	39.1	33.6	22.8	16.4	14.1	11.7

Figure 108 – Gastric cancer: Observed survival in men by age group

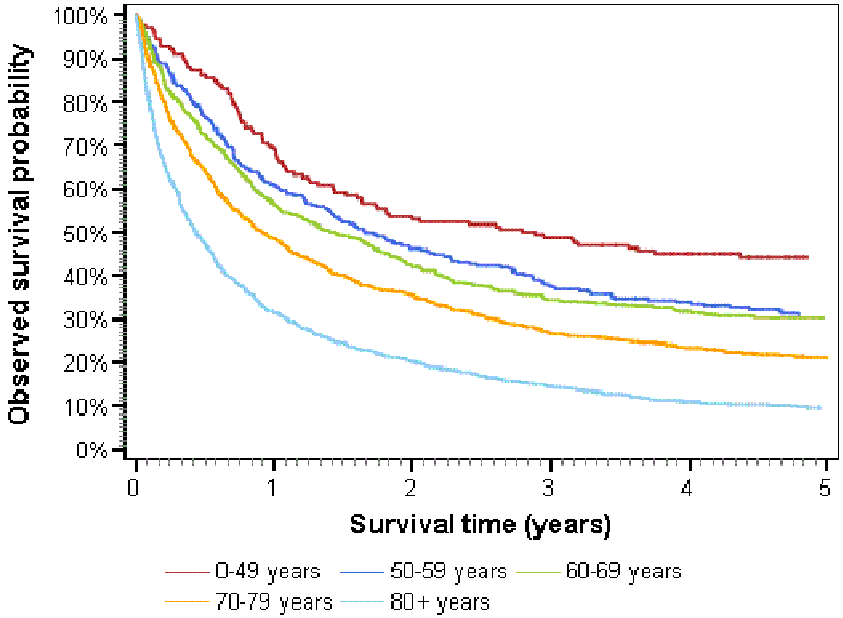


Figure 109 – Gastric cancer: Observed survival in women by age group

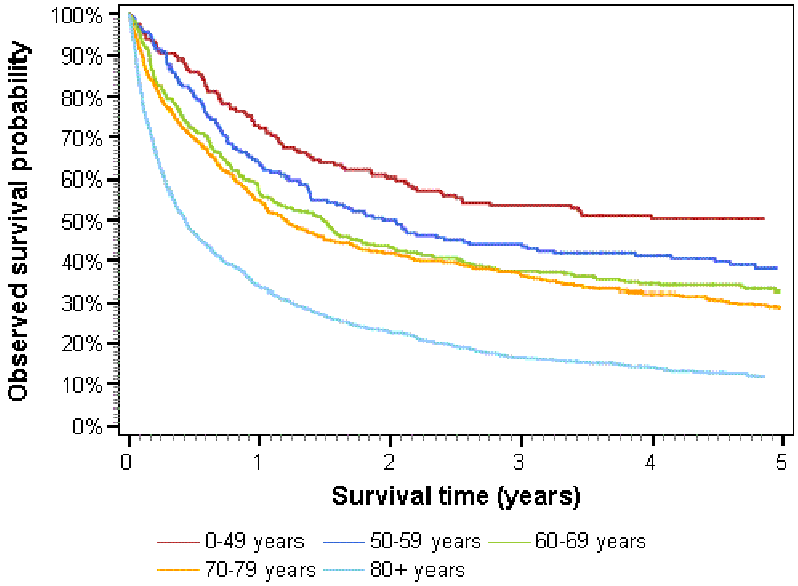


Table 189 – Gastric cancer: Observed survival by sex and combined stage (combStage)

	Men							Women						
	No at Risk		Relative Survival (%)					No at Risk		Relative Survival (%)				
	n	%	1 year	2 year	3 year	4 year	5 year	n	%	1 year	2 year	3 year	4 year	5 year
Stage I	525	18.7	81.9	73.9	67.0	61.8	57.9	386	19.0	79.5	71.2	66.3	61.9	58.3
Stage II	299	10.6	78.6	64.9	51.8	45.3	40.7	207	10.2	69.1	56.5	47.3	41.4	36.5
Stage III	375	13.3	57.3	38.1	25.1	19.2	17.6	222	10.9	54.5	34.7	23.0	19.2	17.1
Stage IV	709	25.2	28.3	11.0	5.4	4.2	3.7	432	21.2	28.0	10.9	5.6	3.4	2.8
Stage X	906	32.2	29.7	19.9	14.6	12.9	12.1	786	38.7	38.6	29.7	25.1	23.1	21.0

Figure 110 – Gastric cancer: Observed survival in men by combined stage (combStage)

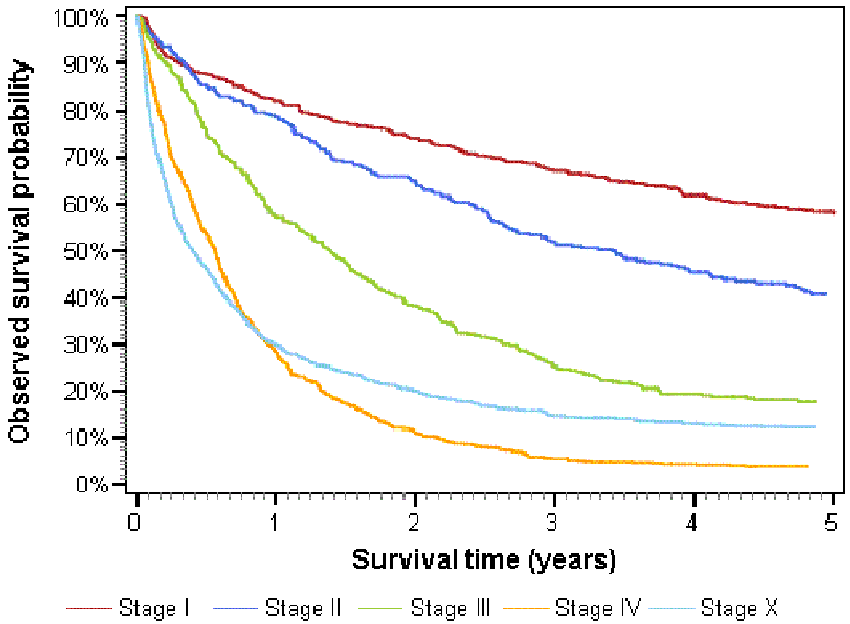
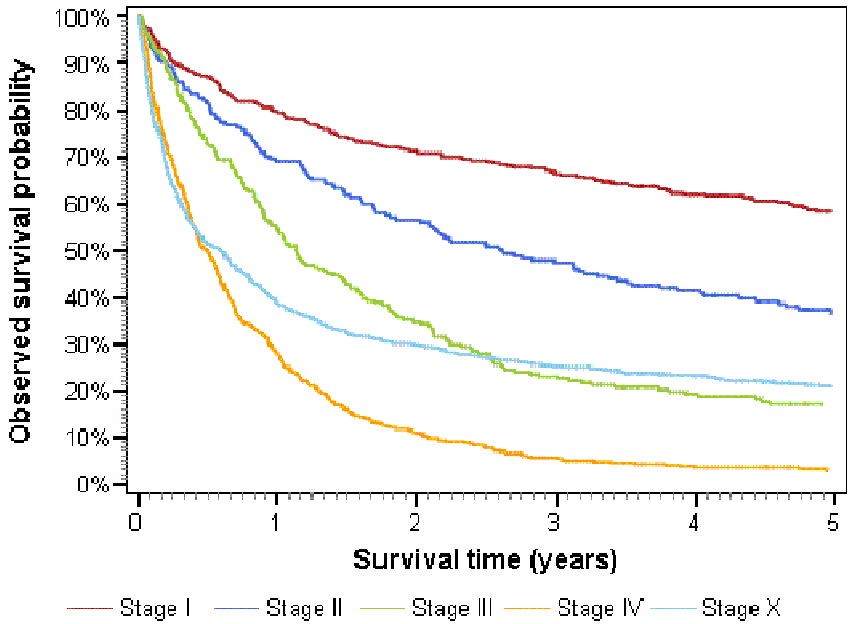


Figure 111 – Gastric cancer: Observed survival in women by combined stage (combStage)



Comparison between centres

Most centres treating (medically or surgically) less than 150 patients within 5 years obtained very similar results, falling within the 95% limits of the funnel plot (Figure 112). Adjusted for age, sex, and combined stage, the majority of low- and medium-volume centres fell between the limits of the funnel plot (85%). However, 13 centres reported higher survival rates, that fell above the 95% upper limit, without apparent link with their volume of patients (Figure 113).

Restricting the population to those who underwent a surgical resection increased the observed survival at the level of the country (38%) (Figure 114).

Only one centre fell above the 99% upper limit, reaching a 55% survival rate for operated patients. This centre reported the highest volume of operated patients (110 patients operated within 5 years).

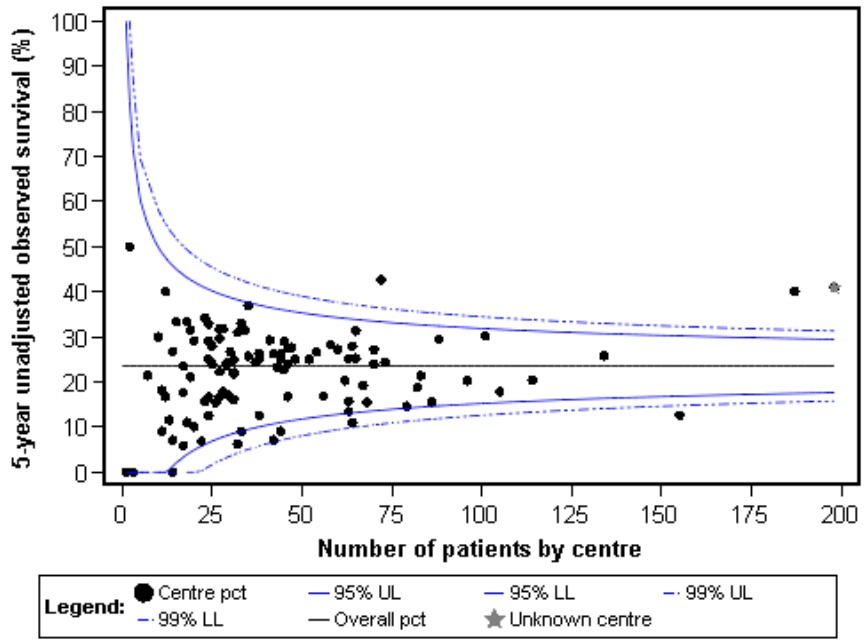
Figure 115 shows the unadjusted 5-year survival rates for centres grouped according to the volume of patients they treated (medically or surgically) during the period 2004-2008. Eleven categories of centres were defined, from low-volume (category 1, less than 10 patients) to the high-volume centres (category 11, 149-200 patients). The highest volume category was the only one that fell above the 99% upper limit, reaching a 5-year survival rate as high as 32.5%.

A similar figure was drawn to illustrate the unadjusted 5-year survival rates for centres grouped according to the volume of patients surgically treated during the period 2004-2008 (Figure 116). Nine categories of centres were represented, from low-volume (category 1, less than 10 operated patients) to high-volume centres (category 9, 100-149 operated patients). The highest volume category was the only one that fell above the 99% upper limit, reaching a 5-year survival rate as high as 55.3%.

However, when adjusted for age, sex and combined stage a less clear relationship was found between volume of patients and 5-year survival (Figure 117, Figure 118 and Figure 119), particularly when only operated patients were considered (Figure 117 and Figure 119).

Finally, demographic parameters (age and sex), tumour characteristics (stage, histological type, anatomical location) and hospital volume of gastrectomies (<6, 6-19, ≥20 per year) were included in a multivariate analysis to predict 5-year observed mortality (Table 198). Multivariate Cox regression analysis showed that gender (higher mortality in men), older age, advanced stage and adenocarcinoma histological type were independently and significantly correlated with 5-year observed mortality of all patients with a gastric cancer. The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence. Patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.75; 95%CI 0.62–0.91). The same significant association was reported for patients with gastric cancer who benefited from a surgical intervention (Table 199), since surgical patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.73; 95%CI 0.55–0.97).

Figure 112 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer, by centre



Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

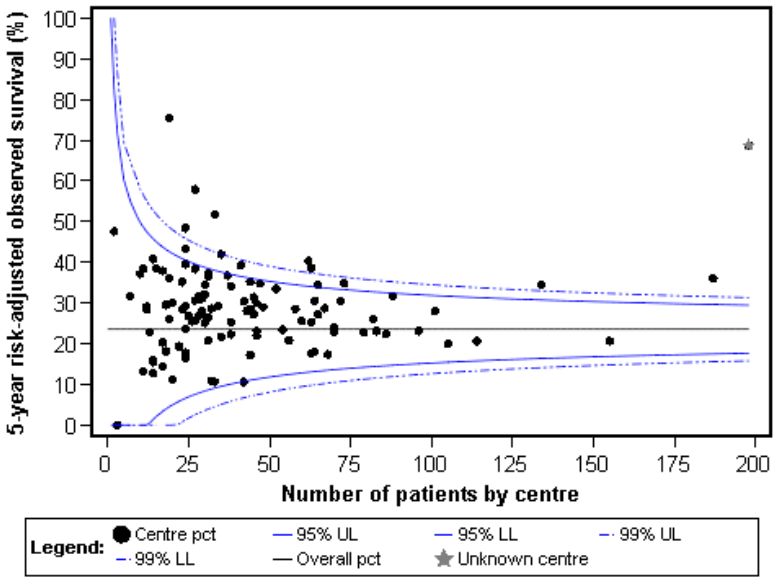
Table 190 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	0.89	1	0.89
Equal to 99%LL or lower than 95%LL	5	4.46	6	5.36
Between 95% control limits	103	91.96	109	97.32
Upper than 99%UL	3	2.68	112	100.00

Table 191 – Number and proportion of outlying centres

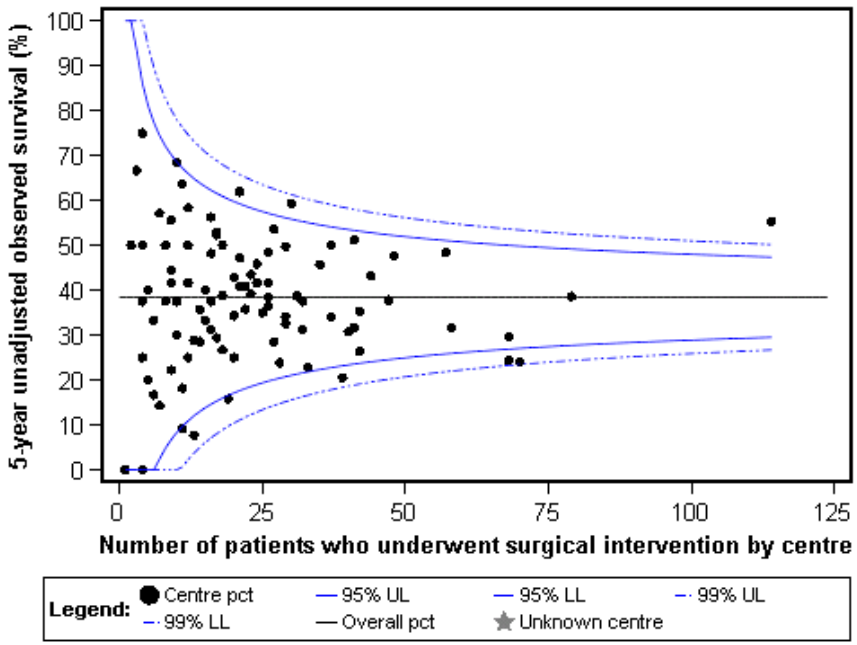
	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	2	1.79	2	1.79
Equal to 99%LL or lower than 95%LL	1	0.89	3	2.68
Between 95% control limits	95	84.82	98	87.50
Equal to 99%UL or upper than 95%UL	5	4.46	103	91.96
Upper than 99%UL	9	8.04	112	100.00

Figure 113 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer, by centre, adjusted for sex, age and combined stage



Note: For three centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Figure 114 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre

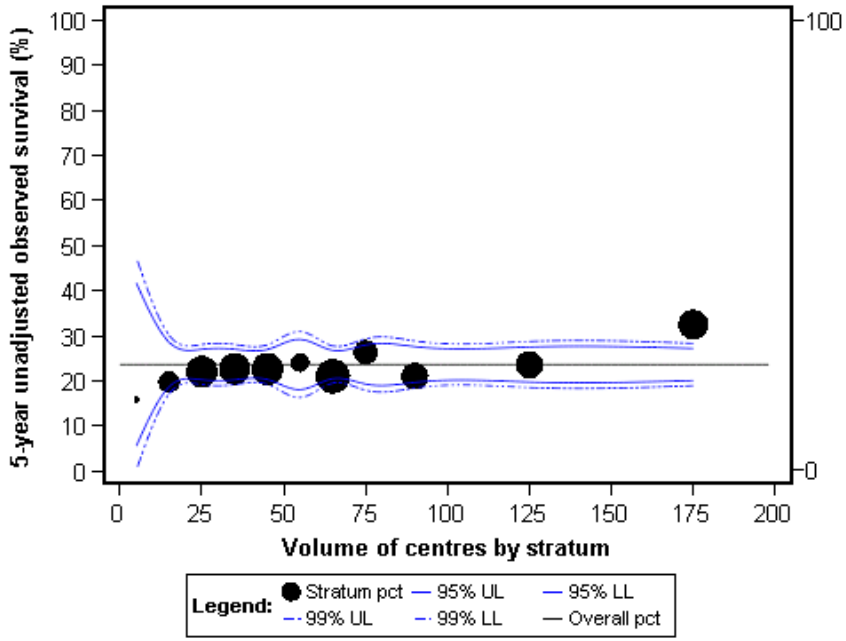


Note: For two centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot

Table 192 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Equal to 99%LL or lower than 95%LL	6	5.50	6	5.50
Between 95% control limits	100	91.74	106	97.25
Equal to 99%UL or upper than 95%UL	2	1.83	108	99.08
Upper than 99%UL	1	0.92	109	100.00

Figure 115 – Gastric cancer: 5-year unadjusted observed survival in function of volume of centres with control limits*



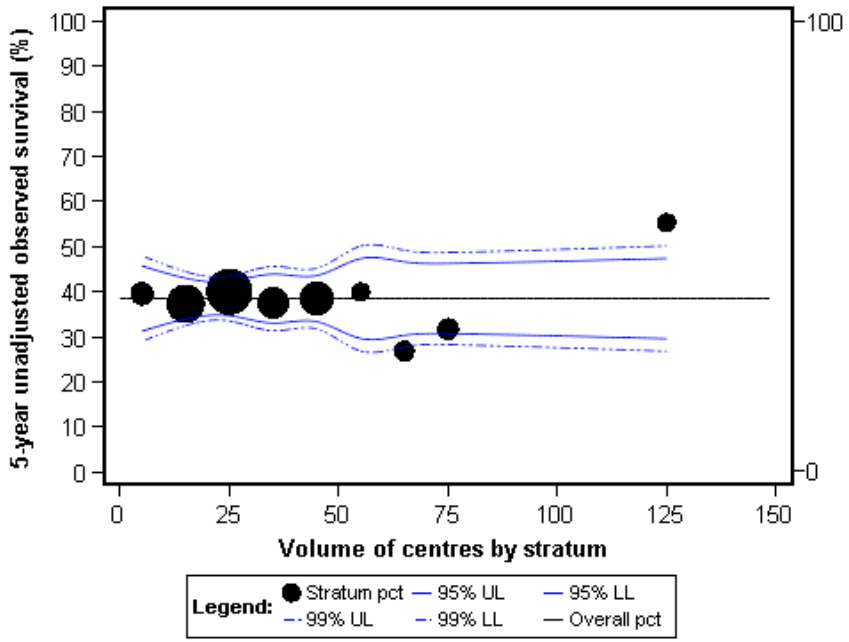
* Control limits were computed based on number of patients in each stratum

Table 193 – Unadjusted observed survival by categories of centres grouped according to the volume of patients

Category	Volume	N	Deaths	Observed survival (%)	Survexp_Max [§]
1	0-9 patients	21	17	15.87	60.00
2	10-19 patients	284	227	19.78	60.00
3	20-29 patients	603	467	22.06	60.00
4	30-39 patients	599	461	22.67	60.00
5	40-49 patients	623	479	22.64	60.00
6	50-59 patients	220	165	24.06	60.00
7	60-69 patients	704	550	21.00	60.00
8	70-79 patients	364	266	26.39	60.00
9	80-99 patients	435	338	21.05	60.00
10	100-149 patients	454	344	23.57	60.00
11	150-199 patients	540	360	32.49	60.00

[§] Survexp_max: Maximum theoretical follow up time for the first diagnosed patient. To be included in the funnel plot, Survexp_max of centres needed to be greater or equal to 60 months.

Figure 116 – Gastric cancer: 5-year unadjusted observed survival for patients who underwent surgical intervention in function of volume of centres with control limits*



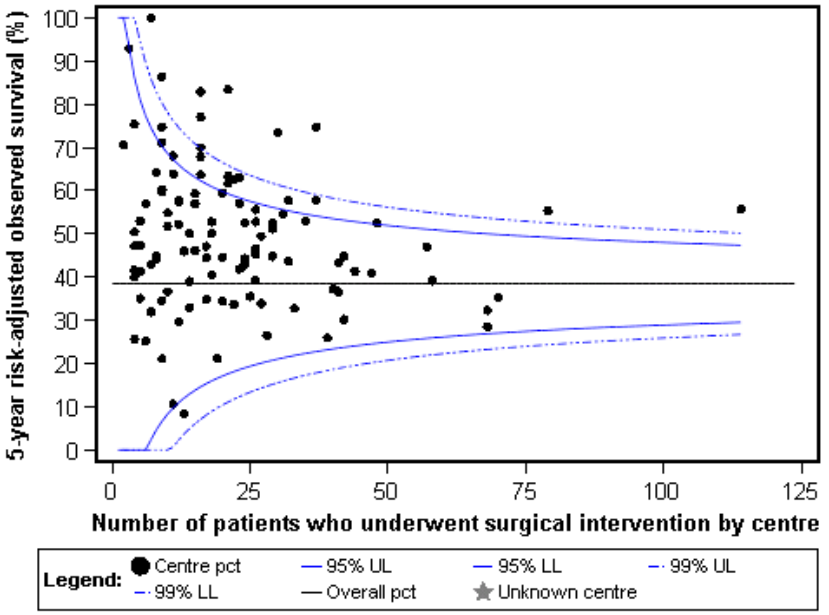
* Control limits were computed based on number of patients in each stratum

Table 194 – Unadjusted observed survival by categories of centres grouped according to the volume of surgically treated patients

Category	Volume	N	Deaths	Observed survival (%)	Survexp_ Max [§]
1	0-9 patients	172	103	39.54	60.00
2	10-19 patients	440	273	37.33	60.00
3	20-29 patients	632	373	40.01	60.00
4	30-39 patients	306	189	37.49	60.00
5	40-49 patients	345	207	38.46	60.00
6	50-59 patients	115	68	39.97	60.00
7	60-69 patients	136	97	26.84	60.00
8	70-79 patients	149	100	31.70	60.00
9	80-99 patients	0			
10	100-149 patients	114	50	55.33	60.00
11	150-199 patients	0			

[§] Survexp_max: Maximum theoretical follow up time for the first diagnosed patient. To be included in the funnel plot, Survexp_max of centres needed to be greater or equal to 60 months.

Figure 117 – Funnel plot of the 5-year observed survival for patients diagnosed with a gastric cancer who underwent surgical intervention, by centre, adjusted for sex, age and combined stage

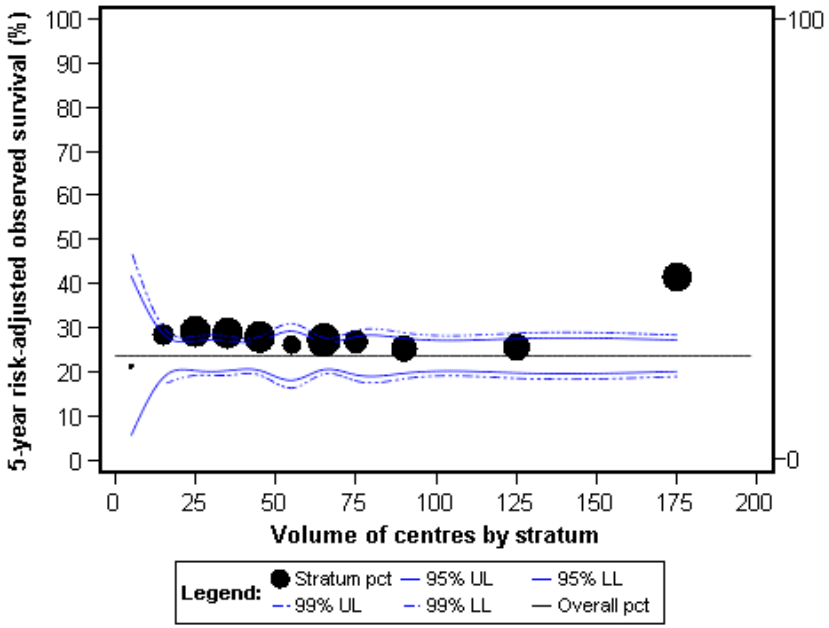


Note: For two centres the maximum theoretical follow up time is lower than 60 months for the first diagnosed patient, and they are therefore not reported in the funnel plot.

Table 195 – Number and proportion of outlying centres

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	1	0.92	1	0.92
Equal to 99%LL or lower than 95%LL	1	0.92	2	1.83
Between 95% control limits	85	77.98	87	79.82
Equal to 99%UL or upper than 95%UL	12	11.01	99	90.83
Upper than 99%UL	10	9.17	109	100.00

Figure 118 – Gastric cancer: 5-year Risk-adjusted observed survival in function of volume of centres with control limits* (adjustment for sex, age and combined stage)



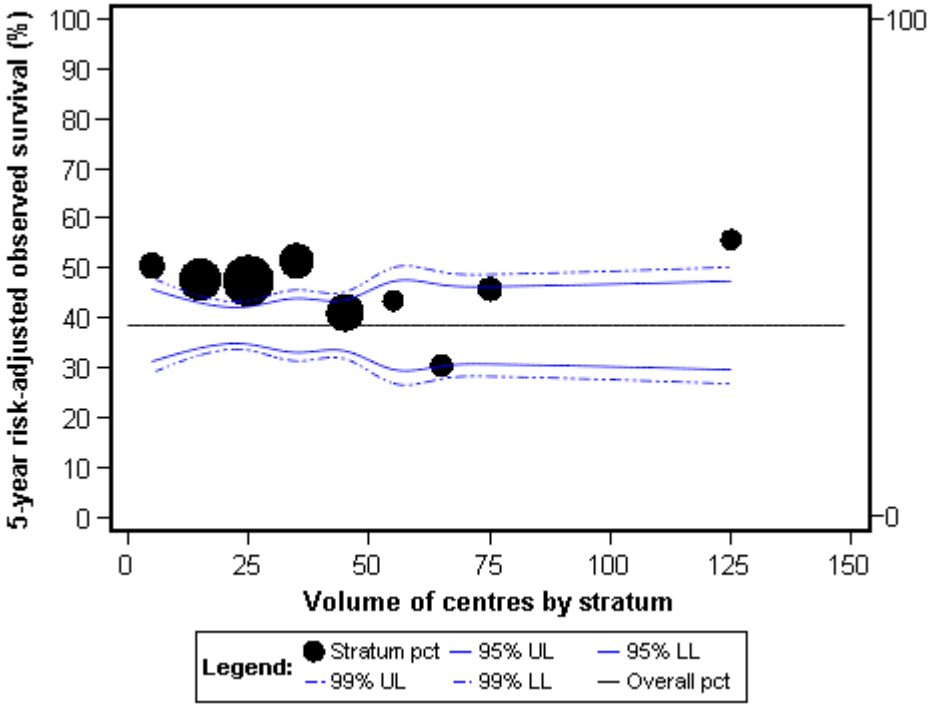
* Control limits were computed based on number of patients in each stratum

Table 196 – 5-year risk-adjusted observed survival in function of volume of centres grouped according to the volume of patients (risk-adjusted on sex, age and combined stage)

Category	Volume	N	Deaths	N survivors	Survival_sum [§]	Observed survival	Adjusted survival	Survexp_Max [§]
1	0-9 patients	21	17	4	4.42	15.87	21.29	60.00
2	10-19 patients	284	227	57	47.23	19.78	28.40	60.00
3	20-29 patients	603	467	136	109.8	22.06	29.13	60.00
4	30-39 patients	599	461	138	112.9	22.67	28.77	60.00
5	40-49 patients	623	479	144	121.4	22.64	27.90	60.00
6	50-59 patients	220	165	55	49.56	24.06	26.11	60.00
7	60-69 patients	704	550	154	133.4	21.00	27.16	60.00
8	70-79 patients	364	266	98	85.92	26.39	26.84	60.00
9	80-99 patients	435	338	97	90.20	21.05	25.31	60.00
10	100-149 patients	454	344	110	101.2	23.57	25.59	60.00
11	150-199 patients	540	360	180	102.1	32.49	41.49	60.00

[§] Survival_sum: Number of expected survivors from Cox regression model. Survexp_max: Maximum theoretical follow up time for the first diagnosed patient.

Figure 119 – Gastric cancer: 5-year Risk-adjusted observed survival for patients who underwent surgical intervention in function of volume of centres with control limits* (adjustment for sex, age and combined stage)



* Control limits were computed based on number of patients in each stratum

Table 197 – 5-year risk-adjusted observed survival in function of volume of centres grouped according to the volume of surgical patients (risk-adjusted on sex, age and combined stage)

Category	Volume	N	Deaths	N survivors	Survival_sum §	Observed survival	Adjusted survival	Survexp_Max §
1	0-9 patients	172	103	69	52.55	39.54	50.46	60.00
2	10-19 patients	440	273	167	134.5	37.33	47.70	60.00
3	20-29 patients	632	373	259	209.9	40.01	47.42	60.00
4	30-39 patients	306	189	117	87.41	37.49	51.44	60.00
5	40-49 patients	345	207	138	129.3	38.46	41.02	60.00
6	50-59 patients	115	68	47	41.58	39.97	43.43	60.00
7	60-69 patients	136	97	39	49.30	26.84	30.40	60.00
8	70-79 patients	149	100	49	41.15	31.70	45.76	60.00
9	80-99 patients	0						
10	100-149 patients	114	50	64	44.19	55.33	55.66	60.00
11	150-199 patients	0						

Table 198 – Gastric cancer: Univariate and multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality

	N	5-year OS (%)	5-year Overall Mortality (%)	Univariate HR	Univariate 95%CI	Univariate p-value	Multivariate HR	Multivariate 95%CI	Multivariate p-value
Sex						0.074			0.002
Men (Ref)	2 814	22.2	77.8	1			1		
Women	2 033	25.3	74.7	0.942	[0.882-1.006]		0.897	[0.839-0.959]	
Age (years)						<0.001			<0.001
0-49 (Ref)	333	47.4	52.6	1			1		
50-59	463	33.7	66.3	1.396	[1.159-1.682]		1.423	[1.180-1.716]	
60-69	919	31.1	68.9	1.565	[1.323-1.851]		1.568	[1.324-1.857]	
70-79	1 562	23.9	76.1	1.898	[1.619-2.226]		2.005	[1.707-2.354]	
80+	1 570	10.6	89.4	3.124	[2.667-3.659]		3.380	[2.879-3.969]	
Histology						<0.001			<0.001
Adenocarcinoma (Ref)	4 449	22.4	77.6	1			1		
Other	398	36.3	63.7	0.716	[0.630-0.814]		0.708	[0.620-0.807]	
Localisation						<0.001			
C16.1 Fundus of stomach	200	26.2	73.8	1					
C16.2 Body of stomach	193	20	80	1.084	[0.864-1.360]				
C16.3 Pyloric antrum	714	29.8	70.2	0.837	[0.696-1.007]				
C16.4 Pylorus	64	19.5	80.5	1.106	[0.804-1.521]				
C16.5 Lesser curvature of stomach, unspecified	138	33.6	66.4	0.763	[0.587-0.992]				
C16.6 Greater curvature of stomach, unspecified	58	28.6	71.4	0.881	[0.623-1.245]				
C16.8 + C16.9 Overlapping lesion of stomach + Stomach, unspecified	3 480	21.9	78.1	1.104	[0.934-1.303]				
Combined stage						<0.001			<0.001

	N	5-year OS (%)	5-year Overall Mortality (%)	Univariate HR	Univariate 95%CI	Univariate p-value	Multivariate HR	Multivariate 95%CI	Multivariate p-value
Stage I (Ref)	911	58.0	42.0	1			1		
Stage II	506	38.9	61.1	1.647	[1.415-1.917]		1.647	[1.414-1.917]	
Stage III	597	17.4	82.6	2.922	[2.552-3.347]		3.042	[2.656-3.485]	
Stage IV	1 141	3.3	96.7	5.651	[5.010-6.374]		6.422	[5.687-7. 251]	
Unknown	1 692	16.2	83.8	4.178	[3.723-4.689]		4.189	[3.728-4.709]	
Year of incidence						0.001			
2004 (Ref)	988	19.4	80.6	1					
2005	1 009	23.9	76.1	0.916	[0.830-1.012]				
2006	1 006	23.1	76.9	0.897	[0.812-0.990]				
2007	921	27.4	72.6	0.799	[0.721-0.886]				
2008	923	26.5	73.5	0.898	[0.810-0.995]				
Hospital volume of gastrectomies						<0.001			<0.001
Low (<6 per year) (Ref)	2 173	23.2	76.8	1			1		
Medium (6-19 per year)	2 487	22.5	77.5	0.982	0.919-1.049]		1.081	[1.011-1.155]	
High (≥20 per year)	187	40.1	59.9	0.607	[0.501-0.736]		0.749	[0.617-0.908]	

Table 199 – Gastric cancer: Univariate and multivariate analysis using Cox proportional hazard model to predict 5-year observed mortality of patients who underwent surgical intervention

	N	5-year OS (%)	5-year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Sex						0.47			0.426
Men (Ref)	1 444	37.7	62.3	1			1		
Women	965	39.6	60.4	0.962	[0866-1.069]		0.958	[0.861-1.065]	
Age (years)						<0.001			<0.001
0-49 (Ref)	195	57.1	42.9	1			1		
50-59	279	45.3	54.7	1.334	[1.021-1.745]		1.293	[0.987-1.695]	
60-69	523	45.7	54.3	1.345	[1.053-1.718]		1.318	[1.029-1.687]	
70-79	866	36.2	63.8	1.732	[1.375-2.183]		1.830	[1.447-2.315]	
80+	546	24.6	75.4	2.527	[1.995-3.201]		3.018	[2.372-3.839]	
Histology						0.702			0.036
Adenocarcinoma (Ref)	2 286	38.5	61.5	1			1		
Other	123	36.6	63.4	1.046	[0.831-1.316]		1.286	[1.017-1.627]	
Localisation						0.231			
C16.1 Fundus of stomach	76	40.6	59.4	1					
C16.2 Body of stomach	110	33.6	66.4	1.140	[0.783-1.661]				
C16.3 Pyloric antrum	427	41.9	58.1	0.908	[0.659-1.252]				
C16.4 Pylorus	39	32.1	67.9	1.227	[0.756-1.993]				
C16.5 Lesser curvature of stomach, unspecified	93	43.9	56.1	0.876	[0.585-1.311]				
C16.6 Greater curvature of stomach, unspecified	32	43.8	56.2	0.894	[0.517-1.547]				
C16.8 + C16.9 Overlapping lesion of stomach + Stomach, unspecified	1 632	37.5	62.5	1.063	[0.786-1.437]				
Combined stage						<0.001			<0.001
Stage I (Ref)	751	64.6	35.4	1			1		
Stage II	443	43.4	56.6	1.865	[1.565-2.222]		1.881	[1.578-2.243]	
Stage III	504	19.7	80.3	3.757	[3.208-4.400]		3.897	[3.326-4.566]	
Stage IV	416	7.0	93.0	6.264	[5.328-7.365]		6.989	[5.935-8.230]	
Unknown	295	40.9	59.1	2.235	[1.842-2.713]		2.313	[1.904-2.810]	

	N	5-year OS (%)	5-year Overall Mortality (%)	Univariate			Multivariate		
				HR	95%CI	p-value	HR	95%CI	p-value
Year of incidence						<0.001			
2004 (Ref)	488	32.0	68.0	1					
2005	528	37.3	62.7	0.875	[0.752-1.019]				
2006	516	39.2	60.8	0.815	[0.698-0.951]				
2007	455	43.3	56.7	0.705	[0598-0.830]				
2008	422	44.5	55.5	0.767	[0.648-0.907]				
Hospital volume of gastrectomies						0.001			0.005
Low (<6 per year) (Ref)	945	39.2	60.8	1			1		
Medium (6-19 per year)	1 350	36.4	63.6	1.050	[0.944-1.168]		1.110	[0.998-1.235]	
High (≥20 per year)	114	55.3	44.7	0.618	[0.463-1.825]		0.730	[0.546-0.975]	

Appendix 6.17.5. Discussion

Gastric cancer remains highly lethal as documented in other international studies [43, 81, 102, 106]. In Belgium, between 2004-2008, the observed 5-year survival was 22.2% in men and 25.3% in women. In England, Coupland et al. [81] investigated the incidence and survival of oesophageal and gastric cancers using data on 133 804 patients diagnosed between 1998 and 2007. Among patients with a cancer located in the cardia, 40.0% (95%CI 39.3-40.7%) survived 1 year and 10.9% (95%CI 10.4-11.4%) survived five years after diagnosis. Among patients with a non-cardia cancer, 40.8% (95%CI 40.0-41.6%) survived 1 year and 15.6% (95%CI 15.0-16.3%) survived 5 years after diagnosis. Over half of gastric cancers were NOS; 28.5% (95%CI 28.0-29.0%) of patients survived 1 year and 10.1% (95%CI 9.8-10.5%) survived 5 years after diagnosis. In the Netherlands, Dassen et al. [106] conducted a time trend analysis, and compared two periods (1990-1993 and 2002-2006). Five-year survival for patients with gastric cardia adenocarcinoma remained more or less stable (around 10%), while 5-year survival rates decreased for patients with non-cardia adenocarcinoma (from 22% to 14%, p=0.004). These poor survival was explained by the large proportion of patients with gastric cancer who had already reached stage IV at time of diagnosis (47% for cardia and 41% for non-cardia in 2006–2007), due to late presentation of symptoms and the lack of pathognomonic signs together with the absence of a screening programme [106].

A more recent report from National Oesophago-gastric Cancer Audit [30] reported the proportion of patients receiving a curative treatment (surgery with or without neoadjuvant chemotherapy) estimated to survive 1, 2 and 3 years from date of diagnosis (unadjusted Kaplan-Meier estimates). Results were clearly higher than those reported for a global population whatever the treatment administered (77.6% [95%CI 75.7-79.5] at 1 year, 59.7% [95%CI 57.4-61.9] at 2 years, and 49.4% [95%CI 47.1-51.2] at 3 years). Clearly, such population was restricted to non-metastatic patients.

Cox proportional hazard models were used to assess the influence of specific risk factors on the 5-year survival. Six risk factors were available for the regression model: patients' characteristics (age, sex), tumour characteristics (histological type, tumour localization and cancer stage) and the annual volume of gastrectomies (<6, 6-19 and ≥ 20 gastrectomies/year). Gender (higher mortality in men), older age, advanced stage and adenocarcinoma histological type were independently and significantly correlated with 5-year observed mortality. A clear association was also found between the yearly volume of gastrectomies performed by centre and the percentage of 5-year survivors: 23.2%, 22.5% and 40.1% for all patients with gastric cancer treated in low-volume, medium-volume and high-volume hospitals, respectively. After case-mix adjustment, patients in high-volume hospitals had a decreased risk of death compared to patients in low-volume hospitals (HR 0.75; 95%CI 0.62–0.91). For patients who benefited from a surgical intervention, the percentage of survivors in high-volume hospitals was clearly higher compared to low-volume hospitals (55.2% vs. 39.2%), confirming the previous association between volume of gastrectomies and 5 year-overall survival (HR 0.73; 95%CI 0.55–0.97).

Association between volume of gastrectomies and long-term survival was less extensively studied than the association between volume of gastrectomies and in-hospital mortality [62, 92, 107]. In particular, the relative importance of volume after gastrectomy is disputed. In The Netherlands, Dikken et al. [108] reported overall survival rates for 14 221 patients with resectable, non-metastatic gastric cancer who underwent a resection between 1989 and 2009. In this country, no minimum number of gastrectomies was required during this period, and the majority of gastric cancer resections were performed in low-volume hospitals. In 2009, 91 of the 92 hospitals in the Netherlands performed gastrectomies. To analyze volume-outcome associations, annual hospital volumes were defined as the number of gastrectomies per hospital per year. Clinically relevant volume categories were defined as very low (1-5 per year), low (6-10 per year), medium (11-20 per year), and high (≥21 per year). From 1989 to 2009, the annual number of gastrectomies steadily decreased (from 1 107 to 495) and the percentage of gastrectomies performed in high-volume hospitals decreased from 8% to 5%. Neither six-month mortality, nor three-year conditional survival were associated with hospital volume category whereas the same study revealed that increasing hospital volume was associated with lower mortality and increased long-term survival after esophagectomy. When analyzing hospital volume as a linear covariate, volume-survival results remained the same. Globally, patients treated in high-volume hospitals were older and had more advanced tumours. However, as of 2012 gastrectomies in the Netherlands will be centralized

to a minimum of 10/year, and as of 2013 to a minimum of 20/year [108]. In Denmark, centralization of gastric cancer surgery from 37 to 5 hospitals leaded to a drop in postoperative mortality from 8.4% to 2.1% over a period of 5 years [107].

In Belgium, gastrectomies are not concentrated in specialized centres, leading to a high dispersion. The highest volume centre reached a maximum of 114 gastrectomies within a 5-year period, i.e. 23 gastrectomies yearly. In the large majority of the centres (93%), less than 10 patients underwent a gastrectomy per year. However, in the current study, higher hospital volume of gastrectomies was statistically associated with lower mortality and increased long-term survival when centres performing at least 20 gastrectomies per year were compared to those performing less than 6 gastrectomies per year. Such positive association was found both for all patients with gastric cancer, who benefited from the higher specialization of all medical and nursing teams, and for patients who underwent a surgical intervention.

In other studies that did also find an association between gastrectomy in high volumes and good outcomes, the lower limit of high-volume surgery varied from 20/year up to 264/year [91, 92]. For example, in the US, Hannan reported that the highest-volume hospitals (and surgeons) had an absolute risk-adjusted mortality rate that was 7.1% lower (p<0.0001) than the lowest-volume hospitals, although the overall mortality rate for the procedure was only 6.2%.

Finally, the analysis did not reveal anything about quality of care. Some beneficial factors, supported by the literature, can be used to explain more positive results. Above all, accurate cancer staging, better patient selection, improved patient preparation for surgery and appropriate experience in managing postoperative complications are related to the knowledge, experience, and judgment of the specialists, working in a multidisciplinary team [25]. Some low volume hospitals obtained excellent results after gastrectomy. For this reason, some advocated to reconsider volume-based referral in outcome based-referral, after having conducted national audits [24].

Key points

- **Belgium reported higher 5-year survival rates than the majority of European countries, reaching 22.2% in men and 25.3% in women between 2004 and 2008**
- **Gender (higher mortality in men), older age, advanced stage and adenocarcinoma histological type were independently and significantly correlated with 5-year observed mortality.**
- **All patients with gastric cancer who were (medically or surgically) treated in high-volume hospitals (≥20 gastrectomies/year) had a decreased risk of death compared to patients who were treated in low-volume hospitals (< 6 gastrectomies/year [HR 0.75; 95%CI 0.62–0.91]).**
- **Taking only patients who were surgically treated into account, patients operated in high-volume (≥20 gastrectomies/year) hospitals had a decreased risk of death compared to patients in low-volume hospitals (< 6 gastrectomies/year [HR 0.73; 95%CI 0.55–0.97]).**
- **The influence of hospital volume on 5-year mortality was independent of the tumour characteristics (tumour stage, histology and topography), patient demographics (age and sex) and the year of incidence.**
- **This outcome indicator seems pertinent to compare all Belgian centres according to the volume of patients (surgically) treated per year.**

Appendix 6.18. GC14: Percentage of patients treated in high-volume hospitals

Appendix 6.18.1. Rationale

Postoperative mortality after gastrectomy for gastric cancer seems to be associated with the surgeon and hospital volume (low level of evidence [66, 67]). Centralization of gastric cancer surgery in dedicated high-volume centers, which also combine other favourable characteristics (infrastructure, specialization of medical professionals, outcome measures) could lead to better outcomes in this patient group.

In Denmark, both in 1996 and in 2001 the National Board of Health recommended that gastric cancer surgery was restricted to five university departments only [107]. A nationwide Danish study of patients undergoing surgery for gastric cancer found that centralization of treatment together with implementation of national clinical guidelines and the establishment of a national database was followed by clear improvement in surgical quality and in-hospital mortality [107]. However, it remains difficult to set a minimal volume to consider a hospital as a high-volume centre [27, 107]. Moreover, the overall decreasing incidence of gastric carcinoma will result in fewer cases per hospital over time [107].

Appendix 6.18.2. Definition

Type of quality indicator

Process indicator

Description

Proportion of patients with gastric cancer surgically treated in high-volume hospitals in a given year

Numerator

All patients with gastric cancer surgically treated in high-volume hospitals in a given year

Denominator

All patients with gastric cancer surgically treated in a given year

Appendix 6.18.3. Elaboration

Risk adjustment

- No risk adjustment

Sensitivity analyses

- No sensitivity analysis

Cut-offs to define low-, medium- and high-volume hospitals

- According to Dikken et al. 2012 (NL): Clinically relevant volume categories were defined as very low (1–5/year), low (6–10/year), medium (11–20/year), and high (≥21/year).
  - Low: <=5 per year (<=25 per 5 year)
  - Medium: 6-19 per year (26-99 per 5 year)
  - High: 20+ per year (>=100 per 5 year)

Data source(s)

Source database(s)

- BCR for source population
- IMA

Administrative codes

- Diagnosis of gastric cancer: ICD10 code C16.1 (BCR)
- Stage, histological type, anatomical site, year of incidence: BCR
- Treatment:
  - Surgery: nomenclature codes (IMA) (Appendix 8.3, Table 233)

Appendix 6.18.4. Results

Proportion of patients surgically treated in high-volume hospitals

Between 2004 and 2008, only 4.7% of the patients with gastric cancer were surgically treated in a high-volume centre (i.e. performing at least 20 gastrectomies per year) (Table 200). This proportion remained quite stable, although it was higher in 2006 (7.2%).

Older patients were less likely to be surgically treated in a high-volume hospital (Table 201: 70+ vs. 70-, OR = 0.55, 95%CI 0.37-0.82). No

statistically significant difference was found between men and women (Table 202: OR = 1.27, 95%CI 0.86-1.88), or by stage (Table 203).

Table 200 – Proportion of patients with gastric cancer surgically treated in high-volume hospitals

	Numerator	Denominator	Proportion (%)
2004	17	488	3.5
2005	21	528	4.0
2006	37	516	7.2
2007	17	455	3.7
2008	22	422	5.2
Total	**114**	**2 409**	**4.7**

Table 201 – Proportion of patients with gastric cancer surgically treated in high-volume hospitals, by age group

	Numerator	Denominator	Proportion (%)
<50	16	195	8.2
50-59y	15	279	5.4
60-69y	33	523	6.3
70-79y	31	866	3.6
80+	19	546	3.5
Total	**114**	**2 409**	**4.7**

Table 202 – Proportion of patients with gastric cancer surgically treated in high-volume hospitals, by sex

	Numerator	Denominator	Proportion (%)
Men	62	1 444	4.3
Women	52	965	5.4
Total	**114**	**2 409**	**4.7**

Table 203 – Proportion of patients with gastric cancer surgically treated in high-volume hospitals by stage (combined stage)

	Numerator	Denominator	Proportion (%)
I	37	751	4.9
II	19	443	4.3
III	24	504	4.8
IV	13	416	3.1
X	21	295	7.1
Total	**114**	**2 409**	**4.7**

Patient and tumour characteristics according to volume

Table 204 presents the same type of information as above but presented differently. The percentages correspond to the distribution of patient characteristics (age, sex,) *within each volume category*. This table shows that the proportion of men is higher in low-volume centres than in high-volume centres (61.3% vs. 54.4%), and that the proportion of older patients (+80 years old) is also higher in low-volume centres (25.0% vs. 16.7%). These factors have been accounted for in the volume-outcome analyses presented in the other sections.

Differences in the reporting of the stage to the BCR for patients operated for gastric cancer are less striking than for oesophageal cancer: the percentage of unreported staging is even higher in high-volume centres (18.4% missing stage for high-volume centres compared to 12.7% in low-volume centres). When all patients were taken into account, the problem of reporting the clinical stage to the BCR becomes even more clear (Table 205). This information is missing for 64.8% of the patients in low-volume centres, compared to 55.1% in high-volume centres.

Funnel plots depict the variability between centres to report clinical and pathological stage to the BCR (Figure 120, Figure 121 and Figure 122).

Table 204 – Gastric cancer: Differences in case mix of patients who underwent surgical intervention between low-, medium- and high-volume centres

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (>19 per year)	Total
N of hospitals	76	34	1	**111**
N of patients	945	1 350	114	**2 409**
Sex (%)				
Men	61.3	59.5	54.4	**59.9**
Women	38.7	40.5	45.6	**40.1**
Age (mean)	70.6	69.2	66.3	**69.6**
<50y (%)	7.1	8.3	14.0	**8.1**
50-59y (%)	10.3	12.4	13.2	**11.6**
60-69y (%)	21.4	21.3	29.0	**21.7**
70-79y (%)	36.3	36.4	27.2	**36.0**
80+ (%)	25.0	21.6	16.7	**22.7**
Histological type (%)				
AC	95.5	94.3	97.4	**94.9**
Other	5.6	5.7	2.6	**5.1**
Clinical stage (%)				
0*	0.6	0.2	1.9	**0.5**
I*	40.6	36.1	40.7	**38.1**
II*	24.8	24.3	24.1	**24.5**
III*	24.2	22.5	25.9	**23.3**
IV*	9.9	16.9	7.4	**13.6**
X	64.6	64.1	52.6	**63.7**
Pathological stage (%)				
I*	34.6	37.3	39.3	**36.4**
II*	22.3	19.8	20.2	**20.8**
III*	24.9	23.7	28.1	**24.3**
IV*	18.2	19.2	12.4	**18.5**
X	17.5	15.3	21.9	**16.4**
Combined stage (%)				
I*	33.7	36.5	39.8	**35.5**
II*	22.7	19.8	20.4	**21.0**
III*	25.2	22.7	25.8	**23.8**
IV*	18.4	21.0	14.0	**19.7**
X	12.7	11.4	18.4	**12.3**

* Unknown stage (X) is excluded to calculate the percentages

Table 205 – Gastric cancer: Differences in case mix between low-, medium- and high-volume centres, all patients (operated or not)

	Volume of centres (2004-2008)			
	Low (<6 per year)	Medium (6-19 per year)	High (>19 per year)	Total
N of hospitals	80	34	1	**115**
N of patients	2 173	2 487	187	**4 847**
Sex (%)				
Men	57.9	58.6	51.9	**58.1**
Women	42.1	41.4	48.1	**41.9**
Age (mean)	73.4	71.2	67.1	**72.0**
<50y (%)	5.8	7.3	19.9	**6.9**
50-59y (%)	8.2	10.5	13.4	**9.6**
60-69y (%)	17.2	20.2	23.0	**19.0**
70-79y (%)	32.5	32.3	28.3	**32.2**
80+ (%)	36.3	29.8	21.4	**32.4**
Histological type (%)				
AC	90.7	92.8	91.4	**91.8**
Other	9.3	7.2	8.6	**8.2**
Clinical stage (%)				
0*	0.3	0.1	1.2	**0.2**
I*	27.1	23.4	35.7	**25.5**
II*	15.0	15.0	15.5	**15.1**
III*	15.4	16.4	19.1	**16.1**
IV*	42.2	45.1	28.6	**43.1**
X	64.8	62.3	55.1	**63.1**
Pathological stage (%)				
I*	33.7	35.3	39.8	**34.9**
II*	20.4	18.3	18.4	**19.1**
III*	22.9	21.6	26.5	**22.3**
IV*	23.0	24.8	15.3	**23.7**
X	58.0	47.6	47.6	**52.3**
Combined stage (%)				
I*	28.0	29.1	36.0	**28.9**
II*	17.1	15.3	15.2	**16.0**
III*	19.0	18.7	20.8	**18.9**
IV*	36.0	36.9	28.0	**36.2**
X	39.3	31.2	33.2	**34.9**

* Unknown stage (X) is excluded to calculate the percentages

Figure 120 – Funnel plot of the proportion of patients diagnosed with gastric cancer with unknown clinical stage (cStage), by centre

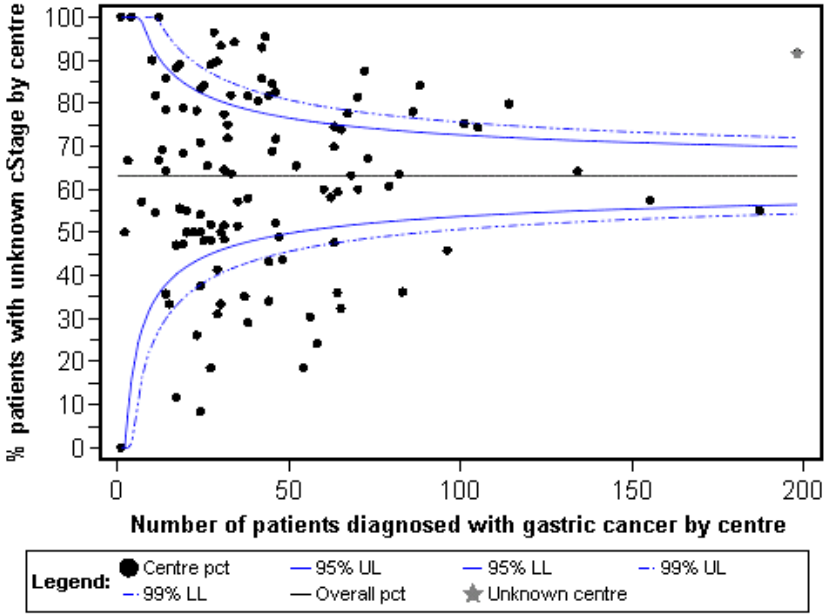


Table 206 – Number and proportion of outlying centres (unknown clinical stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	20	17.39	20	17.39
Equal to 99%LL or lower than 95%LL	6	5.22	26	22.61
Between 95% control limits	60	52.17	86	74.78
Equal to 99%UL or upper than 95%UL	11	9.57	97	84.35
Upper than 99%UL	18	15.65	115	100.00

Figure 121 – Funnel plot of the proportion of patients diagnosed with gastric cancer who underwent surgical intervention with unknown pathological stage (pStage), by centre

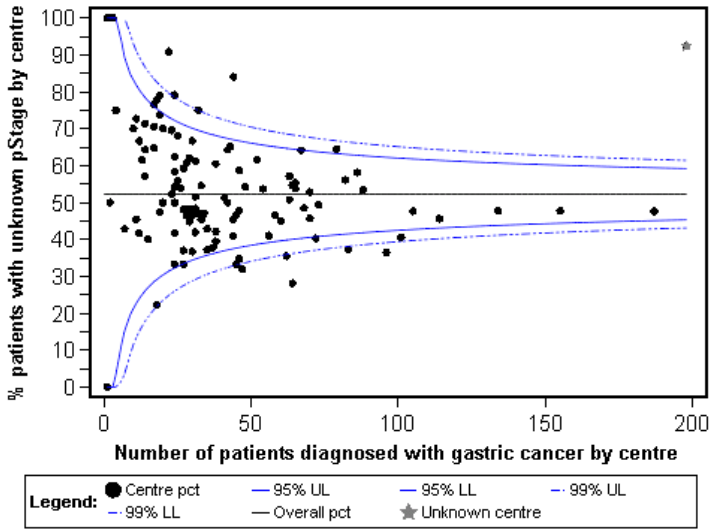


Figure 122 – Funnel plot of the proportion of patients diagnosed with gastric cancer with unknown combined stage (combStage), by centre

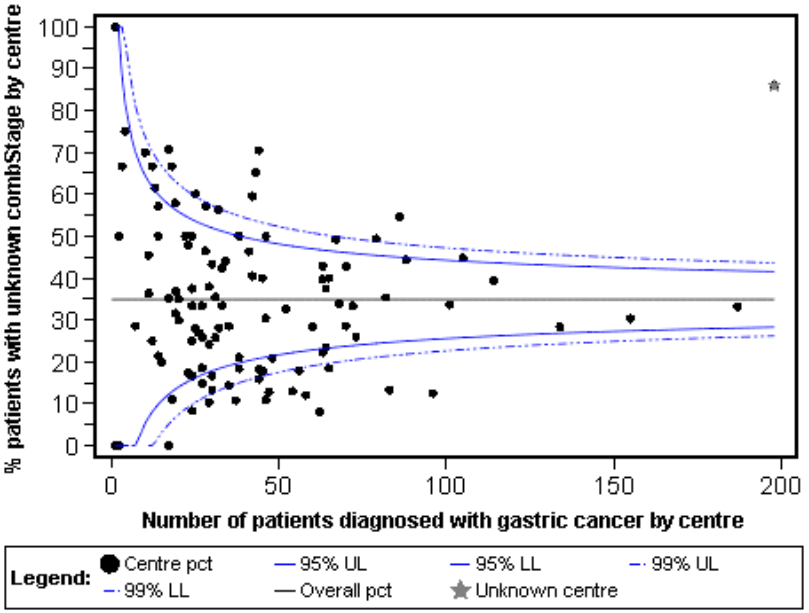


Table 207 – Number and proportion of outlying centres (unknown pathological stage)

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	5	4.35	5	4.35
Equal to 99%LL or lower than 95%LL	6	5.22	11	9.57
Between 95% control limits	95	82.61	106	92.17
Equal to 99%UL or upper than 95%UL	5	4.35	111	96.52
Upper than 99%UL	4	3.48	115	100.00

Table 208 – Number and proportion of outlying centres (unknown combined stage)…

	Frequency	Percent	Cumulative frequency	Cumulative percent
Lower than 99%LL	14	12.17	14	12.17
Equal to 99%LL or lower than 95%LL	10	8.70	24	20.87
Between 95% control limits	73	63.48	97	84.35
Equal to 99%UL or upper than 95%UL	9	7.83	106	92.17
Upper than 99%UL	9	7.83	115	100.00

Appendix 6.18.5. Discussion

Centralisation of care for patients with oesophagogastric cancer was recommended in the 2012 guidelines [8]. This recommendation was based on the evidence available from the scientific literature. In the period 2004-2008, 111 and 114 out of 115 acute Belgian hospitals delivered a medico-surgical treatment for patients with oesophageal and gastric cancer, respectively. During this period, only about 5% of patients with gastric cancer was treated in a high-volume hospital (defined as treating at least 20 patients with gastric cancer per year). Comparison of case-mix between the hospitals grouped by volume shows that patients operated in low- or high-volume centres are different: there were slightly more men in low-volume centers and more older patients. These factors have been accounted for in the volume-outcome analyses.

First, it is clear that the care for patients with oesophagogastric cancer was not centralised at all in the period 2004-2008, and very probably still is not. With the volume definitions that were used for the present report (high: ≥20 patients/year; medium: 6-19 patients/year; low: <6 patients/year), only two high-volume hospitals were identified for oesophageal cancer and only one for gastric cancer. Only about 35% and 5% of patients with oesophageal and gastric cancer, respectively, were treated at a high-volume centre. Second, clear differences were found in the case-mix according to hospital volume. For oesophageal cancer, high-volume centres treated more men, younger patients, more adenocarcinomas and less stage IV tumours. For gastric cancer, high-volume centres treated more women, younger patients, and less stage IV tumours. These results suggest that high-volume centres treated patients with more favourable characteristics. Third, for patients with oesophagogastric cancer that underwent surgery, hospital volume had a significant impact on postoperative mortality (for oesophageal cancer) and 5-year survival (for oesophageal and gastric cancer). For all patients with oesophagogastric cancer whatever their treatment, hospital volume had a significant impact on 5-year survival (for oesophageal and gastric cancer). Fourth, the results of the process indicators that were measurable with administrative data did not provide an explanation for this volume-outcome relationship. Furthermore, where the case-mix suggested that high-volume centres were treating patients with more favourable characteristics, the volume-outcome relationship persisted after correction for age, sex, stage and histological type.

A big caveat with these results is the absence of information on comorbidity. It is still possible that the differences in outcome according to volume can be explained by differences in comorbidity, i.e. that high-volume centres are treating patients with less comorbidity. To further explore this, comorbidity of cancer patients (e.g. with the WHO performance status) should be registered in a consistent way and it should be clearly defined what degree of comorbidity is considered to be clinically relevant. Currently, the Belgian Cancer Registry records the WHO performance score at diagnosis of all patients. However, less than half of all files reported this information between 2004 and 2008. Another option would be to construct a comorbidity score based on IMA data.

Despite this caveat, these results cannot be ignored and confirm the recommendation that was previously published, i.e. to centralise the care for patients with upper gastrointestinal cancer. This was supported in consensus by the experts that were involved in this project. However, this report does not allow to recommend on how to organise this centralisation. No search for an ideal volume cut-off point or for essential characteristics of centres or care providers was done. The discussion about these organisational issues should be done using this report as a starting point. The appropriate methodology for this discussion should be decided on first. Important questions to be answered are: is a minimal level of activity and experience needed? Can the results on process and outcome indicators be used to deliver accreditation to centres? Are structural

prerequisites (e.g. availability of radiotherapy facilities) recommended? The only available example of a similar discussion in the field of oncology in Belgium is breast cancer. Regulations were introduced by a Royal Decree on July 20th 2007. To be recognized as a breast clinic, a centre has to surgically treat at least 150 new patients per year since 2010.

Differences in reporting stage to BCR for patients operated for gastric cancer are less striking than for oesophageal cancer. Nevetheless, when all patients are taken into account (operated and not operated), there appears to be a real problem of reporting the clinical stage to the BCR: this information is missing for 64.8% of the patients in low-volume centers, compared to 55.1% in high-volume centres.The high proportion of missing stages was already reported previously in 2 KCE reports concerning other cancer types [4, 5]. It is difficult to find a good explanation for the underreporting of information that is actually that basic. Probably, the explanation is multifactorial. In some cases, the medical file probably contained insufficient information to decide on the final stage. In other cases, the necessary information was probably available, but no final decision regarding the stage was recorded on file or paper. Finally, in some cases all necessary information and the final stage was probably available in the medical file, but never communicated to the Cancer Registry. Anyhow, the high number of missing stages weakens the results of this report, since this information was needed for the elaboration or calculation of several indicators. During the discussion with clinical experts, it became clear that reporting of cancer stage should be included as a quality indicator. Furthermore, actions should be undertaken to improve the registration of the cancer stage. Linking the reimbursement of the multidisciplinary discussion to the registration of the cancer stage could be a solution.

Key Points

- **A minority of the patients operated for a gastric cancer is treated in high-volume centres: 4.7% over 2004-2008.**
- **Comparison of case-mix between the hospitals grouped by volume shows that patients operated in small or high volume centres are different: there were slightly more men in small volume centers and more older patients. These factors have been accounted for in the volume-outcome analyses.**
- **Differences in reporting stage to BCR for patients operated for gastric cancer are less striking than for oesophageal cancer. Nevetheless, when all patients are taken into account (operated and not operated), there appears to be a real problem of reporting the clinical stage to the BCR: this information is missing for 64.8% of the patients in low-volume centers, compared to 55.1% in high-volume centres.**

APPENDIX 7. DETAILED DISTRIBUTION OF TNM STAGING

Appendix 7.1. Oesophageal cancer

Table 209 – Oesophageal cancer (C15.0-15.9): clinical stage

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
In situ: Tis N0/x M0/x	7	0.2	7	0.2
Stage I: T1 N0 M0	211	4.8	218	5.0
Stage I: T1 N0 Mx	8	0.2	226	5.2
Stage I: T1 Nx M0	13	0.3	239	5.5
Stage I: T1 Nx Mx	11	0.3	250	5.7
Stage IIA: T2 N0 M0	150	3.4	400	9.2
Stage IIA: T2 N0 Mx	14	0.3	414	9.5
Stage IIA: T2 Nx M0	20	0.5	434	10.0
Stage IIA: T2 Nx Mx	14	0.3	448	10.3
Stage IIA: T3 N0 M0	146	3.4	594	13.6
Stage IIA: T3 N0 Mx	14	0.3	608	13.9
Stage IIA: T3 Nx M0	33	0.8	641	14.7
Stage IIA: T3 Nx Mx	19	0.4	660	15.1
Stage IIB: T1 N1 M0	91	2.1	751	17.2
Stage IIB: T1 N1 Mx	18	0.4	769	17.6
Stage IIB: T1 N2 M0	3	0.1	772	17.7
Stage IIB: T1 N2 Mx	2	0.1	774	17.8
Stage IIB: T1 N3 M0	3	0.1	777	17.8
Stage IIB: T2 N1 M0	126	2.9	903	20.7
Stage IIB: T2 N1 Mx	18	0.4	921	21.1

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IIB: T2 N2 M0	7	0.2	928	21.3
Stage IIB: T2 N2 Mx	3	0.1	931	21.4
Stage III: T3 N1 M0	513	11.8	1 444	33.1
Stage III: T3 N1 Mx	71	1.6	1 515	34.7
Stage III: T3 N2 M0	18	0.4	1 533	35.2
Stage III: T3 N2 Mx	8	0.2	1 541	35.3
Stage III: T3 N3 M0	1	0.0	1 542	35.4
Stage III: T3 N3 Mx	1	0.0	1 543	35.4
Stage III: T4 N0 M0	25	0.6	1 568	36.0
Stage III: T4 N1 M0	97	2.2	1 665	38.2
Stage III: T4 N1 Mx	28	0.6	1 693	38.8
Stage III: T4 N2 M0	9	0.2	1 702	39.0
Stage III: T4 N2 Mx	3	0.1	1 705	39.1
Stage III: T4 N3 M0	1	0.0	1 706	39.1
Stage III: T4 N3 Mx	2	0.1	1 708	39.2
Stage III: T4 Nx M0	14	0.3	1 722	39.5
Stage III: T4 Nx Mx	14	0.3	1 736	39.8
Stage IV: T1 N0 M1	2	0.1	1 738	39.9
Stage IV: T1 N1 M1	8	0.2	1 746	40.0
Stage IV: T1 N2 M1	1	0.0	1 747	40.1
Stage IV: T1 N3 M1	1	0.0	1 748	40.1
Stage IV: T1 Nx M1	2	0.1	1 750	40.1
Stage IV: T2 N0 M1	11	0.3	1 761	40.4
Stage IV: T2 N1 M1	41	0.9	1 802	41.3
Stage IV: T2 N2 M1	5	0.1	1 807	41.4

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IV: T2 N3 M1	3	0.1	1 810	41.5
Stage IV: T2 Nx M1	11	0.3	1 821	41.8
Stage IV: T3 N0 M1	13	0.3	1 834	42.1
Stage IV: T3 N1 M1	223	5.1	2 057	47.2
Stage IV: T3 N2 M1	21	0.5	2 078	47.7
Stage IV: T3 N3 M1	2	0.1	2 080	47.7
Stage IV: T3 Nx M1	25	0.6	2 105	48.3
Stage IV: T4 N0 M1	10	0.2	2 115	48.5
Stage IV: T4 N1 M1	118	2.7	2 233	51.2
Stage IV: T4 N2 M1	26	0.6	2 259	51.8
Stage IV: T4 N3 M1	3	0.1	2 262	51.9
Stage IV: T4 Nx M1	148	3.4	2 410	55.3
Stage IVA: T1 N1 M1a	1	0.0	2 411	55.3
Stage IVA: T2 N1 M1a	9	0.2	2 420	55.5
Stage IVA: T2 N2 M1a	2	0.1	2 422	55.5
Stage IVA: T3 N0 M1a	2	0.1	2 424	55.6
Stage IVA: T3 N1 M1a	62	1.4	2 486	57.0
Stage IVA: T3 N2 M1a	2	0.1	2 488	57.1
Stage IVA: T4 N0 M1a	1	0.0	2 489	57.1
Stage IVA: T4 N1 M1a	11	0.3	2 500	57.3
Stage IVA: T4 N2 M1a	2	0.1	2 502	57.4
Stage IVA: T4 Nx M1a	4	0.1	2 506	57.5
Stage IVB: T1 N2 M1b	2	0.1	2 508	57.5
Stage IVB: T2 N1 M1b	9	0.2	2 517	57.7
Stage IVB: T3 N1 M1b	48	1.1	2 565	58.8

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IVB: T3 N2 M1b	2	0.1	2 567	58.9
Stage IVB: T3 Nx M1b	3	0.1	2 570	58.9
Stage IVB: T4 N0 M1b	2	0.1	2 572	59.0
Stage IVB: T4 N1 M1b	14	0.3	2 586	59.3
Stage IVB: T4 Nx M1b	5	0.1	2 591	59.4
Stage X: Tx Nx Mx	198	4.5	2 789	64.0
Stage: X Tx Nx M0	1 572	36.1	4 361	100.0

Table 210 – Oesophageal cancer (C16.0): clinical stage

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IA: T1 N0 M0	57	3.9	57	3.9
Stage IA: T1 N0 Mx	4	0.3	61	4.2
Stage IA: T1 Nx M0	5	0.3	66	4.6
Stage IA: T1 Nx Mx	7	0.5	73	5.0
Stage IB: T1 N1 M0	7	0.5	80	5.5
Stage IB: T2 N0 M0	43	3.0	123	8.5
Stage IB: T2 N0 Mx	6	0.4	129	8.9
Stage IB: T2 Nx M0	9	0.6	138	9.5
Stage IB: T2 Nx Mx	9	0.6	147	10.1
Stage IB: Tx N1 M0	7	0.5	154	10.6
Stage IB: Tx N1 Mx	4	0.3	158	10.9
Stage II: T2 N1 M0	40	2.8	198	13.6

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage II: T2 N1 Mx	5	0.3	203	14.0
Stage II: T3 N0 M0	63	4.3	266	18.3
Stage II: T3 N0 Mx	3	0.2	269	18.5
Stage II: T3 Nx M0	16	1.1	285	19.6
Stage II: T3 Nx Mx	6	0.4	291	20.0
Stage II: Tx N2 M0	1	0.1	292	20.1
Stage IIIA: T2 N2 M0	2	0.1	294	20.3
Stage IIIA: T2 N2 Mx	1	0.1	295	20.3
Stage IIIA: T3 N1 M0	155	10.7	450	31.0
Stage IIIA: T3 N1 Mx	29	2.0	479	33.0
Stage IIIA: T4 N0 M0	3	0.2	482	33.2
Stage IIIA: T4 Nx M0	3	0.2	485	33.4
Stage IIIA: T4 Nx Mx	2	0.1	487	33.5
Stage IIIB: T3 N2 M0	13	0.9	500	34.4
Stage IIIB: T3 N2 Mx	8	0.6	508	35.0
Stage IV: T1 N1 M1	1	0.1	509	35.1
Stage IV: T1 Nx M1	4	0.3	513	35.3
Stage IV: T2 N0 M1	4	0.3	517	35.6
Stage IV: T2 N1 M1	13	0.9	530	36.5
Stage IV: T2 N2 M1	4	0.3	534	36.8
Stage IV: T2 N3 M1	2	0.1	536	36.9
Stage IV: T2 Nx M1	5	0.3	541	37.3
Stage IV: T3 N0 M1	5	0.3	546	37.6
Stage IV: T3 N1 M1	97	6.7	643	44.3
Stage IV: T3 N2 M1	23	1.6	666	45.9

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IV: T3 N3 M0	1	0.1	667	45.9
Stage IV: T3 N3 M1	3	0.2	670	46.1
Stage IV: T3 Nx M1	9	0.6	679	46.8
Stage IV: T4 N0 M1	2	0.1	681	46.9
Stage IV: T4 N1 M0	10	0.7	691	47.6
Stage IV: T4 N1 M1	17	1.2	708	48.8
Stage IV: T4 N1 Mx	2	0.1	710	48.9
Stage IV: T4 N2 M0	2	0.1	712	49.0
Stage IV: T4 N2 M1	3	0.2	715	49.2
Stage IV: T4 N2 Mx	2	0.1	717	49.4
Stage IV: T4 Nx M1	6	0.4	723	49.8
Stage IV: Tx N0 M1	4	0.3	727	50.1
Stage IV: Tx N1 M1	26	1.8	753	51.9
Stage IV: Tx N2 M1	7	0.5	760	52.3
Stage IV: Tx N3 M1	2	0.1	762	52.5
Stage IV: Tx Nx M1	72	5.0	834	57.4
Stage X: Tx Nx M0	96	6.6	930	64.1
Stage X: Tx Nx Mx	522	36.0	1 452	100.0

Table 211 – Oesophageal cancer (C15.0-15.9): pathological stage for patients who underwent surgery

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage I: T1 N0 Mx	244	19.7	244	19.7
Stage I: T1 Nx Mx	20	1.6	264	21.3

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IIA: T2 N0 Mx	95	7.7	359	29.0
Stage IIA: T2 Nx Mx	3	0.2	362	29.2
Stage IIA: T3 N0 Mx	113	9.1	475	38.3
Stage IIA: T3 Nx Mx	17	1.4	492	39.7
Stage IIB: T1 N1 Mx	58	4.7	550	44.4
Stage IIB: T1 N3 Mx	1	0.1	551	44.4
Stage IIB: T2 N1 Mx	57	4.6	608	49.0
Stage IIB: T2 N2 Mx	1	0.1	609	49.1
Stage IIB: T2 N3 Mx	2	0.2	611	49.3
Stage III: T3 N1 Mx	223	18.0	834	67.3
Stage III: T3 N2 Mx	8	0.7	842	67.9
Stage III: T3 N3 Mx	1	0.1	843	68.0
Stage III: T4 N0 Mx	4	0.3	847	68.3
Stage III: T4 N1 Mx	8	0.7	855	69.0
Stage IV: T1 N0 M1	2	0.2	857	69.1
Stage IV: T1 N1 M1	2	0.2	859	69.3
Stage IV: T2 N0 M1	1	0.1	860	69.4
Stage IV: T2 N1 M1	1	0.1	861	69.4
Stage IV: T3 N0 M1	3	0.2	864	69.7
Stage IV: T3 N1 M1	15	1.2	879	70.9
Stage IV: T3 N2 M1	3	0.2	882	71.1
Stage IV: T3 Nx M1	1	0.1	883	71.2
Stage IV: T4 N1 M1	1	0.1	884	71.3
Stage IV: T4 Nx M1	1	0.1	885	71.4
Stage IVA: T2 N1 M1a	1	0.1	886	71.5

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IVA: T3 N1 M1a	7	0.6	893	72.0
Stage IVA: T4 N1 M1a	3	0.2	896	72.3
Stage IVB: T3 N1 M1b	8	0.7	904	72.9
Stage IVB: T4 N1 M1b	1	0.1	905	73.0
Stage X: Tx Nx Mx	335	27.0	1 240	100.0

Table 212 – Oesophageal cancer (C16.0): pathological stage for patients who underwent surgery

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IA: T1 N0 Mx	71	9.6	71	9.6
Stage IA: T1 Nx Mx	4	0.5	75	10.2
Stage IB: T1 N1 Mx	20	2.7	95	12.9
Stage IB: T2 N0 Mx	75	10.2	170	23.1
Stage IB: T2 Nx Mx	6	0.8	176	23.9
Stage IB: Tx N1 Mx	1	0.1	177	24.0
Stage II: T2 N1 Mx	112	15.2	289	39.2
Stage II: T3 N0 Mx	51	6.9	340	46.1
Stage II: T3 Nx Mx	10	1.4	350	47.5
Stage IIIA: T2 N2 Mx	26	3.5	376	51.0
Stage IIIA: T3 N1 Mx	123	16.7	499	67.7
Stage IIIA: T4 N0 Mx	3	0.4	502	68.1
Stage IIIB: T3 N2 Mx	33	4.5	535	72.6
Stage IV: T1 N0 M1	1	0.1	536	72.7

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IV: T1 N1 M1	1	0.1	537	72.9
Stage IV: T1 N3 Mx	1	0.1	538	73.0
Stage IV: T2 N0 M1	3	0.4	541	73.4
Stage IV: T2 N1 M1	5	0.7	546	74.1
Stage IV: T2 N2 M1	5	0.7	551	74.8
Stage IV: T2 N3 Mx	5	0.7	556	75.4
Stage IV: T3 N0 M1	1	0.1	557	75.6
Stage IV: T3 N1 M1	10	1.4	567	76.9
Stage IV: T3 N2 M1	5	0.7	572	77.6
Stage IV: T3 N3 M1	2	0.3	574	77.9
Stage IV: T3 N3 Mx	14	1.9	588	79.8
Stage IV: T4 N0 M1	2	0.3	590	80.1
Stage IV: T4 N1 M1	4	0.5	594	80.6
Stage IV: T4 N1 Mx	12	1.6	606	82.2
Stage IV: T4 N2 M1	3	0.4	609	82.6
Stage IV: T4 N2 Mx	7	1.0	616	83.6
Stage IV: T4 N3 M1	2	0.3	618	83.9
Stage IV: T4 N3 Mx	1	0.1	619	84.0
Stage IV: T4 Nx M1	1	0.1	620	84.1
Stage X: Tx Nx Mx	117	15.9	737	100.0

Appendix 7.2. Gastric cancer

Table 213 – Gastric cancer: clinical stage

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
In situ: Tis N0/x M0	4	0.1	4	0.1
Stage IA: T1 N0 M0	141	2.9	145	3.0
Stage IA: T1 N0 Mx	8	0.2	153	3.2
Stage IA: T1 Nx M0	16	0.3	169	3.5
Stage IA: T1 Nx Mx	14	0.3	183	3.8
Stage IB: T1 N1 M0	10	0.2	193	4.0
Stage IB: T1 N1 Mx	3	0.1	196	4.0
Stage IB: T2 N0 M0	140	2.9	336	6.9
Stage IB: T2 N0 Mx	14	0.3	350	7.2
Stage IB: T2 Nx M0	22	0.5	372	7.7
Stage IB: T2 Nx Mx	23	0.5	395	8.2
Stage IB: Tx N1 M0	54	1.1	449	9.3
Stage IB: Tx N1 Mx	11	0.2	460	9.5
Stage II: T1 N2 M0	1	0.0	461	9.5
Stage II: T2 N1 M0	66	1.4	527	10.9
Stage II: T2 N1 Mx	6	0.1	533	11.0
Stage II: T3 N0 M0	107	2.2	640	13.2
Stage II: T3 N0 Mx	11	0.2	651	13.4
Stage II: T3 Nx M0	38	0.8	689	14.2
Stage II: T3 Nx Mx	31	0.6	720	14.9
Stage II: Tx N2 M0	8	0.2	728	15.0
Stage II: Tx N2 Mx	1	0.0	729	15.0

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IIIA: T2 N2 M0	12	0.3	741	15.3
Stage IIIA: T2 N2 Mx	1	0.0	742	15.3
Stage IIIA: T3 N1 M0	140	2.9	882	18.2
Stage IIIA: T3 N1 Mx	28	0.6	910	18.8
Stage IIIA: T4 N0 M0	25	0.5	935	19.3
Stage IIIA: T4 N0 Mx	4	0.1	939	19.4
Stage IIIA: T4 Nx M0	8	0.2	947	19.5
Stage IIIA: T4 Nx Mx	22	0.5	969	20.0
Stage IIIB: T3 N2 M0	42	0.9	1,011	20.9
Stage IIIB: T3 N2 Mx	6	0.1	1,017	21.0
Stage IV: T1 N0 M1	4	0.1	1,021	21.1
Stage IV: T1 N1 M1	4	0.1	1,025	21.2
Stage IV: T1 N2 M1	2	0.0	1,027	21.2
Stage IV: T1 N3 M1	1	0.0	1,028	21.2
Stage IV: T1 Nx M1	2	0.0	1,030	21.3
Stage IV: T2 N0 M1	10	0.2	1,040	21.5
Stage IV: T2 N1 M1	17	0.4	1,057	21.8
Stage IV: T2 N2 M1	8	0.2	1,065	22.0
Stage IV: T2 N3 M0	2	0.0	1,067	22.0
Stage IV: T2 N3 M1	2	0.0	1,069	22.1
Stage IV: T2 N3 Mx	1	0.0	1,070	22.1
Stage IV: T2 Nx M1	15	0.3	1,085	22.4
Stage IV: T3 N0 M1	11	0.2	1,096	22.6
Stage IV: T3 N1 M1	68	1.4	1,164	24.0
Stage IV: T3 N2 M1	30	0.6	1,194	24.6

Clinical stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IV: T3 N3 M0	2	0.0	1,196	24.7
Stage IV: T3 N3 M1	3	0.1	1,199	24.7
Stage IV: T3 N3 Mx	1	0.0	1,200	24.8
Stage IV: T3 Nx M1	34	0.7	1,234	25.5
Stage IV: T4 N0 M1	6	0.1	1,240	25.6
Stage IV: T4 N1 M0	37	0.8	1,277	26.4
Stage IV: T4 N1 M1	37	0.8	1,314	27.1
Stage IV: T4 N1 Mx	12	0.3	1,326	27.4
Stage IV: T4 N2 M0	12	0.3	1,338	27.6
Stage IV: T4 N2 M1	21	0.4	1,359	28.0
Stage IV: T4 N2 Mx	6	0.1	1,365	28.2
Stage IV: T4 N3 M0	4	0.1	1,369	28.2
Stage IV: T4 N3 M1	4	0.1	1,373	28.3
Stage IV: T4 Nx M1	39	0.8	1,412	29.1
Stage IV: Tx N0 M1	21	0.4	1,433	29.6
Stage IV: Tx N1 M1	53	1.1	1,486	30.7
Stage IV: Tx N2 M1	10	0.2	1,496	30.9
Stage IV: Tx N3 M0	2	0.0	1,498	30.9
Stage IV: Tx N3 M1	4	0.1	1,502	31.0
Stage IV: Tx Nx M1	285	5.9	1,787	36.9
Stage X: Tx Nx M0	402	8.3	2,189	45.2
Stage X: Tx Nx Mx	2,658	54.8	4,847	100.0

Table 214 – Gastric cancer: pathological stage for patients who underwent surgery

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IA: T1 N0 Mx	311	12.9	311	12.9
Stage IA: T1 Nx Mx	30	1.3	341	14.2
Stage IB: T1 N1 Mx	54	2.2	395	16.4
Stage IB: T2 N0 Mx	301	12.5	696	28.9
Stage IB: T2 Nx Mx	34	1.4	730	30.3
Stage IB: Tx N1 Mx	2	0.1	732	30.4
Stage II: T1 N2 Mx	5	0.2	737	30.6
Stage II: T2 N1 Mx	307	12.7	1,044	43.3
Stage II: T3 N0 Mx	87	3.6	1,131	47.0
Stage II: T3 Nx Mx	18	0.8	1,149	47.7
Stage II: Tx N2 Mx	1	0.0	1,150	47.7
Stage IIIA: T2 N2 Mx	106	4.4	1,256	52.1
Stage IIIA: T3 N1 Mx	205	8.5	1,461	60.7
Stage IIIA: T4 N0 Mx	24	1.0	1,485	61.6
Stage IIIA: T4 Nx Mx	3	0.1	1,488	61.8
Stage IIIB: T3 N2 Mx	152	6.3	1,640	68.1
Stage IV: T1 N0 M1	2	0.1	1,642	68.2
Stage IV: T1 N1 M1	1	0.0	1,643	68.2
Stage IV: T1 N3 Mx	1	0.0	1,644	68.2
Stage IV: T2 N0 M1	2	0.1	1,646	68.3
Stage IV: T2 N1 M1	16	0.7	1,662	69.0
Stage IV: T2 N2 M1	14	0.6	1,676	69.6
Stage IV: T2 N3 M1	4	0.2	1,680	69.7
Stage IV: T2 N3 Mx	34	1.4	1,714	71.2

Pathological stage	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Stage IV: T3 N0 M1	6	0.3	1,720	71.4
Stage IV: T3 N1 M1	30	1.3	1,750	72.6
Stage IV: T3 N2 M1	38	1.6	1,788	74.2
Stage IV: T3 N3 M1	19	0.8	1,807	75.0
Stage IV: T3 N3 Mx	59	2.5	1,866	77.5
Stage IV: T3 Nx M1	1	0.0	1,867	77.5
Stage IV: T4 N0 M1	2	0.1	1,869	77.6
Stage IV: T4 N1 M1	12	0.5	1,881	78.1
Stage IV: T4 N1 Mx	45	1.9	1,926	80.0
Stage IV: T4 N2 M1	16	0.7	1,942	80.6
Stage IV: T4 N2 Mx	40	1.7	1,982	82.3
Stage IV: T4 N3 M1	12	0.5	1,994	82.8
Stage IV: T4 N3 Mx	11	0.5	2,005	83.2
Stage IV: T4 Nx M1	2	0.1	2,007	83.3
Stage IV: Tx N1 M1	1	0.0	2,008	83.4
Stage IV: Tx Nx M1	5	0.2	2,013	83.6
Stage X: Tx Nx Mx	396	16.4	2,409	100.0

APPENDIX 8. NOMENCLATURE CODES

Appendix 8.1.1. MDT meeting

Table 215 – Nomenclature codes for MDT meeting

Outpatient code	Inpatient code	Dutch description	French description
350372	350383	Schriftelijk verslag van een multidisciplinair oncologisch consult met deelname van minstens drie geneesheren van verschillende specialismen onder leiding van een geneesheer-coördinator, met beschrijving van de diagnose en van het behandelingsplan	Rapport écrit d'une concertation oncologique multidisciplinaire avec la participation d'au moins trois médecins de spécialités différentes sous la direction d'un médecin-coordinateur et reprenant la description du diagnostic et du plan de traitement
350394	350405	Deelname aan multidisciplinair oncologisch consult	Participation à la concertation oncologique multidisciplinaire
350416	350420	Deelname aan multidisciplinair oncologisch consult door de behandelende arts die geen deel uitmaakt van de ziekenhuisstaf	Participation à la concertation oncologique multidisciplinaire par le médecin traitant qui n'est pas membre de l'équipe hospitalière

Since November 1st 2011, new nomenclature codes became available: 350276-350280 and 350291-350302. These will not be considered for the present project (cfr. patient selection).

Appendix 8.1.2. Imaging

Computed tomography

Table 216 – Nomenclature codes for CT

Outpatient code	Inpatient code	Dutch description	French description
458533	458544	Verstrekkingen waarvoor de bekwaming van specialist voor röntgendiagnose (R) vereist is - Computergestuurde tomografieën: Computergestuurde tomografie van de hals (weke delen) of van de thorax of van het abdomen, met en/of zonder contrastmiddel, met registreren en clichés, minimum 15 coupes, voor het hele onderzoek	Prestations qui requièrent la qualification de médecin spécialiste en radiodiagnostic (R) - Tomographies par ordinateur : Tomographie commandée par ordinateur, du cou (parties molles) ou du thorax, ou de l'abdomen,avec et/ou sans moyen de contraste, avec enregistrement et clichés, 15 coupes au minimum, pour l'ensemble de l'examen
458813	458824	Computergestuurde tomografie van de hals (weke delen) of van de thorax of van het abdomen, met en/of zonder contrastmiddel, met registreren en clichés, minimum 15 coupes, voor het hele onderzoek	Tomographie commandée par ordinateur, du cou (parties molles) ou du thorax, ou de l'abdomen,avec et/ou sans moyen de contraste, avec enregistrement et clichés, 15 coupes au minimum, pour l'ensemble de l'examen

Magnetic Resonance Imaging

Table 217 – Nomenclature codes for MRI

Outpatient code	Inpatient code	Dutch description	French description
459410	459421	NMR-onderzoek van de hals of van de thorax of van het abdomen of van het bekken, minstens drie sequenties, met of zonder contrast, met registratie op optische of elektromagnetische drager	Examen d'IRM du cou ou du thorax ou de l'abdomen ou du bassin, minimum 3 séquences, avec ou sans contraste, avec enregistrement sur support soit optique, soit électromagnétique

Positron Emission Tomography

Table 218 – Nomenclature codes for PET

Outpatient code	Inpatient code	Dutch description	French description
442971	442982	Positronentomografisch onderzoek door coïncidentiedetectie met protocol en documenten, voor het geheel van het onderzoek	Tomographie à positrons par détection en coïncidence avec protocole et documents, pour l'ensemble de l'examen
442595	442606	Functionele scintigrafische test die twee opeenvolgende tomografische onderzoeken omvat, met verwerking op computer, die ten minste twee niet-parallelle reconstructievlakken omvat, met protocol en iconografische documenten, niet cumuleerbaar met de verstrekkingen 442411 - 442422, 442455 - 442466, 442610 - 442621 en 442632 - 442643 voor het onderzoek van een zelfde functie dat met een zelfde gemerkt produkt wordt verricht	Test scintigraphique fonctionnel comportant deux examens tomographiques successifs avec traitement par ordinateur comprenant au moins deux plans non parallèles de reconstruction, avec protocole et documents iconographiques, non cumulable avec les prestations 442411 - 442422, 442455 - 442466, 442610 - 442621 et 442632 - 442643 pour l'examen d'une même fonction effectué au moyen d'un même produit marqué

Appendix 8.1.3. Tissue / cell examination

Biopsy

Table 219 – Nomenclature codes for biopsy

Outpatient code	Inpatient code	Dutch description	French description
588011	588022	Honorarium voor het pathologisch-anatomische onderzoek door inclusie en coupe van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen en met inbegrip van het eventueel macroscopisch onderzoek van operatiestukken, voor die prelevementen die niet overeenkomen met de prestaties 588232 - 588243, 588254 - 588265, 588276 - 588280 of 588291 - 588302	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe d'autant de prélèvements que nécessaire, quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, y compris l'examen macroscopique éventuel des pièces opératoires, pour les prélèvements ne correspondant pas aux prestations 588232 - 588243, 588254 - 588265, 588276 - 588280 ou 588291 - 588302
588033	588044	Peroperatoir pathologisch-anatomisch extempore onderzoek, ongeacht het aantal afnamen volgens de vriesmethode en ongeacht het aantal verrichte	Examen peropératoire extemporané quel que soit le nombre de prélèvements examinés par la technique de congélation et quel que soit le nombre de

Outpatient code	Inpatient code	Dutch description	French description
		controle-onderzoeken na inclusie en coupe	contrôles effectués après inclusion et coupe
588070	588081	Immunohistologische onderzoeken (maximum 4 per afname) voor het aantonen van antigenen in de coupes, na incubatie met antisera, per gebruikt antiserum	Examens immunohistologiques (maximum 4 par prélèvement) pour révéler des antigènes sur des coupes, après incubation d'anticorps, par anti-sérum
588114	588125	Pathologisch-anatomisch onderzoek met een elektronenmicroscoop, ongeacht de aangewende techniek of technieken, ongeacht het aantal afnamen	Examen anatomo-pathologique avec microscope électronique quelle(s) que soi(en)t la ou les technique(s) utilisée(s), quel que soit le nombre de prélèvements
588232	588243	Honorarium voor het pathologisch-anatomisch onderzoek door inclusie en coupe, van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen, en met inbegrip van het eventueel macroscopisch onderzoek voor volgende prelevementen - vagotomie - vasectomie - tuba-ligatuur - tonsillectomie (< 18 jaar) - adenoidectomie (< 18 jaar) - sympathectomie	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe, d'autant de prélèvements que nécessaire, quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, et y compris l'examen macroscopique éventuel, pour les prélèvements suivants : - vagotomie - vasectomie - ligature tubaire - amygdalectomie (< 18 ans) - adenoidectomie (<18 ans) - sympathectomie
588276	588280	Honorarium voor het pathologisch-anatomisch onderzoek, door inclusie en coupe, van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen, en met inbegrip van het eventueel macroscopisch onderzoek voor volgende operatiestukken : - lymfeklierexerese, - eenzijdige lymfeklier okselevidement, - eenzijdige lymfeklier liesevidement, - heelkundige longbiopsie, - totale of partiële thymectomie, - resectie van subaponeurotische tumoren, - partiële pancreatectomie, - partiële hepatectomie, - cholecystectomie, - splenectomie, - mesenteriale tumorectomie, - retroperitoneale tumorectomie, - oogbol resectie, - speekselklierresectie (met uitzondering van de accessoire speekselklieren), -	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe, d'autant de prélèvements que nécessaire, quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, y compris l'examen macroscopique éventuel des pièces opératoires suivantes : - exérèse de ganglion lympathique, - évidement ganglionnaire axillaire unilatéral, - évidement ganglionnaire inguinal unilatéral - biopsie pulmonaire chirurgicale, - thymectomie totale ou partielle, - résection de tumeur subaponévrotique, - pancréatectomie partielle, - hépatectomie partielle, - cholécystectomie , - splénectomie, - tumorectomie mésentérique, - tumorectomie rétropéritonéale, - résection du globe oculaire, - résection d'une glande salivaire (à l'exception des glandes salivaires accessoires), - glossectomie partielle ou totale, - thyroïdectomie,- parathyroïdectomie, - pharyngectomie, - biopsie par

Outpatient code	Inpatient code	Dutch description	French description
			incision du sein, - tumorectomie du sein, - cystectomie partielle (à l'exception de la résection vésicale endoscopique), - adénomectomie prostatique chirurgicale ou endoscopique , - épididymectomie, - orchidectomie, - amputation partielle du pénis, - tumorectomie profonde du cou, - néphrectomie partielle, - annexectomie uni-ou bilatérale, - ovariectomie, - salpingectomie totale, - vulvectomie partielle, - conisation ou résection du col de l'utérus, - résection de la glande surrénale, - biopsie nerveuse- biopsie musculaire, - résection d'une tumeur du cerveau, de la moelle épinière ou de l'hypophyse, - résection de tumeur osseuse, - amygdalectomie (> 18 ans), - adénoïdectomie (> 18 ans)
588291	588302	Honorarium voor het pathologisch-anatomisch onderzoek, door inclusie en coupe, van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen en met inbegrip van het eventueel macroscopisch onderzoek, voor volgende operatiestukken : - partiële mammectomie met okselklier uitruiming, - totale mammectomie met of zonder okselklier uitruiming, - partiële of totale pneumectomie, - partiële of totale slokdarmresectie, - bilaterale lies klierevidement, - lymfeklierevidement van 2 of meerdere groepen halsklieren, - tumorectomie van de mondbodem met of zonder mandibulectomie, - tumorectomie van het verhemelte met of zonder maxillectomie, - totale maxillectomie, - partiële of totale gastrectomie, - dunne darm resectie, - partiële of totale colectomie, - duodenopancreatectomie, - radicale, totale of subtotale hysterectomie, - abdominoperineale resectie, - partiële of totale laryngectomie, - totale cystectomie, - totale penisamputatie, - totale nefrectomie, - totale prostatectomie (met	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe d'autant de prélèvements que nécessaire quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, y compris l'examen macroscopique éventuel des pièces opératoires suivantes : - mammectomie partielle avec évidement ganglionnaire, - mammectomie totale avec ou sans évidement ganglionnaire, - pneumectomie partielle ou totale, - résection partielle ou totale de l'oesophage, - évidement ganglionnaire inguinal bilatéral, - évidement de deux ou plusieurs groupes de ganglions du cou, - tumorectomie du plancher buccal avec ou sans mandibulectomie, - tumorectomie du palais avec ou sans maxillectomie, - maxillectomie totale, - gastrectomie partielle ou totale, - résection de l'intestin grêle, - colectomie partielle ou totale, - duodénopancréatectomie, - hystérectomie radicale, totale ou subtotale, - résection abdominopérinéale, - laryngectomie partielle ou totale, - cystectomie totale, - amputation totale du pénis, - néphrectomie totale, -

Outpatient code	Inpatient code	Dutch description	French description
		zaadblaasjes), - hartresectie, - hart long blok, - totale hepatectomie, - totale pelvectomie, - totale vulvectomie, - foetus van 14 tot en met 24 weken	prostatectomie totale (avec vésicules séminales), - résection cardiaque, - bloc coeur poumons complet, - hépatectomie totale, - pelvectomie totale, - vulvectomie totale, - foetus de 14 à 24 semaines y compris

Cytology – oesophageal cancer

Table 220 – Nomenclature codes for cytology – oesophageal cancer

Outpatient code	Inpatient code	Dutch description	French description
588394	588405	Honorarium voor het cytopathologisch onderzoek voor het opzoeken van neoplastische cellen (zowel na uitstrijken en/of insluiten), op urinestalen en/of sputumstalen, ongeacht het aantal uitstrijkpreparaten en/of insluiten	Honoraires pour l'examen cytopathologique pour la recherche de cellules néoplasiques (après frottis et/ou inclusion), sur échantillons d'urine et/ou d'expectoration, quel que soit le nombre de frottis et/ou d'inclusions
588416	588420	Honorarium voor het cytopathologisch onderzoek voor het opzoeken van neoplastische cellen (zowel na uitstrijken en/of insluiten), van afnamen niet gespecificeerd in de verstrekkingen 588350 - 588361 en 588394 - 588405, ongeacht het aantal uitstrijkpreparaten en/of insluiten per afname	Honoraires pour l'examen cytopathologique pour la recherche de cellules néoplasiques (après frottis et/ou inclusion), de prélèvements non précisés dans les prestations 588350 - 588361 et 588394 - 588405, quel que soit le nombre de frottis et/ou d'inclusions, par prélèvement

Cytology – gastric cancer

Table 221 – Nomenclature codes for cytology – gastric cancer

Outpatient code	Inpatient code	Dutch description	French description
588394	588405	Honorarium voor het cytopathologisch onderzoek voor het opzoeken van neoplastische cellen (zowel na uitstrijken en/of insluiten), op urinestalen en/of sputumstalen, ongeacht het aantal uitstrijkpreparaten en/of insluiten	Honoraires pour l'examen cytopathologique pour la recherche de cellules néoplasiques (après frottis et/ou inclusion), sur échantillons d'urine et/ou d'expectoration, quel que soit le nombre de frottis et/ou d'inclusions
588416	588420	Honorarium voor het cytopathologisch onderzoek voor het opzoeken van neoplastische cellen (zowel na uitstrijken en/of insluiten), van afnamen niet gespecificeerd in de verstrekkingen 588350 - 588361 en 588394 - 588405, ongeacht het aantal uitstrijkpreparaten en/of insluiten per afname	Honoraires pour l'examen cytopathologique pour la recherche de cellules néoplasiques (après frottis et/ou inclusion), de prélèvements non précisés dans les prestations 588350 - 588361 et 588394 - 588405, quel que soit le nombre de frottis et/ou d'inclusions, par prélèvement
472253	472264	Afname met het oog op een cytologisch onderzoek van maagcellen, door abrasieve methode of abrasief instrument of door spoeling, inclusief radioscopie	Prélèvement en vue d'un examen cytologique de cellules gastriques par méthode ou instrument abrasif ou par rinçage, radioscopie comprise

Appendix 8.1.4. Endoscopic ultrasonography

Endoscopic ultrasonography

Table 222 – Nomenclature codes for EUS

Outpatient code	Inpatient code	Dutch description	French description
473852	473863	Echo-endoscopie van de bovenste gastro-intestinale tractus	Echoendoscopie du tube digestif supérieur

Fine-needle aspiration cytology

Table 223 – Nomenclature codes for FNAC

Outpatient code	Inpatient code	Dutch description	French description
473874	473885	Echo-endoscopie met punctie van extramuraal weefsel (disposable materieel niet inbegrepen)	Echoendoscopie avec ponction de tissu extramural (matériel disposable non compris)

Appendix 8.1.5. Endoscopic examination

Oesophagogastroduodenoscopy (without resection of the tumour and/or coagulation)

Table 224 – Nomenclature codes for oesophagogastroduodenoscopy (without resection of the tumour and/or coagulation)

Outpatient code	Inpatient code	Dutch description	French description
472356	472360	Oesofagoscopie	Oesophagoscopie
472415	472426	Fibrogastroscopie en/of fibrobulboscopie	Fibro-gastroscopie et/ou fibro-bulboscopie
473056	473060	fibroduodenoscopie (2e en 3e duodenum)	Fibro-duodénoscopie (2ème et 3ème duodénum)
472231	472242	Duodenum- of dunne darmbiopsie met sonde, inclusief radioscopie	Biopsie du duodénum ou de l'intestin grêle, par sonde, radioscopie comprise

Oesophagogastroduodenoscopy (with resection of the tumour and/or coagulation)

Table 225 – Nomenclature codes for oesophagogastroduodenoscopy (with resection of the tumour and/or coagulation)

Outpatient code	Inpatient code	Dutch description	French description
472555	472566	Oesofagoscopie met wegnemen van tumors en/of coagulatie van letsels	Oesophagoscopie avec ablation de tumeurs et/ou coagulation de lésions
472570	472581	Fibrogastroscopie en/of fibrobulboscopie met wegnemen van tumors en/of coagulatie van letsels	Fibro-gastroscopie et/ou fibro-bulboscopie avec ablation de tumeurs et/ou coagulation de lésions
473793	473804	Wegnemen van tumors en /of coagulatie van letsels (2e en 3e duodenum)	Ablation de tumeurs et/ou coagulation de lésions (2e et 3e duodénum)

Bronchoscopy - Oesophageal cancer

Table 226 – Nomenclature codes for bronchoscopy

Outpatient code	Inpatient code	Dutch description	French description
257294	257305	Bronchoscopie zonder afname voor biopsie en/of bronchoscopie met therapeutische aspiratie	Bronchoscopie sans prélèvement biopsique, et/ou bronchoscopie avec aspiration thérapeutique
257316	257320	Bronchoscopie met afname voor biopsie en/of verwijderen van tumors en/of coagulatie van letsels	Bronchoscopie avec prélèvement biopsique, et/ou ablation de tumeurs, et/ou coagulation de lésions
471715	471726	Bronchoscopie zonder afname voor biopsie	Bronchoscopie sans prélèvement biopsique
471730	471741	Bronchoscopie met afname voor biopsie, en/of verwijderen van tumors, en/of coagulatie van letsels	Bronchoscopie avec prélèvement biopsique, et/ou ablation de tumeurs, et/ou coagulation de lésions
471752	471763	Bronchoscopie met transcarinale punctie en eventuele radioscopische controle	Bronchoscopie avec ponction transcarinale et contrôle radioscopique éventuel
471796	471800	Bronchoscopie met extractie van vreemde lichamen of plaatsing van een prothetisch element	Bronchoscopie avec extraction de corps étrangers ou mise en place d'un élément prothétique
471811	471822	Bronchoscopie met perifere pulmonaire afnamen voor biopsie (ofwel veelvuldige afnamen, minimum 5, ofwel geleide afname in geval van perifere tumor), inclusief de eventuele radioscopische controle	Bronchoscopie avec prélèvement de biopsies pulmonaires périphériques (soit prélèvements multiples minimum 5, soit prélèvement dirigé en cas de tumeur périphérique) y compris le contrôle radioscopique éventuel
471774	471785	Bronchoscopie met bronchoalveolair wassen (min. 100 ml)	Bronchoscopie avec lavage broncho-alvéolaire (minimum 100 ml)

Appendix 8.2.1. Explorative surgery

Mediastinoscopy

Table 227 – Nomenclature codes for mediastinoscopy

Outpatient code	Inpatient code	Dutch description	French description
228152	228163	Mediastinoscopie	Médiastinoscopie

Laparoscopy

Table 228 – Nomenclature codes for laparoscopy

Outpatient code	Inpatient code	Dutch description	French description
350512	350523	**Laparoscopie, zonder afname voor biopsie, inclusief pneumoperitoneum	** Laparoscopie sans prélèvement biopsique, y compris le pneumopéritoine
353253	353264	**Laparoscopie, met afname voor biopsie, inclusief pneumoperitoneum	** Laparoscopie avec prélèvement biopsique, y compris le pneumopéritoine
432493	432504	Diagnostische laparoscopie zonder biopsie, inclusief het pneumoperitoneum	Laparoscopie diagnostique sans biopsie y compris le pneumopéritoine
432515	432526	Diagnostische laparoscopie met biopsie of cytologie inclusief het pneumoperitoneum	Laparoscopie diagnostique avec biopsie ou cytologie y compris le pneumopéritoine

Explorative thoracotomy

Table 229 – Nomenclature codes for explorative thoracotomy

Outpatient code	Inpatient code	Dutch description	French description
227452	227463	Exploratieve thoracotomie, inclusief long- of lymfknoopbiopsie	Thoracotomie exploratrice y compris la biopsie pulmonaire ou ganglionnaire

Appendix 8.3.1. Surgery

Oesophageal cancer (including gastro-oesophageal junction)

Table 230 – Nomenclature codes for oesophagectomy

Outpatient code	Inpatient code	Dutch description	French description
228012	228023	Thoracale of thoraco-abdominale oesofagectomie of gastro-oesofagectomie in één operatietijd	**7.** Oesophagectomie ou gastro-oesophagectomie thoracique ou thoraco-abdominale
228174	228185	Subtotale oesofagectomie tot op het niveau van de arcus aortae, met herstellen van de continuïteit	Oesophagectomie subtotale jusqu'au niveau de la crosse aortique, avec reconstitution de la continuité

Since April 1st 2011, new nomenclature codes became available : 228233-228244 and 228255-228266. These will not be considered for the present project (cfr. patient selection).

Table 231 – Nomenclature codes for surgical intervention (oesophagectomy and/or gastrectomy)

Outpatient code	Inpatient code	Dutch description	French description
228012	228023	Thoracale of thoraco-abdominale oesofagectomie of gastro-oesofagectomie in één operatietijd	8. Oesophagectomie ou gastro-oesophagectomie thoracique ou thoraco-abdominale
228174	228185	Subtotale oesofagectomie tot op het niveau van de arcus aortae, met herstellen van de continuïteit	Oesophagectomie subtotale jusqu'au niveau de la crosse aortique, avec reconstitution de la continuité
241452	241463	Totale gastrectomie met oesofago-jejunale anastomose of subtotale gastrectomie met herstellen van de transit, door interpositie van een darmsegment	Gastrectomie totale avec anastomose oesophago-jéjunale ou gastrectomie subtotale avec restauration du transit, par interposition d'un segment intestinal
241415	241426	Totale gastrectomie met hemipancreatectomie links en segmentaire colectomie	Gastrectomie totale avec hémipancréatectomie gauche et colectomie segmentaire
241430	241441	Totale gastrectomie of degastrogastrectomie met hemipancreatectomie links of segmentaire colectomie	Gastrectomie total ou dégastrogastrectomie avec hémipancréatectomie gauche ou colectomie segmentaire
241474	241485	Subtotale gastrectomie	Gastrectomie subtotale
241555	241566	Degastro-gastrectomie	Dégastro-gastrectomie
241533	241544	Resectie van de maag of reducerende gastroplastiek zonder onderbreking van de continuïteit	Résection de l'estomac ou gastroplastie de réduction sans interruption de la continuité

Table 232 – Nomenclature codes for lymphadenectomy

Outpatient code	Inpatient code	Dutch description	French description
220356	220360	Exeresis van ganglion	Exérèse ganglionnaire
256815	256826	Exeresis van veretterde adenitis of van een halsklier	Exérèse d'adénite suppurée ou d'un ganglion du cou
258370	258381	Beperkte klieruitruiming van 2 of meerdere kliergroepen in de hals	Evidement ganglionnaire restreint de 2 ou plusieurs groupes ganglionnaires du cou
258392	258403	Volledige halsklieruitruiming van een gebied afgelijnd door : bovenaan het mastoïd en de onderkaak, onderaan de clavicula, achteraan de M. Trapezius en vooraan de pretracheale spieren	Evidement ganglionnaire total d'une région délimitée par : en haut, la mastoïde et la mandibule, en bas, la clavicule, à l'arrière le muscle trapèze et devant les muscles prétrachéaux
258554	258565	Uitruiming van ganglia van een kliergroep in de hals	Evidement ganglionnaire d'un groupe ganglionnaire du cou
311835	311846	Exeresis van veretterde adenitis of van een halsklier	Exérèse d'adénite suppurée ou d'un ganglion du cou
312572	312583	Beperkte klieruitruiming van 2 of meerdere kliergroepen in de hals	Evidement ganglionnaire restreint de 2 ou plusieurs groupes ganglionnaires du cou
312594	312605	Volledige halsklieruitruiming van een gebied afgelijnd door : bovenaan het mastoïd en de onderkaak, onderaan de clavicula, achteraan de M. Trapezius en vooraan de pretracheale spieren	Evidement ganglionnaire total d'une région délimitée par : en haut, la mastoïde et la mandibule, en bas, la clavicule, à l'arrière le muscle trapèze et devant les muscles prétrachéaux
312970	312981	Unilaterale uitruiming van één of twee kliergroepen in de hals	Evidement unilatéral d'un ou deux groupes ganglionnaires du cou
588276	588280	Honorarium voor het pathologisch-anatomisch onderzoek, door inclusie en coupe, van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen, en met inbegrip van het eventueel macroscopisch onderzoek voor volgende operatiestukken : - lymfeklierexerese, - eenzijdige lymfeklier okselevidement, - eenzijdige lymfeklier liesevidement, - heelkundige longbiopsie, - totale of partiële thymectomie, - resectie van subaponeurotische tumoren, - partiële pancreatectomie, - partiële hepatectomie, - cholecystectomie, - splenectomie, - mesenteriale tumorectomie, - retroperitoneale tumorectomie, -	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe, d'autant de prélèvements que nécessaire, quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, y compris l'examen macroscopique éventuel des pièces opératoires suivantes : - exérèse de ganglion lympathique, - évidement ganglionnaire axillaire unilatéral, - évidement ganglionnaire inguinal unilatéral - biopsie pulmonaire chirurgicale, - thymectomie totale ou partielle, - résection de tumeur subaponévrotique, - pancréatectomie partielle, - hépatectomie partielle, - cholécystectomie , - splénectomie, - tumorectomie mésentérique, -

Outpatient code	Inpatient code	Dutch description	French description
		oogbol resectie, - speekselklierresectie (met uitzondering van de accessoire speekselklieren), - partiële of totale glossectomie, - thyroidectomie, - parathyroidectomie, - pharyngectomie, -incisionele borstbiopsie, - borsttumorectomie, - partiële cystectomie (met uitzondering van de endoscopische blaasresectie), - heelkundige of endoscopische prostaatadenomectomie, - epididymectomie, - orchidectomie, - partiële penis amputatie, - diepe hals tumorectomie, - partiële nefrectomie, - uni- of bilaterale adnexectomie, - ovariectomie, - totale salpingectomie, - partiële vulvectomie, - baarmoederhals conisatie of -resectie, - bijnier resectie, - zenuwbiopsie, - spierbiopsie, - hersen-, ruggemerg- of hypofyse- tumor resectie, - bottumor resectie, - tonsillectomie (> 18 jaar), - adenoidectomie (> 18 jaar)	tumorectomie rétropéritonéale, - résection du globe oculaire, - résection d'une glande salivaire (à l'exception des glandes salivaires accessoires), - glossectomie partielle ou totale, - thyroïdectomie,- parathyroïdectomie, - pharyngectomie, - biopsie par incision du sein, - tumorectomie du sein, - cystectomie partielle (à l'exception de la résection vésicale endoscopique), - adénomectomie prostatique chirurgicale ou endoscopique , - épididymectomie, - orchidectomie, - amputation partielle du pénis, - tumorectomie profonde du cou, - néphrectomie partielle, - annexectomie uni-ou bilatérale, - ovariectomie, - salpingectomie totale, - vulvectomie partielle, - conisation ou résection du col de l'utérus, - résection de la glande surrénale, - biopsie nerveuse- biopsie musculaire, - résection d'une tumeur du cerveau, de la moelle épinière ou de l'hypophyse, - résection de tumeur osseuse, - amygdalectomie (> 18 ans), - adénoïdectomie (> 18 ans)

Gastric cancer

Table 233 – Nomenclature codes for gastrectomy

Outpatient code	Inpatient code	Dutch description	French description
241452	241463	Totale gastrectomie met oesofago-jejunale anastomose of subtotale gastrectomie met herstellen van de transit, door interpositie van een darmsegment	Gastrectomie totale avec anastomose oesophago-jéjunale ou gastrectomie subtotale avec restauration du transit, par interposition d'un segment intestinal
241415	241426	Totale gastrectomie met hemipancreatectomie links en segmentaire colectomie	Gastrectomie totale avec hémipancréatectomie gauche et colectomie segmentaire
241430	241441	Totale gastrectomie of degastrogastrectomie met hemipancreatectomie links of segmentaire colectomie	Gastrectomie total ou dégastrogastrectomie avec hémipancréatectomie gauche ou colectomie segmentaire
241474	241485	Subtotale gastrectomie	Gastrectomie subtotale
241555	241566	Degastro-gastrectomie	Dégastro-gastrectomie
241533	241544	Resectie van de maag of reducerende gastroplastiek zonder onderbreking van de continuïteit	Résection de l'estomac ou gastroplastie de réduction sans interruption de la continuité
241496	241500	Antrectomie met vagotomie	Antrectomie avec vagotomie
228012	228023	Thoracale of thoraco-abdominale oesofagectomie of gastro-oesofagectomie in één operatietijd	9. Oesophagectomie ou gastro-oesophagectomie thoracique ou thoraco-abdominale
228174	228185	Subtotale oesofagectomie tot op het niveau van de arcus aortae, met herstellen van de continuïteit	Oesophagectomie subtotale jusqu'au niveau de la crosse aortique, avec reconstitution de la continuité

Table 234 – Nomenclature codes for lymphadenectomy

Outpatient code	Inpatient code	Dutch description	French description
220356	220360	Exeresis van ganglion	Exérèse ganglionnaire
588276	588280	Honorarium voor het pathologisch-anatomisch onderzoek, door inclusie en coupe, van zoveel prelevementen als nodig, ongeacht het aantal coupes en ongeacht het aantal onderzochte organen, en met inbegrip van het eventueel macroscopisch onderzoek voor volgende operatiestukken : - lymfeklierexerese, - eenzijdige lymfeklier okselevidement, - eenzijdige lymfeklier liesevidement, - heelkundige longbiopsie, - totale of partiële thymectomie, - resectie van subaponeurotische tumoren, - partiële pancreatectomie, - partiële hepatectomie, - cholecystectomie, - splenectomie, - mesenteriale tumorectomie, - retroperitoneale tumorectomie, - oogbol resectie, - speekselklierresectie (met uitzondering van de accessoire speekselklieren), - partiële of totale glossectomie, - thyroidectomie, - parathyroidectomie, - pharyngectomie, -incisionele borstbiopsie, - borsttumorectomie, - partiële cystectomie (met uitzondering van de endoscopische blaasresectie), - heelkundige of endoscopische prostaatadenomectomie, - epididymectomie, - orchidectomie, - partiële penis amputatie, - diepe hals tumorectomie, - partiële nefrectomie, - uni- of bilaterale adnexectomie, - ovariectomie, - totale salpingectomie, - partiële vulvectomie, - baarmoederhals conisatie of -resectie, - bijnier resectie, - zenuwbiopsie, - spierbiopsie, - hersen-, ruggemerg- of hypofyse- tumor resectie, - bottumor resectie, - tonsillectomie (> 18 jaar), - adenoidectomie (> 18 jaar)	Honoraires pour l'examen anatomo-pathologique par inclusion et coupe, d'autant de prélèvements que nécessaire, quel que soit le nombre de coupes et quel que soit le nombre d'organes examinés, y compris l'examen macroscopique éventuel des pièces opératoires suivantes : - exérèse de ganglion lympathique, - évidement ganglionnaire axillaire unilatéral, - évidement ganglionnaire inguinal unilatéral - biopsie pulmonaire chirurgicale, - thymectomie totale ou partielle, - résection de tumeur subaponévrotique, - pancréatectomie partielle, - hépatectomie partielle, - cholécystectomie , - splénectomie, - tumorectomie mésentérique, - tumorectomie rétropéritonéale, - résection du globe oculaire, - résection d'une glande salivaire (à l'exception des glandes salivaires accessoires), - glossectomie partielle ou totale, - thyroïdectomie,- parathyroïdectomie, - pharyngectomie, - biopsie par incision du sein, - tumorectomie du sein, - cystectomie partielle (à l'exception de la résection vésicale endoscopique), - adénomectomie prostatique chirurgicale ou endoscopique , - épididymectomie, - orchidectomie, - amputation partielle du pénis, - tumorectomie profonde du cou, - néphrectomie partielle, - annexectomie uni-ou bilatérale, - ovariectomie, - salpingectomie totale, - vulvectomie partielle, - conisation ou résection du col de l'utérus, - résection de la glande surrénale, - biopsie nerveuse- biopsie musculaire, - résection d'une tumeur du cerveau, de la moelle épinière ou de l'hypophyse, - résection de tumeur osseuse, - amygdalectomie (> 18 ans), - adénoïdectomie (> 18 ans)

Appendix 8.3.2. Chemotherapy

Table 235 – ATC codes of chemotherapeutic agents

ATC code	Description
L01AA	NITROGEN MUSTARD ANALOGUES
L01AD	NITROSOUREAS
L01BA	FOLIC ACID ANALOGUES
L01BC	PYRIMIDINE ANALOGUES
L01CA	VINCA ALKALOIDS AND ANALOGUES
L01CB	PODOPHYLLOTOXIN DERIVATIVES
L01CD	TAXANES
L01DB	ANTHRACYCLINES AND RELATED SUBSTANCES
L01DC	OTHER CYTOTOXIC ANTIBIOTICS
L01XA	PLATINUM COMPOUNDS
L01XC	MONOCLONAL ANTIBODIES
L01XE	PROTEÏNE KINASE INHIBITORS

Appendix 8.3.3. Radiotherapy

Table 236 – Nomenclature codes for external radiotherapy

Outpatient code	Inpatient code	Dutch description	French description
444113	444124	Forfaitair honorarium voor een eenvoudige uitwendige bestralingsreeks van 1 tot 10 fracties voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 1	Honoraires forfaitaires pour une série d'irradiations externes simples de 1 à 10 fractions chez un patient qui répond aux critères ou pathologie repris en catégorie 1
444135	444146	Forfaitair honorarium voor een eenvoudige uitwendige bestralingsreeks van minstens 11 tot 35 fracties voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 2	Honoraires forfaitaires pour une série d'irradiations externes simples de 11 à 35 fractions chez un patient qui répond aux critères ou pathologie repris en catégorie 2
444150	444161	Forfaitair honorarium voor een complexe uitwendige bestralingsreeks voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 3	Honoraires forfaitaires pour une série d'irradiations externes complexes chez un patient qui répond aux critères ou pathologie repris en catégorie 3
444172	444183	Forfaitair honorarium voor een complexe uitwendige bestralingsreeks voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 4	Honoraires forfaitaires pour une série d'irradiations externes complexes chez un patient qui répond aux critères ou pathologie repris en catégorie 4

Table 237 – Nomenclature codes for brachytherapy

Outpatient code	Inpatient code	Dutch description	French description
444216	444220	Forfaitair honorarium voor exclusieve curietherapie voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 7	Honoraires forfaitaires pour curiethérapie exclusive chez un patient qui répond aux critères ou pathologie repris en catégorie 7
444253	444264	Forfaitair honorarium voor exclusieve curietherapie voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 8	Honoraires forfaitaires pour curiethérapie exclusive chez un patient qui répond aux critères ou pathologie repris en catégorie 8

Table 238 – Nomenclature codes for combined external radiotherapy and brachytherapy

Outpatient code	Inpatient code	Dutch description	French description
444290	444301	Forfaitair honorarium voor curietherapie gecombineerd met uitwendige bestralingsreeks voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 5	Honoraires forfaitaires pour curiethérapie combinée à une série d'irradiations externes chez un patient qui répond aux critères ou pathologie repris en catégorie 5
444312	444323	Forfaitair honorarium voor curietherapie gecombineerd met uitwendige bestralingsreeks voor een patiënt die beantwoordt aan de criteria of lijdt aan een aandoening opgenomen in categorie 6	Honoraires forfaitaires pour curiethérapie combinée à une série d'irradiations externes chez un patient qui répond aux critères ou pathologie repris en catégorie 6

Appendix 8.3.4. Endoscopy / ablative treatment

Oesophageal cancer

Table 239 – Nomenclature codes for gastrostomy

Outpatient code	Inpatient code	Dutch description	French description
241695	241706	Gastrostomie	Gastrostomie
355950	355961	Percutane gastrostomie onder endoscopische controle met het oog op het plaatsen van een sonde voor enterale voeding	Gastrostomie percutanée sous contrôle endoscopique en vue du placement d'une sonde d'alimentation entérale

Table 240 – Nomenclature codes for coagulation

Outpatient code	Inpatient code	Dutch description	French description
472555	472566	Oesofagoscopie met wegnemen van tumors en/of coagulatie van letsels	Oesophagoscopie avec ablation de tumeurs et/ou coagulation de lésions
472570	472581	Fibrogastroscopie en/of fibrobulboscopie met wegnemen van tumors en/of coagulatie van letsels	Fibro-gastroscopie et/ou fibro-bulboscopie avec ablation de tumeurs et/ou coagulation de lésions
473793	473804	Wegnemen van tumors en/of coagulatie van letsels (2e en 3e duodenum)	Ablation de tumeurs et/ou coagulation de lésions (2e et 3e duodénum)
353231	353242	° Wegnemen of uitroeien, door om het even welk procédé (heelkundige behandeling, elektrocoagulatie), van allerhande oppervlakkige tumors van huid of slijmvliezen of van alle andere rechtstreeks bereikbare niet traumatische letsels,	° Ablation ou destruction, quel que soit le procédé (cure chirurgicale, électrocoagulation), de tumeurs superficielles de toute nature de la peau ou des muqueuses ou de toutes autres lésions non traumatiques directement accessibles, par cure

Outpatient code	Inpatient code	Dutch description	French description
		volledige behandeling	
532630	532641	Ablatie of vernietiging door om het even welk procédé (heelkundig zonder hechting, elektrocoagulatie of andere methode) van een oppervlakkig goed- of kwaadaardig gezwel van de huid of van de slijmvliezen of van elk ander niet traumatisch, direct toegankelijk letsel	Ablation ou destruction quel que soit le procédé (chirurgical sans suture, électrocoagulation ou autre méthode) d'une tumeur superficielle de la peau bénigne ou maligne ou des muqueuses ou de toute autre lésion non traumatique directement accessible

Table 241 – Nomenclature codes for stenting

Outpatient code	Inpatient code	Dutch description	French description
473292	473303	Plaatsen van een slokdarmstent langs endoscopische weg inclusief de eventuele radioscopische controle met beeldversterker en televisie in gesloten keten	Placement d'un tuteur oesophagien, par voie endoscopique, y compris le contrôle éventuel par examen radioscopique avec amplificateur de brillance et chaîne de télévision

Table 242 – Nomenclature codes for dilatation

Outpatient code	Inpatient code	Dutch description	French description
112210	112221	Dilatatie van de slokdarm	Dilatation de l'oesophage
350556	350560	Dilatatie van slokdarm	Dilatation de l'oesophage
472091	472102	Pneumatische dilatatie van slokdarm, per behandeling	Dilatation pneumatique de l'oesophage, par traitement
473314	473325	Oesofagusdilatatie op leidraad langs endoscopische weg, inclusief de eventuele radioscopie	Dilatation de l'oesophage sur fil guide par voie endoscopique, y compris la radioscopie éventuelle
473815	473826	Dilatatie van stricturen langs endoscopische weg, inclusief de eventuele ballon en de eventuele radioscopie, de endoscopische procedure zelf niet inbegrepen	Dilatation de sténoses par voie endoscopique, y compris le ballon éventuel et la radioscopie éventuelle, non compris l'endoscopie elle-même
		Dilatatie van stricturen langs endoscopische weg, inclusief de eventuele radioscopie, de endoscopische procedure zelf niet inbegrepen	Dilatation de sténoses par voie endoscopique, y compris la radioscopie éventuelle, non compris l'endoscopie elle-même

Table 243 – Nomenclature codes for EMR/ESD

Outpatient code	Inpatient code	Dutch description	French description
473970	473981	Endoscopische resectie van een oppervlakkig cancereus letsel van het hogere spijsverteringskanaal door technieken van mucosectomie (multipele ligaturen of cap aspiratie) of submucosale dissectie, inbegrepen het gedetailleerd verslag van de procedure.	Résection endoscopique d'une lésion cancéreuse superficielle du tractus digestif supérieur par techniques de mucosectomie (ligatures multiples ou cap aspiration) ou de dissection sous-muqueuse, y compris le rapport détaillé de la procédure.

Gastric cancer

Table 244 – Nomenclature codes for gastrostomy

Outpatient code	Inpatient code	Dutch description	French description
241695	241706	Gastrostomie	Gastrostomie
355950	355961	Percutane gastrostomie onder endoscopische controle met het oog op het plaatsen van een sonde voor enterale voeding	Gastrostomie percutanée sous contrôle endoscopique en vue du placement d'une sonde d'alimentation entérale
473911	473922	Endoscopische kystogastrostomie of endoscopische kystoduodenostomie	Cystogastrostomie endoscopique ou cystoduo-dénostomie endoscopique

Table 245 – Nomenclature codes for coagulation

Outpatient code	Inpatient code	Dutch description	French description
472570	472581	Fibrogastroscopie en/of fibrobulboscopie met wegnemen van tumors en/of coagulatie van letsels	Fibro-gastroscopie et/ou fibro-bulboscopie avec ablation de tumeurs et/ou coagulation de lésions
473793	473804	Wegnemen van tumors en/of coagulatie van letsels (2e en 3e duodenum)	Ablation de tumeurs et/ou coagulation de lésions (2e et 3e duodénum)
353231	353242	° Wegnemen of uitroeien, door om het even welk procédé (heelkundige behandeling, elektrocoagulatie), van allerhande oppervlakkige tumors van huid of slijmvliezen of van alle andere rechtstreeks bereikbare niet traumatische letsels, volledige behandeling	° Ablation ou destruction, quel que soit le procédé (cure chirurgicale, électrocoagulation), de tumeurs superficielles de toute nature de la peau ou des muqueuses ou de toutes autres lésions non traumatiques directement accessibles, par cure
532630	532641	Ablatie of vernietiging door om het even welk procédé (heelkundig zonder hechting, elektrocoagulatie of	Ablation ou destruction quel que soit le procédé (chirurgical sans suture, électrocoagulation ou autre

Outpatient code	Inpatient code	Dutch description	French description
		andere methode) van een oppervlakkig goed- of kwaadaardig gezwel van de huid of van de slijmvliezen of van elk ander niet traumatisch, direct toegankelijk letsel	méthode) d'une tumeur superficielle de la peau bénigne ou maligne ou des muqueuses ou de toute autre lésion non traumatique directement accessible

Oesophageal and gastric cancer

Table 246 – Nomenclature codes for photodynamic therapy

Outpatient code	Inpatient code	Dutch description	French description
258893	258904	Endoscopisch procedure voor intratumorale photodynamische behandeling of electroporatietherapie bij mucosatumoren voor de volledige behandeling van het geheel der letsels	Procédure endoscopique pour le traitement photodynamique intratumoral ou thérapie par électroporation de tumeurs des muqueuses pour le traitement complet de l'ensemble des lésions

Table 247 – Nomenclature codes for cryotherapy

Outpatient code	Inpatient code	Dutch description	French description
353194	353205	°* Cryotherapie wegens huid- of slijmvliesletsels, per zitting	°* Cryothérapie pour lésions cutanées ou muqueuses, par séance
353216	353220	°* Cryotherapie wegens huid- of slijmvliesletsels, volledige behandeling van acht en meer zittingen	°* Cryothérapie pour lésions cutanées ou muqueuses, par cure de 8 séances et davantage
353290	353301	Cryochirurgie, met vloeibare stikstof, van huidslijmvliestumors die de basale laag doorboren, onder controle door thermozuil	Cryochirurgie, à l'azote liquide, des tumeurs cutanéomuqueuses effractant la couche basale, sous contrôle par thermocouple

Table 248 – Nomenclature codes for laser therapy

Outpatient code	Inpatient code	Dutch description	French description
355036	355040	Bijkomend honorarium dat mag worden aangerekend door de geneesheer-specialist die één van de volgende verstrekkingen verricht volgens de YAG-lasermethode : 230436 - 230440, 230473 - 230484 , 230532 - 230543, 230716 - 230720, 230731 - 230742, 231011 - 231022, 231033 - 231044, 232514 - 232525, 232536 - 232540, 232551 - 232562, 232735 - 232746, 232772 - 232783, 232971 - 232982, 246772 - 246783, 248172 - 248183, 248194 - 248205, 248216 - 248220, 248231 - 248242, 248253 - 248264, 248275 - 248286, 248290 - 248301, 248312 - 248323, 257316 - 257320, 257456 - 257460, 431115 - 431126, 432412 - 432423, 432456 - 432460, 471612 - 471623, 471730 - 471741 en 473653 - 473664	Supplément attestable par le médecin spécialiste qui effectue une des prestations suivantes, par la méthode au laser YAG : 230436 - 230440, 230473 - 230484 , 230532 - 230543, 230716 - 230720, 230731 - 230742, 231011 - 231022, 231033 - 231044, 232514 - 232525, 232536 - 232540, 232551 - 232562, 232735 - 232746, 232772 - 232783, 232971 - 232982, 246772 - 246783, 248172 - 248183, 248194 - 248205, 248216 - 248220, 248231 - 248242, 248253 - 248264, 248275 - 248286, 248290 - 248301, 248312 - 248323, 257316 - 257320, 257456 - 257460, 431115 - 431126, 432412 - 432423, 432456 - 432460, 471612 - 471623, 471730 - 471741 et 473653 - 473664
473653	473664	Behandeling van een stenose van het spijsverteringskanaal met laser	Traitement d'une sténose du tube digestif, par laser

Appendix 8.3.5. Palliative treatment

Table 249. Nomenclature codes for palliative support in the hospital

Outpatient code	Inpatient code	Dutch description	French description
	109701 §	Honorarium voor de behandelende erkende huisarts, voor het bezoek in een ziekenhuis aan een patiënt, in een Sp-dienst (palliatieve zorg), op verzoek van de patiënt of op verzoek van een familielid of van één van zijn naastbestaanden	
	597763	Honorarium voor toezicht op de rechthebbende die in een Sp-dienst (palliatieve zorg) is opgenomen vanaf de eerste dag hospitalisatie in deze dienst : vanaf de eenendertigste dag tot het einde van de zesde maand per dag	
	599782	Honorarium voor toezicht op de rechthebbende die in een Sp-dienst (palliatieve zorg) is opgenomen vanaf	

Outpatient code	Inpatient code	Dutch description	French description
		de eerste dag hospitalisatie in deze dienst : van de 1ste tot de 30ste dag, per dag	
	599804	Honorarium voor toezicht op de rechthebbende die in een Sp-dienst (palliatieve zorg) is opgenomen vanaf de eerste dag hospitalisatie in deze dienst : door een geaccrediteerde geneesheer, van de 1ste tot de 30ste dag, per dag	
	768143	Ziekenhuisverpleging - variabel gedeelte op basis van ingediende facturen : palliatieve Sp-diensten - bedrag per dag	
	768445	Ziekenhuisverpleging, variabel gedeelte op basis van ingediende facturen, patiënt niet in regel met verzekerbaarheid, palliatieve Sp-diensten	
	768762	Ziekenhuisverpleging, vast gedeelte via begrotingstwaalfden, palliatieve Sp-diensten - begrotingstwaalfden	
	768784	Ziekenhuisverpleging, vast gedeelte via begrotingstwaalfden, palliatieve Sp-diensten - correctie internationale verdragen	
	768806	Ziekenhuisverpleging, vast gedeelte via begrotingstwaalfden, palliatieve Sp-diensten - correctie subrogatie	
	768821	Ziekenhuisverpleging, vast gedeelte via begrotingstwaalfden, palliatieve Sp-diensten - correctie ten onrechte betaalde facturen	

[§] Not available in research database for this project.

Table 250. Nomenclature codes for palliative support at home – general practitioner.

Outpatient code	Inpatient code	Dutch description	French description
104370 §		Bezoek door de erkende huisarts thuis bij een palliatieve patiënt	
104392 §		Bezoek door de erkende huisarts tussen 18 en 21 uur thuis bij een palliatieve patiënt	
104414 §		Bezoek door de erkende huisarts 's nachts tussen 21 en 8 uur thuis bij een palliatieve patiënt	
104436 §		Bezoek door de erkende huisarts tijdens het weekeind van zaterdag 8 uur tot maandag 8 uur, thuis bij een palliatieve patiënt	
104451 §		Bezoek door de erkende huisarts op een feestdag, dat wil zeggen vanaf daags voor die feestdag om 21 uur tot daags na die feestdag om 8 uur bij een palliatieve patiënt	
104672 §		Bezoek door de algemeen geneeskundige met verworven rechten, thuis bij een palliatieve patiënt	
104694 §		Bezoek door de algemeen geneeskundige met verworven rechten, tussen 18 en 21 uur thuis bij een palliatieve patiënt	
104716 §		Bezoek door de algemeen geneeskundige met verworven rechten, 's nachts tussen 21 en 8 uur thuis bij een palliatieve patiënt	
104731 §		Bezoek door de algemeen geneeskundige met verworven rechten, tijdens het weekeind van zaterdag 8 uur tot maandag 8 uur thuis bij de palliatieve patiënt	
104753 §		Bezoek door de algemeen geneeskundige met verworven rechten, op een feestdag, dat wil zeggen vanaf daags voor die feestdag om 21 uur tot daags na die feestdag om 8 uur thuis bij de palliatieve patiënt	

§ Not available in research database for this project.

Table 251. Nomenclature codes for palliative support at home – nurses.

Outpatient code	Inpatient code	Dutch description	French description
427011 §		Forfaitair honorarium PC, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : • wiens fysieke afhankelijkheidstoestand beantwoordt aan de volgende criteria : o afhankelijkheid wegens het criterium zich wassen (score 4) en het criterium zich kleden (score 4), en o afhankelijk wegens het criterium transfer en verplaatsingen (score 4) en om het criterium toiletbezoek (score 4), en o afhankelijkheid wegens het criterium continentie en het criterium eten (waarvoor één van de twee criteria een score 4 heeft en het andere criterium een score van minimum 3) • en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires forfaitaires PC, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : • dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver (score 4) et le critère s'habiller (score 4), et o dépendance pour le critère transfert et déplacements (score 4) et le critère aller à la toilette (score 4), et o dépendance pour le critère continence et pour le critère manger (pour laquelle un des deux critères obtient un score de 4, et l'autre un score de minimum 3) • et qui répond à la définition du patient palliatif reprise au § 5bis, 1°
427033 §		Forfaitair honorarium PB, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : • wiens fysieke afhankelijkheidstoestand beantwoordt aan de volgende criteria : o afhankelijkheid wegens het criterium zich wassen en het criterium zich kleden (score 3 of 4), en o afhankelijk wegens het criterium transfer en verplaatsingen en het criterium toiletbezoek (score 3 of 4), en o afhankelijkheid wegens het criterium	Honoraires forfaitaires PB, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : • dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver et le critère s'habiller (score 3 ou 4), et o dépendance pour le critère transfert et déplacements et le critère aller à la toilette (score 3 ou 4), et o dépendance pour le critère continence et/ou pour le critère manger (score 3 ou 4). • et qui répond à la définition du patient palliatif

Outpatient code	Inpatient code	Dutch description	French description
		continentie en/of het criterium eten (score 3 of 4) • en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	reprise au § 5bis, 1°
427055 §		Forfaitair honorarium PA, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend : • aan een rechthebbende wiens fysieke afhankelijk-heidstoestand beantwoordt aan de volgende criteria : o afhankelijk wegens het criterium zich wassen en het criterium zich kleden (score 3 of 4), en o afhankelijk wegens het criterium transfer en verplaatsingen en/of het criterium toiletbezoek (score 3 of 4) • op voorwaarde dat deze rechthebbende beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires forfaitaires PA, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués : • au bénéficiaire dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver et le critère s'habiller (score 3 ou 4), et o dépendance pour le critère transfert et déplacements et/ou le critère aller à la toilette (score 3 ou 4) • sous la condition que le bénéficiaire répond à la définition de patient palliatif reprise au § 5bis, 1°
427070 §		Supplementair honorarium, forfait PN, genoemd, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : . in wiens hoofde één of meer verstrekkingen bedoeld sub I of sub III van deze rubriek worden aangerekend, zonder dat het dagplafond bedoeld in § 4, 6° wordt bereikt ; . en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires supplémentaires, dits forfaits PN, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : . pour lequel une ou plusieurs prestations visées sous I ou sous III de la présente rubrique ont été attestées, sans que le plafond journalier visé au § 4, 6° n'ait été atteint ; . et qui répond à la définition de patient palliatif reprise au § 5bis 1°
427173 §		Forfaitair honorarium PP, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend: • aan een rechthebbende in wiens hoofde de bepalingen in § 4, 6° van toepassing zijn;	Honoraires forfaitaires PP, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués : • au bénéficiaire pour qui s'appliquent les dispositions du § 4, 6°;

Outpatient code	Inpatient code	Dutch description	French description
		• op voorwaarde dat deze rechthebbende beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	• sous la condition que le bénéficiaire répond à la définition de patient palliatif reprise au § 5bis, 1°
427092 §		Forfaitair honorarium PC, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : • wiens fysieke afhankelijkheidstoestand beantwoordt aan de volgende criteria : o afhankelijkheid wegens het criterium zich wassen (score 4) en het criterium zich kleden (score 4), en o afhankelijk wegens het criterium transfer en verplaatsingen (score 4) en om het criterium toiletbezoek (score 4), en o afhankelijkheid wegens het criterium continentie en het criterium eten (waarvoor één van de twee criteria een score 4 heeft en het andere criterium een score van minimum 3) • en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires forfaitaires PC, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : • dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver (score 4) et le critère s'habiller (score 4), et o dépendance pour le critère transfert et déplacements (score 4) et le critère aller à la toilette (score 4), et o dépendance pour le critère continence et pour le critère manger (pour laquelle un des deux critères obtient un score de 4, et l'autre un score de minimum 3) • et qui répond à la définition du patient palliatif reprise au § 5bis, 1°
427114 §		Forfaitair honorarium PB, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : • wiens fysieke afhankelijkheidstoestand beantwoordt aan de volgende criteria : o afhankelijkheid wegens het criterium zich wassen en het criterium zich kleden (score 3 of 4), en o afhankelijk wegens het criterium transfer en verplaatsingen en het criterium toiletbezoek	Honoraires forfaitaires PB, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : • dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver et le critère s'habiller (score 3 ou 4), et o dépendance pour le critère transfert et déplacements et le critère aller à la toilette (score 3 ou 4) et o dépendance pour le critère continence et/ou

Outpatient code	Inpatient code	Dutch description	French description
		(score 3 of 4), en o afhankelijkheid wegens het criterium continentie en/of het criterium eten (score 3 of 4) • en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	pour le critère manger (score 3 ou 4). • et qui répond à la définition du patient palliatif reprise au § 5bis, 1°
427136 §		Forfaitair honorarium PA, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend • aan een rechthebbende wiens fysieke afhankelijkheidstoestand beantwoordt aan de volgende criteria : o afhankelijk wegens het criterium zich wassen en het criterium zich kleden (score 3 of 4), en o afhankelijk wegens het criterium transfer en verplaatsingen en/of het criterium toiletbezoek (score 3 of 4) • op voorwaarde dat deze rechthebbende beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires forfaitaires PA, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués : • au bénéficiaire dont l'état de dépendance physique répond aux critères suivants : o dépendance pour le critère se laver et le critère s'habiller (score 3 ou 4), et o dépendance pour le critère transfert et déplacements et/ou le critère aller à la toilette (score 3 ou 4) • sous la condition que le bénéficiaire répond à la définition de patient palliatif reprise au § 5bis, 1°
427151 §		Supplementair honorarium forfait PN genoemd, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend aan een rechthebbende : . in wiens hoofde één of meer verstrekkingen bedoeld sub I of sub III van deze rubriek worden aangerekend, zonder dat het dagplafond bedoeld in § 4, 6° wordt bereikt ; . en die beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	Honoraires supplémentaires, dits forfaits PN, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués au bénéficiaire : . pour lequel une ou plusieurs prestations visées sous I ou sous III de la présente rubrique ont été attestées, sans que le plafond journalier visé au § 4, 6° n'ait été atteint ; . et qui répond à la définition de patient palliatif reprise au § 5bis, 1°
427195 §		Forfaitair honorarium PP, dat één keer per verzorgingsdag wordt toegekend voor het geheel van de verpleegkundige verzorging, verleend :	Honoraires forfaitaires PP, accordés une seule fois par journée de soins pour l'ensemble des soins infirmiers effectués :

Outpatient code	Inpatient code	Dutch description	French description
		• aan een rechthebbende in wiens hoofde de bepalingen in § 4, 6° van toepassing zijn; • op voorwaarde dat deze rechthebbende beantwoordt aan de definitie van palliatieve patiënt, zoals bedoeld in § 5bis, 1°	• au bénéficiaire pour qui s'appliquent les dispositions du § 4, 6°. • sous la condition que le bénéficiaire répond à la définition de patient palliatif reprise au § 5bis, 1°
740213		Forfait palliatieve thuispatiënten	Forfait patients palliatifs à domicile
426510		Thuisverpleging, palliatieve patiënten : dringend bezoek overdag - patiënt	Soins à domicile, patients palliatives : visite urgente - journée - patient
426532		Thuisverpleging, palliatieve patiënten : gepland bezoek 's nachts	Soins à domicile, patients palliatifs : visite planifiée - nuit
426554		Thuisverpleging, palliatieve patiënten : dringend bezoek 's nachts - patiënt	Soins à domicile, patients palliatifs : visite urgente - nuit - patient
426576		Thuisverpleging, palliatieve patiënten : voorbereiding medicatie	Soins à domicile, patients palliatifs : préparation médication
426871		Thuisverpleging, palliatieve patiënten : contact referentieverpleegkundige	Soins à domicile, patients palliatifs : contact praticien de référence
426893		Thuisverpleging, palliatieve patiënten : overlegvergadering	Soins à domicile, patients palliatifs : réunion concertation médecin
426915		Thuisverpleging, palliatieve patiënten : coördinatievergadering equipe	Soins à domicile, patients palliatifs : réunion coordination équipe
426930		Thuisverpleging, palliatieve patiënten : bezoek zonder nomenclatuurhandeling	Soins à domicile, patients palliatifs : visite sans acte nomenclature
426952		Thuisverpleging, palliatieve patiënten : bezoek van minimum 1 uur	Soins à domicile, patients palliatifs : visite de minimum 1 heure

[§] Not available in research database for this project.

APPENDIX 9. DESCRIPTIVE STATISTICS ON TREATMENT OF UPPER GASTROINTESTINAL CANCER

Table 252 – Oesophageal cancer (C15.0-C16.0): therapeutic procedures

Therapeutic procedure	C15.0-C16.0 Oesophagus and gastro-oesophageal junction (GOJ)							Oesophagus (N=4 361)		GOJ (N=1 452)	
	Total (N=5 813)		2004 (N=1099)	2005 (N=1164)	2006 (N=1181)	2007 (N=1235)	2008 (N=1134)				
	N	%	%	%	%	%	%	N	%	N	%
Surgery (-1m<inc<+9m)											
Major surgery : oesophagectomy + gastrectomy	1 977	34.0	33.4	36.2	35.1	33.4	31.9	1 240	28.4	737	50.8
Oesophagectomy	1 724	29.7	28.8	30.8	30.9	28.9	28.7	1 218	27.9	506	34.8
Gastrectomy	282	4.9	4.9	6.1	4.7	4.8	3.8	40	0.9	242	16.7
Gastrostomy	714	12.3	10.6	12.0	14.1	11.9	12.7	630	14.4	84	5.8
Thoracotomy	53	0.9	1.0	0.9	0.7	0.9	1.1	41	0.9	12	0.8
Other surgery	554	9.5	9.8	10.5	9.4	9.6	8.3	412	9.4	142	9.8
Lymphadenectomy	526	9.0	10.3	10.4	9.3	9.2	6.0	376	8.6	150	10.3
Radiotherapy											
Without surgery (-1m<inc<+9m)*	1 555	40.5	39.3	41.9	43.5	41.4	36.5	1 426	45.7	129	18.0
External radiotherapy	1 532	39.9	38.9	41.2	42.8	40.9	35.9	1 408	45.1	124	17.3
External radiotherapy and brachytherapy combined	41	1.1	1.0	1.6	1.8	0.6	0.4	38	1.2	3	0.4
Brachytherapy	21	0.5	0.3	0.5	0.7	0.5	0.8	18	0.6	3	0.4
Neo-adjuvant (-9m<surg)**	332	16.8	16.6	13.5	16.2	19.9	18.0	286	23.1	46	6.2
External radiotherapy	330	16.7	16.6	13.3	15.9	19.9	18.0	284	22.9	46	6.2
External radiotherapy and brachytherapy combined	1	0.1	0.0	0.0	0.2	0.0	0.0	1	0.1	0	0.0
Brachytherapy	1	0.1	0.0	0.2	0.0	0.0	0.0	1	0.1	0	0.0
Adjuvant (surg<+9m)**	222	11.2	9.8	10.9	11.8	9.7	14.1	118	9.5	104	14.1
External radiotherapy	221	11.2	9.8	10.7	11.8	9.7	14.1	118	9.5	103	14.0
External radiotherapy and brachytherapy combined	1	0.1	0.0	0.0	0.0	0.2	0.0	1	0.1	0	0.0

Therapeutic procedure	C15.0-C16.0 Oesophagus and gastro-oesophageal junction (GOJ)							Oesophagus (N=4 361)		GOJ (N=1 452)	
	Total (N=5 813)		2004 (N=1099)	2005 (N=1164)	2006 (N=1181)	2007 (N=1235)	2008 (N=1134)				
	N	%	%	%	%	%	%	N	%	N	%
Brachytherapy	1	0.1	0.0	0.2	0.0	0.0	0.0	0	0.0	1	0.1
Chemotherapy											
Without surgery (-1m<inc<+9m)*	2 123	55.3	55.2	55.0	52.5	57.5	56.2	1 738	55.7	385	53.8
Neo-adjuvant (-9m<surg)**	604	30.6	24.8	24.0	28.7	38.0	37.6	413	33.3	191	25.9
Adjuvant (surg<+9m)**	493	24.9	20.2	23.0	24.4	26.6	30.7	245	19.8	248	33.6
Coagulation											
Without surgery (-1m<inc<+9m)*	373	9.7	8.7	9.4	9.8	10.8	9.7	303	9.7	70	9.8
Preoperative (-9<surg)**	115	5.8	5.2	5.9	6.3	6.3	5.2	96	7.7	19	2.6
Postoperative (surg<+9m)**	72	3.6	3.3	2.6	4.8	4.6	2.8	47	3.8	25	3.4
Cryotherapy											
Without surgery (-1m<inc<+9m)*	51	1.3	1.1	1.6	2.0	1.0	1.0	43	1.4	8	1.1
Preoperative (-9<surg)**	51	2.6	1.1	1.0	6.5	1.9	2.2	24	1.9	27	3.7
Postoperative (surg<+9m)**	33	1.7	1.1	1.7	2.4	1.7	1.4	24	1.9	9	1.2
Lasertherapy											
Without surgery (-1m<inc<+9m)*	65	1.7	3.0	2.3	2.0	0.6	0.8	50	1.6	15	2.1
Preoperative (-9<surg)**	7	0.4	0.8	0.5	0.0	0.0	0.6	3	0.2	4	0.5
Postoperative (surg<+9m)**	12	0.6	0.5	0.5	0.7	0.7	0.6	10	0.8	2	0.3
Stenting and dilatation											
Without surgery (-1m<inc<+9m)*	1 246	32.5	31.8	30.3	33.0	32.4	34.8	1 070	34.3	176	24.6
Preoperative (-9<surg)**	120	6.1	7.6	5.2	5.8	5.1	6.9	89	7.2	31	4.2
Postoperative (surg<+9m)**	468	23.7	27.2	24.7	21.3	23.7	21.5	340	27.4	128	17.4

* The total number of patients (C15.0-C16.0) without major surgery is 3 836, for cancer of the oesophageus (C15) this is 3 121 and for cancer of the gastro-oesophaageal junction (C16.0) this is 715.

** The total number of patients (C15.0-C16.0) with major surgery is 1 977, for cancer of the oesophagus (C15.0) this is 1 240 and for cancer of the gastro-oesophageal junction (C16.0) this is 737.

Table 253 – Oesophageal cancer (C15.0-C16.0): external radiotherapy and chemotherapy in patients without major surgery, by clinical stage (cStage) (-1m<inc<+9m)

		External Radiotherapy Only		External Radiotherapy and Chemotherapy		Chemotherapy Only	
cStage	Total (100%)	N	%	N	%	N	%
0	4	0	0.0%	1	25.0%	0	0.0%
I	139	16	11.5%	18	13.0%	8	5.8%
II	425	58	13.7%	214	50.4%	36	8.5%
III	563	61	10.8%	318	56.5%	84	14.9%
IV	1 055	64	6.1%	341	32.3%	431	40.9%
X	1 650	115	7.0%	326	19.8%	346	21.0%
Total	3 836	314	8.2%	1 218	31.8%	905	23.6%

Table 254 – Oesophageal cancer (C15.0-C16.0): neoadjuvant external radiotherapy and chemotherapy in patients with major surgery, by clinical stage (cStage) (-9m<sur)

		External Radiotherapy only		External Radiotherapy and Chemotherapy		Chemotherapy only	
cStage	Total (100%)	N	%	N	%	N	%
0	3	0	0.0%	0	0.0%	0	0.0%
I	262	1	0.4%	1	0.4%	8	3.1%
II	418	0	0.0%	61	14.6%	43	10.3%
III	430	0	0.0%	177	41.2%	81	18.8%
IV	126	2	1.6%	51	40.5%	36	28.6%
X	738	2	0.3%	35	4.7%	111	15.0%
Total	1 977	5	0.3%	325	16.4%	279	14.1%

Table 255 – Oesophageal cancer (C15.0-C16.0): adjuvant external radiotherapy and chemotherapy in patients with major surgery, by pathological stage (pStage) (surg<+9m)

		External Radiotherapy Only		External Radiotherapy and Chemotherapy		Chemotherapy Only	
pStage	Total (100%)	N	%	N	%	N	%
I	441	3	0.7%	8	1.8%	32	7.3%
II	529	13	2.5%	52	9.8%	75	14.2%
III	420	15	3.6%	67	16.0%	85	20.2%
IV	135	4	3.0%	25	18.5%	47	34.8%
X	452	9	2.0%	25	5.5%	77	17.0%
Total	1 977	44	2.2%	177	9.0%	316	16.0%

Table 256 – Oesophageal cancer (C15.0-C16.0): overview of general treatment schemes

Treatment scheme	Frequency	Percent
Major surgery	1 977	34.0
Surgery	1 046	18.0
Chemotherapy < surgery	118	2.0
Chemotherapy < surgery < chemotherapy	121	2.1
Chemotherapy < surgery < chemotherapy/radiotherapy	33	0.6
Chemotherapy < surgery < radiotherapy	7	0.1
Chemotherapy/radiotherapy < surgery	270	4.6
Chemotherapy/radiotherapy < surgery < chemotherapy	40	0.7
Chemotherapy/radiotherapy < surgery < chemotherapy/radiotherapy	6	0.1
Chemotherapy/radiotherapy < surgery < radiotherapy	9	0.2
Radiotherapy < surgery	5	0.1
Radiotherapy < surgery < chemotherapy/radiotherapy	1	0.0
Radiotherapy < surgery < radiotherapy	1	0.0

Treatment scheme	Frequency	Percent
Surgery < chemotherapy	155	2.7
Surgery < chemotherapy/radiotherapy	137	2.4
Surgery < radiotherapy	28	0.5
No surgery	3 836	66.0
Chemotherapy	899	15.5
Chemotherapy/radiotherapy	1 224	21.1
Radiotherapy	331	5.7
No chemotherapy/radiotherapy	1 382	23.8
Other treatment*	674	11.6
Coagulation (9m)	209	3.6
Cryotherapy (9m)	18	0.3
Lasertherapy (9m)	38	0.7
Stenting and dilatation (9m)	494	8.5
No major treatment registered	708	12.2

Table 257 – Gastric cancer (C16.1-16.9): therapeutic procedures

Therapeutic procedure	Total (N=4 847)		2004 (N=988)	2005 (N=1 009)	2006 (N=1 006)	2007 (N=921)	2008 (N=923)
	N	%	%	%	%	%	%
Surgery (-1m<inc<+9m)							
Major surgery : oesophagectomy/gastrectomy	2 409	49.7	49.4	52.3	51.3	49.4	45.7
Gastrostomy	142	2.9	2.7	3.6	3.4	2.4	2.5
Thoracotomy	11	0.2	0.1	0.3	0.2	0.2	0.3
Gastrotomy	13	0.3	0.5	0.2	0.0	0.5	0.1
Lymphadenectomy	503	10.4	10.6	10.2	10.8	9.6	10.6
Radiotherapy							
Without surgery (-1m<inc<+9m)	107	4.4	3.8	5.4	5.7	4.1	3.0
External radiotherapy	107	4.4	3.8	5.4	5.7	4.1	3.0
External radiotherapy and brachytherapy combined	0	0.0	0.0	0.0	0.0	0.0	0.0
Brachytherapy	0	0.0	0.0	0.0	0.0	0.0	0.0
Neo-adjuvant (-9m<surg)	15	0.6	1.0	1.1	0.2	0.0	0.7
External radiotherapy	14	0.6	0.8	1.1	0.2	0.0	0.7
External radiotherapy and brachytherapy combined	0	0.0	0.0	0.0	0.0	0.0	0.0
Brachytherapy	1	0.0	0.2	0.0	0.0	0.0	0.0
Adjuvant (surg<+9m)	303	12.6	13.3	13.4	14.5	11.0	10.0
External radiotherapy	303	12.6	13.3	13.4	14.5	11.0	10.0
External radiotherapy and brachytherapy combined	0	0.0	0.0	0.0	0.0	0.0	0.0
Brachytherapy	0	0.0	0.0	0.0	0.0	0.0	0.0
Chemotherapy							
Without surgery (-1m<inc<+9m)	753	30.9	28.4	29.7	33.3	31.1	31.9
Neo-adjuvant (-9m<surg)	251	10.4	4.5	7.0	9.9	13.8	18.5
Adjuvant (surg<+9m)	708	29.4	28.1	26.1	29.7	32.5	31.3
Coagulation							

Therapeutic procedure	Total (N=4 847)		2004 (N=988)	2005 (N=1 009)	2006 (N=1 006)	2007 (N=921)	2008 (N=923)
	N	%	%	%	%	%	%
Without surgery (-1m<inc<+9m)	152	6.2	5.8	6.2	5.5	6.2	7.4
Preoperative (-9<surg)	96	4.0	3.7	4.7	5.4	2.6	3.1
Postoperative (surg<+9m)	51	2.1	1.8	2.8	3.1	1.3	1.2
Cryotherapy							
Without surgery (-1m<inc<+9m)	29	1.2	1.0	2.3	0.6	1.5	0.6
Preoperative (-9<surg)	64	2.7	1.6	2.7	2.7	2.4	4.0
Postoperative (surg<+9m)	34	1.4	1.2	1.5	1.7	1.8	0.7
Lasertherapy							
Without surgery (-1m<inc<+9m)	20	0.8	0.8	0.8	1.0	1.3	0.2
Preoperative (-9<surg)	17	0.7	0.6	0.9	0.6	0.9	0.5
Postoperative (surg<+9m)	15	0.6	0.6	0.4	0.6	0.4	1.2

Table 258 – Gastric cancer (C16.1-C16.9): external radiotherapy and chemotherapy in patients without major surgery by clinical stage (cStage)

		External Radiotherapy Only		External Radiotherapy and Chemotherapy		Chemotherapy Only	
cStage	Total	N	%	N	%	N	%
0	-	-	-	-	-	-	-
I	123	3	2.4%	1	0.8%	12	9.8%
II	55	2	3.6%	1	1.8%	15	27.3%
III	84	2	2.4%	4	4.8%	29	34.5%
IV	651	12	1.8%	31	4.8%	310	47.6%
X	1 525	22	1.4%	29	1.9%	321	21.1%
Total	**2 438**	**41**	**1.7%**	**66**	**2.7%**	**687**	**28.2%**

Table 259 – Gastric cancer (C16.1-C16.9): neoadjuvant external radiotherapy and chemotherapy in patients with major surgery by clinical stage (cStage)

		External Radiotherapy Only		External Radiotherapy and Chemotherapy		Chemotherapy Only	
cStage	Total	N	%	N	%	N	%
0	4	0	0.0%	0	0.0%	0	0.0%
I	333	2	0.6%	0	0.0%	15	4.5%
II	214	0	0.0%	1	0.5%	34	15.9%
III	204	0	0.0%	0	0.0%	69	33.8%
IV	119	0	0.0%	1	0.8%	32	26.9%
X	1 535	6	0.4%	4	0.3%	95	6.2%
Total	**2 409**	**8**	**0.3%**	**6**	**0.3%**	**245**	**10.2%**

Table 260 – Gastric cancer (C16.1-C16.9): adjuvant external radiotherapy and chemotherapy in patients with major surgery by pathological stage (pStage)

		External Radiotherapy Only		External Radiotherapy and Chemotherapy		Chemotherapy Only	
pStage	Total	N	%	N	%	N	%
I	732	1	0.1%	32	4.4%	51	7.0%
II	418	3	0.7%	82	19.6%	63	15.1%
III	490	2	0.4%	114	23.3%	94	19.2%
IV	373	1	0.3%	44	11.8%	134	35.9%
X	396	2	0.5%	22	5.6%	72	18.2%
Total	**2 409**	**9**	**0.4%**	**294**	**12.2%**	**414**	**17.2%**

Table 261 – Gastric cancer (C16.1-C16.9): overview of general treatment schemes

Treatment scheme	Frequency	Percent
Surgery	1 611	33.2
Chemotherapy < surgery	71	1.5
Chemotherapy < surgery < chemotherapy	153	3.2
Chemotherapy < surgery < chemotherapy/radiotherapy	21	0.4
Chemotherapy/radiotherapy < surgery	3	0.1
Chemotherapy/radiotherapy < surgery < chemotherapy	3	0.1
Radiotherapy < surgery	7	0.1
Radiotherapy < surgery < chemotherapy	2	0.0
Surgery < chemotherapy	256	5.3
Surgery < chemotherapy/radiotherapy	273	5.6
Surgery < radiotherapy	9	0.2
No surgery	**2 438**	**50.3**
Chemotherapy	687	14.2
Chemotherapy/radiotherapy	66	1.4
Radiotherapy	41	0.9
No chemotherapy/radiotherapy	1 644	33.9
Other treatment*	154	3.2
Coagulation (9m)	124	2.6
Cryotherapy (9m)	23	0.5
Lasertherapy (9m)	16	0.3
No major treatment registered	1 490	30.7

* Multiple other treatments for one patient possible

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