Financement de l'hôpital de jour gériatrique

KCE reports vol. 99B

Federaal Kenniscentrum voor de Gezondheidszorg
Centre fédéral d'expertise des soins de santé
2008

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Centre fédéral d'expertise des soins de santé
2008

KCE REPORTS 99B

Titre :	Financement de l'hôpital de jour gériatrique
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Conflict of interest :	Claire Beguin, Daniel Gillain, Pierre Gillet et Philippe Kolh travaillent dans un hôpital qui dispose d'un service de gériatrie et d'un hôpital de jour gériatrique ; Françoise De Wolf a travaillé dans un hôpital qui a participé au projet pilote hôpital de jour gériatrique ; Raf Van Hoeyweghen, Anja Velghe, Xavier Boman Jean Petermans et Nele Van Den Noortgate sont gériatres et sont liés à un hôpital.
Disclaimer:	Les experts externes ont collaboré au rapport scientifique qui a ensuite été soumis aux validateurs. La validation du rapport résulte d'un consensus ou d'un vote majoritaire entre les validateurs. Le KCE reste seul responsable des erreurs ou omissions qui pourraient subsister de même que des recommandations faites aux autorités publiques.
Mise en Page :	Ine Verhulst

Bruxelles, 9 janvier 2009

Etude n° 2007-16

Domaine : Health Services Research (HSR)

MeSH : Health Services for the Aged ; Financing, Organized ; Frail Elderly ; Geriatric Assessment

NLM classification : WT 27

Langage : français, anglais

Format : Adobe® PDF™ (A4)

Dépôt légal : D/2008/10.273/91

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Comment citer ce rapport ?

Gillain D, Velghe A, Boman X, Fecher F, Gillet P, Kolh P, et al. Financement de l'hôpital de jour gériatrique. Health Services Research (HSR). Bruxelles: Centre fédéral d'expertise des soins de santé (KCE); 2008. KCE reports 99B (D/2008/10.273/91)

[a] International Center of Research and Information on the Public, Social and Cooperative Economy.



PREFACE

En tant qu'individus, nous nous réjouissons tous de l'augmentation de l'espérance de vie. Toutefois, son impact sur le vieillissement démographique constitue une source de préoccupations pour les gestionnaires de l'assurance maladie et les différents intervenants des soins de santé. La qualité des années de vie gagnées fait l'objet de préoccupations particulières, d'autant plus que les études à ce sujet aboutissent à des résultats contradictoires.

Les autorités compétentes de notre pays ont d'ailleurs bien compris l'ampleur du défi en initiant un programme spécifique pour le patient gériatrique, dans le cadre duquel le KCE a déjà produit un rapport sur le financement de la gériatrie en hospitalisation classique.

Un autre volet de cette initiative consistait à financer, sous la forme d'un projet pilote, l'organisation et le fonctionnement d'hôpitaux de jour gériatriques (HJG). Il s'agit d'une approche relativement récente au sujet de laquelle se pose différentes questions bien légitimes. L'hospitalisation de jour est elle préférable à l'hospitalisation classique ? Pour quels types de patients ? Comment faut-il l'organiser et le financer ?

Nous avons essayé d'apporter notre contribution à ce vaste débat. Nous espérons que toutes celles et tous ceux qui sont concernés par la gériatrie trouveront des raisons d'être rassérénés par la qualité des structures et des moyens mis en place et par les perspectives qu'ils offrent.

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Executive summary

INTRODUCTION

Avec le vieillissement de la population, les soins de santé prodigués aux patients gériatriques sont susceptibles de présenter une importance croissante. En effet, le patient gériatrique présente des besoins spécifiques auxquels il convient de répondre afin d'éviter ou de retarder le déclin fonctionnel et le placement en institution. Pour optimaliser la prise en charge de ce type de patient, le gouvernement fédéral a mis en place un programme de soins qui organise et définit les structures de prise en charge des patients gériatriques. Parmi ces structures, l'hôpital de jour gériatrique (HJG) a été officiellement créé et reconnu à côté des lits G de l'hôpital classique, de la fonction de liaison interne au sein de ce dernier et de la consultation de gériatrie. L'hôpital de jour gériatrique constitue une entité architecturale distincte de l'hôpital général.

L'hôpital gériatrique de jour s'intéresse aux patients gériatriques âgés en moyenne de plus de 75 ans, référés par un médecin généraliste ou spécialiste ou après consultation de gériatrie. Il a pour mission d'organiser de manière multidisciplinaire l'évaluation diagnostique, la prise en charge thérapeutique ainsi que la revalidation du patient.

Actuellement, ces hôpitaux de jour bénéficient d'un financement sous forme de projet pilote.

QUESTIONS DE RECHERCHE

Ce rapport vise à répondre aux questions de recherche suivantes :

- La pertinence de l'hôpital de jour gériatrique est-elle justifiée par les données de la littérature internationale? Y a-t-il des études disponibles permettant de nous éclairer sur la manière de financer une telle structure, et le cas échéant, ces expériences sont-elles transposables au contexte belge ?
- Quelles sont les caractéristiques des patients qui ont recours à l'HJG ? Dans quelle mesure diffèrent-ils des patients admis en hôpital classique ? quelle part des patients hospitalisés pourrait être admise en HJG?
- Quel système de financement peut être développé et proposé afin de tenir compte du profil des patients ? Quel en serait l'impact sur le budget consacré à l'hôpital de jour gériatrique ?

EFFICACITÉ CLINIQUE ET FINANCEMENT DE L'HÔPITAL DE JOUR GÉRIATRIQUE

Les aspects étudiés dans cette partie concernent l'organisation, le fonctionnement, le mode de financement, l'efficacité de l'HJG et le type de patients qui y sont admis.

METHODOLOGIE

Afin de faire le point sur l'efficacité d'un hôpital de jour gériatrique, une revue de la littérature a été réalisée. Les articles publiés depuis 1987, date de l'apparition des premières structures de ce type, ont été recherchés et sélectionnés dans les bases de données bibliographiques Medline, Embase, Cochrane, CRD et Econlit. La littérature grise a également été consultée.

RESULTATS

Peu de publications décrivent les activités et l'efficacité des HJG de même que leur système de financement. De plus, les comparaisons entre études sont difficiles en raison du manque de standardisation des concepts utilisés (exemple, les échelles de mesure du profil gériatrique).

Si toutes les études comparant les approches gériatriques spécifiques à la pratique « habituelle » de médecine hospitalière démontrent l'efficience des soins gériatriques et plus particulièrement de l'évaluation gériatrique globale, il n'existe pas de données probantes relatives à l'efficacité d'une telle évaluation dans le cadre spécifique d'un HJG. En outre, il n'existe pas de consensus clair quant à l'équipement et aux activités d'un HJG. Les termes "unité de jour", "hôpital de jour", "soins de jour" sont utilisés de manière indifférenciée alors qu'ils ne recouvrent pas les mêmes entités ni les mêmes activités. C'est également le cas pour la composition de l'équipe gériatrique multidisciplinaire et le rôle de ses différents membres bien que les infirmiers et les travailleurs paramédicaux réalisent toujours l'évaluation gériatrique.

Les activités diagnostiques de l'HJG sont rarement décrites dans la littérature contrairement aux activités de revalidation. Pour les patients victimes d'accidents vasculaires, les patients déments, cardiaques où qui souffrent de pathologies chroniques, des effets positifs de l'intervention en HJG sur les résultats sont démontrés (niveau d'évidence 1a).

Par ailleurs, l'hétérogénéité de la population gériatrique, le fait que les patients souffrent de poly- pathologies, l'étendue de l'âge des patients (entre 55 et 75 ans et plus) compliquent l'étude de l'efficacité de l'HJG. De plus, il n'existe pas de consensus sur la manière de mesurer le rapport 'coût-efficacité' de l'HJG.

Pour conclure, nous ne disposons pas de données probantes claires sur le bénéfice d'une prise en charge en HJG en comparaison avec une prise en charge en hôpital classique, même s'il parait indiscutable (niveau d'évidence 1a) que l'évaluation gériatrique globale est une méthode performante de prise en charge du patient gériatrique. Les résultats des études relatives au système de financement qui pourrait être appliqué à l'HJG sont peu concluants.

COMPARAISON DES PATIENTS EN HJG ET EN HÔPITAL CLASSIQUE

La deuxième question de recherche porte sur la possibilité de traiter des patients présentant un profil gériatrique en hôpital de jour plutôt qu'en hôpital classique. Une méthode de comparaison des bases de données a donc été développée afin d'identifier ces patients.

METHODOLOGIE DE COMPARAISON DES BASES DE DONNEES

La base de données collectée dans le cadre de l'évaluation prospective et multicentrique de l'HJG pour le SPF contient un grand nombre d'informations sur les patients qui utilisent l'HJG depuis 2006. En effet, tous les patients admis sur une période de 3 mois dans 42 HJG ont été enregistrés (n=2 739). Pour chaque admission, ont été collectés : les données socio-démographiques, les actes pratiqués (diagnostic, évaluation, traitement, revalidation) ainsi que les outils d'évaluation utilisés.

Une comparaison a été effectuée entre chaque patient de l'HJG et des patients 'semblables' admis en hôpital classique en 2003. Ceux-ci proviennent de la base de données administratives couplées RCM/RFM de 2003.

Avant de procéder à la comparaison, une sélection des patients de l'hôpital classique susceptibles d'être admis en hôpital de jour gériatrique a été réalisée lors de la constitution de la base de données. Les profils cliniques des patients de l'HJG ont été listés (codes ICD-9) et regroupés en problèmes médicaux spécifiques (PMS).

Un thesaurus de 48 groupes de PMS a été constitué, sur base desquels la comparaison entre les patients hospitalisés et les patients de l'HJG a pu être réalisée.

Dans un second temps, le profil gériatrique des patients a été identifié dans les deux populations. Le profil gériatrique est défini par la présence de pathologies multiples, de syndromes gériatriques (SG - mobilité réduite, chute, problèmes mémoriels, dépression, incontinence, malnutrition, perte de poids, fragilité et douleur) spécifiques au déclin fonctionnel des patients, et de fragilité.

La comparaison des bases de données a été réalisée après exclusion des patients ayant subi une procédure en salle d'opération, des patients classés dans un DRG chirurgical, des patients ayant fait un passage en soins intensifs, des patients ayant un degré de sévérité supérieur à 2 et des patients ayant dans leurs codes diagnostiques au moins un code susceptible d'amener une complication.

Afin de déterminer la sévérité du profil des patients, ces derniers ont alors été classés en groupes présentant un PMS (patients monopathologiques), plusieurs PMS (patients polypathologiques) et la présence ou non d'un ou plusieurs syndromes gériatriques.

Un échantillon de 12 538 patients issus de la base de données RCM/RFM 2003 concernant l'ensemble des services de l'hospitalisation classique a finalement été comparé à 2 229 patients de la base de données HJG.

RESULTATS

Malgré leur ressemblance en termes de pathologie, les patients monopathologiques à l'HJG sont en moyenne plus âgés, et comptent proportionnellement plus de femmes que les patients hospitalisés. Ils sont aussi plus nombreux à présenter des syndromes gériatriques.

Les patients polypathologiques en HJG, comme les patients monopathologiques, viennent davantage du domicile (et des MR/MRS) et sont davantage référés par le médecin généraliste.

SYSTEMES DE FINANCEMENT POUR L'HOPITAL DE JOUR GERIATRIQUE

Depuis 2006, les HJG sont financés dans le cadre d'un projet pilote par un forfait inclus dans la partie B1 du budget de l'hôpital (€ 121 312 par HJG destinés à financer l'infrastructure et l'hôtellerie), et par un forfait inclus dans la partie B2 (€ 137 643 par HJG destinés à financer 2 ETP infirmiers et 1 ETP paramédical) et diverses tarifications à l'acte notamment pour l'évaluation gériatrique multidisciplinaire. Un nouveau financement tenant compte du profil particulier des patients gériatriques est envisagé pour 2010.

Partant de l'hypothèse qu'une fraction des patients gériatriques pour lesquels une évaluation est requise sont admis à l'hôpital classique alors qu'ils pourraient être vus en HJG, on peut déduire que les HJG qui n'ont pas utilisé leurs capacités d'admission pourraient, dans le futur, voir l'intensité de leurs activités augmenter.

METHODOLOGIE

Après avoir investigué les modes de financement possibles pour l'HJG, y compris la méthodologie utilisée pour l'hôpital de jour médical, un système fondé sur le financement actuel des hôpitaux classiques a été retenu. Le modèle de financement proposé se divise en 3 composantes : un financement à l'acte du gériatre, un forfait à l'admission calculé à partir du B2 et un forfait par pathologie multipliant un forfait journalier (calculé également à partir du B2) par la durée de séjour.

Les forfaits par admission et forfaits journaliers peuvent être estimés, soit par une valeur nationale standard appliquée uniformément à tous les hôpitaux, soit par une valeur propre à chaque hôpital.

Trois modèles ont été construits : un modèle simplifié qui tient compte des valeurs standard des forfaits et du volume des patients pour l'ensemble des HJG et deux modèles complets qui tiennent compte du case-mix de chaque hôpital, l'un utilisant les valeurs standards des forfaits (modèle standard), l'autre utilisant les valeurs spécifiques des forfaits pour chaque hôpital (modèle spécifique par hôpital). Ces derniers tiennent compte de la lourdeur et du profil gériatrique mesurés par les caractères mono- ou polypathologiques des patients ainsi que par la présence de syndrome(s) gériatrique(s).

RESULTATS

Composantes du financement

Paiement à l'acte :

L'évaluation gériatrique multidisciplinaire (code 102233) de € 90.88 peut être facturée pour chaque admission en HJG. Cette composante est destinée au financement du gériatre.

Forfaits de séjour :

En utilisant les forfaits par admission par patient de la base de données RCM/RFM 2003, on retiendra la valeur moyenne de € 146.2 pour le forfait par admission et € 19.6 pour le forfait journalier.

Les simulations ci-dessous correspondent aux 42 HJG pour lesquels les données étaient disponibles. Toutefois, le nombre d'HJG en fonctionnement actuellement est supérieur (83 HJG en 2008 et 29 candidats potentiels pour 2009), ce qui nécessiterait une actualisation pour déterminer l'impact budgétaire final.

Modèle simplifié :

Le modèle simplifié qui ne tient pas compte du case-mix fournit une estimation pour le financement d'un HJG à € 56 915 (€ 35 088 pour les admissions et € 21 827 pour les séjours) par an, soit € 2 290 430 pour 42 HJG.

Modèle standard :

En appliquant la valeur standard par admission de € 146.2 et de € 19.6 par jour à chaque hôpital et en tenant compte du profil des patients pour chaque hôpital, des sommes spécifiques pour chaque HJG peuvent être calculées. Le budget annuel global serait de € 3 409 468, une variation budgétaire par rapport au modèle simplifié due à la prise en compte du profil des patients (pour les 42 HJG comptabilisés).

Modèle spécifique par HJG :

En appliquant à chaque HJG ses valeurs spécifiques de forfaits par jour et par admission et en tenant compte de son case-mix propre, des valeurs spécifiques pour chaque HJG peuvent être calculées, pour un budget total de € 3 501 368 par an (pour les 42 HJG).

Impact budgétaire global

Partant de l'hypothèse réaliste que chaque HJG accueille 3 nouveaux patients par jour, et en appliquant le modèle spécifique, le total des coûts pour 250 jours de travail s'élèverait à € 12 338 274, un montant très proche du montant consacré actuellement au projet pilote (€ 10 876 152).

LIMITATIONS DE L'ETUDE

Toute l'étude repose sur l'hypothèse selon laquelle ce qui est réalisé en HJG constitue une référence. C'est en effet sur cette base qu'est réalisée la comparaison des bases de données qui joue un rôle considérable dans l'exercice de financement. L'utilisation de cette hypothèse, imparfaite, s'explique entre autres par l'absence de consensus à propos de l'évidence en la matière.

En utilisant la base de données RCM/RFM de 2003 et la base de données SPF 2006 (enquête hôpital de jour), il est évident que les populations ne sont pas tout à fait homogènes. Toutefois, cela permet d'éviter l'effet potentiellement confondant de la disponibilité d'HJG au moment des hospitalisations étudiées.

Etant donné le caractère récent de plusieurs HJG, il est possible que la patientèle de la base de données utilisée ne reflète pas la patientèle réelle à long terme de cette structure.

La comparabilité des deux bases de données n'est pas parfaite : elles n'ont pas été collectées dans le même but, elles ne contiennent pas les mêmes données et celles-ci sont codées différemment. Les données RCM/RFM sont plus exhaustives.

La construction de modèles de financement ne se base que sur les activités diagnostiques des HJG disponibles au départ de l'étude. Ces modèles sont donc à considérer plutôt comme un exercice à améliorer que comme un modèle utilisable tel quel pour le financement.

L'exercice ne concernait que l'hôpital classique comme lieu de recrutement de patients pour l'HJG. Aucune investigation, n'a été réalisée dans les maisons de repos, les maisons de repos et de soins ou à domicile. On ne peut pourtant exclure l'existence de besoins d'ordre gériatrique, au moins diagnostique, dans ces lieux de vie des personnes âgées.

L'étude n'a pas pris en compte la perspective du patient notamment en ce qui concerne l'aspect financier de la gériatrie en hôpital de jour.

Enfin, les alternatives possibles à l'hôpital de jour gériatrique, comme par exemple l'intervention de la médecine générale, n'ont pas fait l'objet d'une analyse, ce qui n'exclu en rien qu'elles puissent s'avérer utiles ou efficaces

RECOMMANDATIONS

Relatives aux données à réunir

- introduire, dès 2009, l'obligation de remplir un RCM lors d'une admission en hôpital de jour gériatrique ;
- sensibiliser les personnes concernées, à l'encodage des items caractérisant les patients gériatriques (codes du thésaurus gériatrique), ainsi qu'à celui des codes des co-morbidités qui influencent tant l'état de santé que les contacts avec les services de santé (codes V) ;
- suivre annuellement l'évolution de la part relative des activités respectivement diagnostiques, thérapeutiques et de revalidation ;
- vérifier l'impact de la durée de séjour sur le financement en utilisant les données RCM des années 2004, 2005 et 2006 ;
- utiliser les résultats de la validation basée sur les RCM 2004, 2005 et 2006 et de les coupler avec les enregistrements du RCM qui seraient rendus obligatoires en HJG dès 2009 ;

Relatives au projet pilote

- réduire ou suspendre le financement pour les hôpitaux qui présentent un taux d'occupation moyen significativement inférieur à celui des autres hôpitaux qui ont une durée d'exercice égale ;

Relatives à la poursuite du financement au-delà du projet pilote

Compte tenu d'un côté des attentes exprimées par de nombreux acteurs en matière de nouvelles approches pour la prise en charge du patient âgé mais de l'autre côté des limitations de la présente étude et du peu d'évidences trouvées à propos des meilleures solutions de prise en charge et de financement, il convient d'accompagner le financement de ces nouvelles approches de travaux de recherche et de réflexions complémentaires sur :

- les objectifs de l'HJG, à savoir quels besoins de ces patients peuvent être satisfaits en HJG en termes de bilan et diagnostic, de thérapeutique et de revalidation ;
- les moyens qui doivent être mis en œuvre pour couvrir ces besoins ;
- la satisfaction engendrée chez les patients, leur famille et chez les prestataires de soins par ces nouvelles initiatives ;
- les coûts supportés par le patient ;
- le rôle que jouent ou pourraient jouer d'autres prestataires tels que les généralistes ;
- les méthodes alternatives de financement par rapport à celle du projet pilote qui peuvent être envisagées pour ces nouvelles approches ;
- la norme à employer comme seuil de financement (par ex. minimum 3 patients par jour).

Scientific summary

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GLOSSARY

These definitions are coming from Belmin[1] and are important as in describing the geriatric patient it is important to be as precise as possible in the identification of the patient, function and societal impacts.

AUTONOMY: to be able to decide, i.e. to be able to manage yourself, living alone, being free, doing what you want; to be self-sufficient.

DEPENDENCY: needing help.

DISABILITY: infirmity which puts you into a certain degree of inferiority

FRAILTY: Syndrome observed in the elderly, not associated with pathology, but with a multi-systemic reduction of physiological capacity. The consequence is a limitation of stress and change adaptation[2].

FUNCTIONAL DECLINE: limitation of capacity; can be caused by, frailty, illness, handicap and very often produce disability. **All those situations** seem reversible, even if a person is very old. The reversibility is sometimes due to the recovery of the illness but sometimes not; so to maintain autonomy it is necessary to manage the deficits to permit the better adaptation. **Example:** Frailty can entail disability and dependency; so you can be frail, dependent but autonomous, if good management is provided to meet your needs. That is what is proposed by an overall geriatric assessment and interventions.

FUNCTIONAL ASSESSMENT: measurement of capacities (often residual) which permit patient to live autonomously in his/her environment.

GERIATRIC ASSESSMENT: evaluation of the different system functions in order to define the impact of different functions on the level of functional decline and to manage the way to maintain autonomy.

LIST OF ABBREVIATIONS

AD	Alzheimer's Disease
ADL	Activity of Daily Living
AEP	Appropriateness Evaluation Protocol
APHJPA	Association pour la Promotion des Hôpitaux de Jour pour Personnes Âgées
APR-DRG	All-Patient Refined Diagnosis-Related Group
ARCD	Age Related Cognitive Decline
CBOC	Community-Based Outpatient Clinic
CC	Complication and Comorbidity
CCI	Charlson Comorbidity Index
CEA	Cost-Effectiveness Analysis
CES-D	Center for Epidemiologic Studies Depression Scale
COPD	Chronic Obstructive Pulmonary Disease
CS	Cohort Study
CV	Variation Coefficient
DRG	Diagnosis-Related Group
E codes	ICD-9 External Causes Of Injury And Poisoning Codes
FIM	Functional Independence Measure
FOD	Federale Overheidsdienst - Federal Public Service
FPS	Federal Public Service
FTE	Full-Time Equivalent
FY	Fiscal Year
GAU	Geriatric Assessment Unit
GDH	Geriatric Day Hospital
GDS	Geriatric Depression Scale

GEM	Geriatric Evaluation and Management
GEU	Geriatric Evaluation Unit
GP	General Practitioner
GS	Geriatric Syndrome
HACC	Home and Community Care
HTA	Health Technology Assessment
IADL	Instrumental Activity of Daily Living
ICD-9-CM	International Classification of Diseases, Ninth Revision, Clinical Modification
ICU	Intensive Care Unit
INAMI	Institut National d'Assurance Maladie-Invalidité
LOS	length of stay
MCHP	Manitoba Centre for Health Policy
MCI	Mild Cognitive Impairment
MFG	Résumé Financier Minimum - minimal financing data
MKG	Minimale Klinische Gegevens - minimal clinical data
MMS	Mini Mental State
MMSE	Mini-Mental State Examination
MR	Maison de repos - Rest home
MRS	Maison de repos et de soins - Nursing home
NEC	ICD-9 rule : Not Elsewhere Classifiable
NOS	ICD-9 rule : Not Otherwise Specified
ODx	Other Diagnoses (secondary diagnosis)
PACE	Program for All-inclusive Care for the Elderly
PDx	Principal Diagnosis
PQRI	Physician Quality Reporting Initiative
QALY	Quality-Adjusted Life Year
RCM	Résumé Clinique Minimum - minimal clinical data
RCT	Randomized Controlled Trial
RD	Royal Decree
RFM	Minimale Financiële Gegevens - minimal financing data
RGM	Minimum geriatric data
RIZIV	Rijksinstituut voor ziekte- en invaliditeitsverzekering
ROB	Rustoorden voor bejaarden - Rest home
RVT	Rust- en verzorgingstehuizen - Nursing home
SES	Socioeconomic Status
SHC	Senior Health Centre
SIP:PFD	Sickness Impact Profile: Physical Functioning Dimension
SMAF	Système de Mesure de l'Autonomie Fonctionnelle
SMP	Specific Medical Problem
SPF	Service Public Fédéral - Federal Public Service
SR	Systematic Review
V codes	ICD-9 Factors Influencing Health Status And Contact With Health Services
VA	Veterans Affairs

SCOPE OF THIS REPORT

The main goal of the study is to assess and to verify whether the geriatric day hospital as a specific function for the ambulant older patient, brings a real improvement in quality of care at an acceptable cost compared to classical hospitalisation.

1 INTRODUCTION

Geriatric care is becoming more important especially because of a fast growing of the old population.

This population has specific needs that are more in correlation with their profile of functionality than with their age. Frailty, illness, social complexity should be assessed to prevent and treat the risk and consequences of disability and functional decline.

Specific tools have been created to try to achieve these goals with the best efficiency. The validation of many of these scales is ongoing or recently updated.

At the same time, new functions have be developed and promoted by health care administration in the Program of care for geriatric patient. The program has to be evaluated looking at its efficiency, but also at its costs compared with classical care.

1.1 CONTEXT

In this introduction, after a brief discussion of the demographical challenge, frailty, disability and functional decline versus normal aging will be discussed.

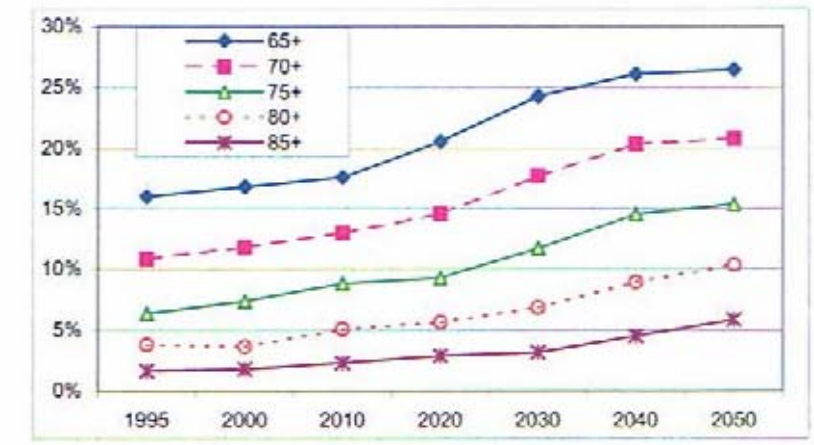
1.1.1 Demographical situation

The evolution of number of patients according age is shown in Figure 1.

As we can see, the octo- and nonagerians are the fast growing groups in the next 50 years. The percentage of people aged eighty and older will grow from 22% of the group 65 years and older up to 33% of this group in 2040 [3].

People aged 85 years and older will become 25% of the elderly population in 2050.

Figure 1: Part of the elders in the population in function of age groups (1995-2050).



Calculations UCL, based on INS, Plannning office, population forecasts

Data show that this situation will probably continue to go on; a female baby born today has a one in two chance of living to the age of a hundred. Females will be numerous in this population, the sex ratio being 1 male for 3 females in the eighties.

Especially in this aged group morbidity due to chronic illness and disability will be more frequent. So life expectancy should be considered with and without disability. Today a male of 75 has still 9 years of life expectancy and a female 11 years; but during the 9 years a man will have a period of 6.5 years of handicap and a woman will have one of 4.5 years.

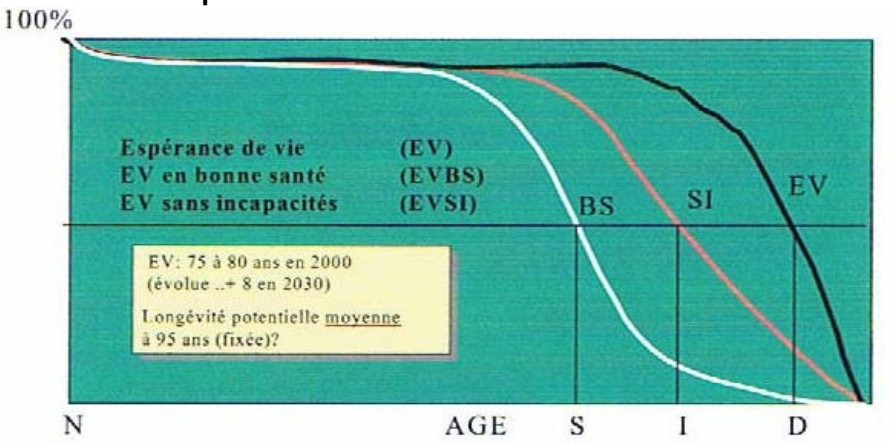
As we can see in Figure 2 there is a difference between life expectancy, healthy life expectancy and disability free life expectancy. So the purpose of health and society care is to try to reduce as much as possible the difference between those 3 curves.

The period of handicap is time during which functional decline, frailty and illness greatly alter quality of life and cause an increase in the health and social costs.

However, if morbidity is compressed as everybody hopes, quality of life will become better for the old population.

Anyway, even if a decline in morbidity is achieved, the need for health care will grow due to a high absolute number of people in the aged group and because of the effects of medical prevention and treatment.

Figure 2: Survival curves of life expectancy, healthy life expectancy and without handicap[3]



1.1.2 Old patient, geriatric patient, frailty

1.1.2.1 Old patient

The old patient is defined especially by his age. Initially, some years ago, 65 years and older has been chosen because it was the retirement age. In a lot of medical studies the cut-off for older age group was also set at 65 years, but nowadays, most often the barrier of 70 or 75 years is used.

A consensus is not reached between researchers to decide at what age you are old, because it seems quite difficult. Oldness is a part of life with its particularities and the importance is the type of person, and the statistical period when problems occur most frequently, because it has importance for quality of life and financial costs of help. So this question is more interesting for public health, politicians, insurances,…than for medical doctors and teams which take care of elderly. Actually, the age of 75 seems a threshold, but if compression of morbidity will become better, 80 or 85 years could be the reference in the future. Age is an abstract parameter which has only importance in predicting risks.

1.1.2.2 Geriatric patient

In the same matter, it is difficult and very hazardous to define a geriatric patient, because it concerns the definition of a concept concerning clinical and individual situations. Geriatricians with their clinical expertise can easily recognise the geriatric patients but a definition is necessary so that also non-geriatricians can identify these subjects.

A lot of experts and medical society had tried to get a definition of the geriatric patient. In summary, there are two types of definition, one which directly check patient characteristics and the other looking at description of geriatric medicine as defined by different geriatric medicine societies and in 2005 by the Belgian Geriatric Society[a].

a www.geriatrie.be

Finally, the characteristic of geriatric patient have been synthesised in 5 items described in the Belgian care program for geriatric patients (see further):

- loss of homeostasis
- atypical patterns of illness
- numerous pathology
- mix of somatic, psychological and social situations
- particular pharmacokinetics

Differences between old person and geriatric patient are summarised in Figure 3.

Figure 3: difference between old person and geriatric patient

Geriatric patient	Old person
multipathology	>75 years
handicap	good health
dependancy	good quality of life
less quality and life expectancy	life expectancy in good health
life conditions	autonomous

1.1.2.3 Frailty

The term of Frailty is has been used more and more in the last 10 years in geriatric literature to check people who lose their reserve (physical, functional, cognitive,…) and who become more sensitive to pathology with a risk of functional decline. But unfortunately all authors do not agree with the definition and frequently this creates confounding factors and misinterpretation of results.

Fried in 2001[4] has demonstrated that 5 items can be considered as frail markers: loss of weight, weakness "Self-reported", weakness described by loss of force (grip strength), slowing down of gait, diminution of physical activity.

The author finds that 6,9% of people living at home have 3 or more of those weaknesses and can be considered as frail which means that they are more at risk of falls, loss of mobility, hospitalisation and disability.

Some other authors [5] [6] [7] think that frailty is also associated with pathology and social situations. Atherosclerosis, sarcopenia, anorexia, immobility, cognitive dysfunction, mobility trouble make patients at risk of frailty.

Figure 4: Frailty components

FRAILTY
Fall
Malnutrition
Cognitive function
Polymedication
Deafness, blindness
Incontinence
> 85 years
Hospital discharge
Socio economic problems
Familial problems (lost, being alone, moving,..)

from Winnograd and al,1991[5]

But how measurement of frailty can be considered useful and how can we check it ?

Fried, using her model, shows that having 3 or more signs is sufficient to be considered as frail because person has a higher risk of mortality and functional decline in the next 5 years[8]. Winograd shows that presenting one or more frailty markers can predict a higher risk of institutionalisation, of mortality and longer stay in hospital [5].

1.1.3 Assessment tools

Definitions presented below are not very useful for the clinician because these are derived from theoretical models which have been created from big patient groups and are difficult to translate in individual clinical practice. These models are important in term of public health and in prediction of risk. The clinician will assess the risk profile by its anamnesis and examination of the patient. This is the more efficient way to assess the risk profile of the patient. Frailty can be considered as a multidimensional syndrome characterized by the loss of reserve and vulnerability to functional decline. Symptoms have to be checked to try to characterize the patient as a geriatric patient. For a systematic way of performing this multidisciplinary assessment, geriatric assessment tools should be developed, validated and tested on their usefulness in daily practice[9]. Several assessment tools are described in a previous KCE report [10].

Application of frailty models and geriatric assessment in order to integrate them in medical problem will be discussed in detail in the following chapters.

1.2 THE BELGIAN CARE PROGRAM FOR GERIATRIC PATIENT

1.2.1 The program in general

The care program for geriatric patient has been published in the "Moniteur Belge" the 07/03/2007. Beside the definition of the geriatric patient and the population which should benefit of that program, it creates an organisation and defines the structures.

The legislator has previewed specific organization of care with architectural structures and medical activities for geriatric patient.

So in the program the Geriatric activity is dedicated to 2 types of patients:

- old persons (>75) in curative but certainly preventive actions
- geriatric persons (not characterised by age as we will see below) in curative, palliative and preventive action.

As proposed in the program for the geriatric patient, every hospital has to organise geriatric care in beds for hospitalisation (G beds) and consultation for ambulant care. More over also internal and external liaison care and day hospital care has to be organized.

A multidisciplinary geriatric file is also necessary including care plans and the summary of the team meetings.

The team also should organize the geriatric manual, where procedures are described according to the good clinical practice.

The program also describes the minimum of number and types of paramedical means necessary to perform all the functions.

1.2.2 Legal definition of the geriatric day hospital

Geriatric day hospital takes part from care program for geriatric patient.

In Article 15 of the Royal Decree of 01/29/2007 (Royal Decree setting the standards which the program of care for geriatric patients must meet to be approved and, secondly, special complementary standards for the accreditation of hospitals and hospital services), the Lawmakers clarifies that "the admission to day hospital for the geriatric patient is made at the request of the general practitioner, or a specialist or after a geriatric consultation. This RD stipulates furthermore that: "The purpose (of GDH) is to organize, in a multidisciplinary way, diagnostic evaluation, therapeutic development and rehabilitation".

In the text, the four main areas are:

- Diagnostic activities: various examinations, advice and consultations of specialists,
- Interdisciplinary assessments of autonomy, fall, cognitive function and other geriatric syndromes.
- Therapeutic activities: administration, modification and evaluation of treatments as transfusion, wounds care etc
- Rehabilitation activities: walking and balance exercises, osteo-articular and muscular re-education to maximize the autonomy and the instrumental activities of daily living.

Moreover, the geriatric team of the day hospital should be multidisciplinary and be able to rely upon the following disciplines: Physician, Nurse, Physical therapist, Occupational therapist, Speech therapist, Social worker, Psychologist.

Finally it is also necessary to consider that the activity of the geriatric day hospital has to take place according to legally defined rules concerning architectural structures. So, articles 30 to 33 of the Royal Decree of 01/29/2007 organize the architectural components in the following way:

"Art. 30. The day hospital for geriatric patient establishes a recognizable and different entity. It contains at least the following: examination room; care room; rest room with adapted armchairs; dining room; a room for individual or group therapeutic activities; a sufficient number of sanitary facilities for the patients. Some activities as referred to in the third and fourth points may be in the same room.

The facilities necessary for functional rehabilitation must be available

Art. 31. The geriatric day hospital has a sufficient numbers of rooms adapted to geriatric patients admitted in day hospitalization. They are specifically reserved for the patients admitted in day hospitalization."

Of course, the cost of that type of care is difficult to calculate and to foresee. To get a better estimation of the real cost, some work has been initiated and financed by the federal health department (FOD) and by the expertise federal centre (KCE). It concerns especially the new functions in the care program for the geriatric patient (liaison and day hospital). The studies try to verify if there is an interest in managing patients by geriatric day hospital and internal liaison instead of classical way of hospitalisation (G beds). Studies would look at the need and specificity of staff, the organisation of the rooms and materials. They would deal with the efficiency in the evolution of the functional state of the patient, the mortality, morbidity, quality of life, etc. but also with the cost effectiveness of the new methods compared with more classical ones.

One of the main reasons to develop geriatric day hospitals lies in the presence of an ambulatory structure to realize geriatric assessment among patients whose hospitalization could thus be totally or partly avoided. A study, sponsored by SPF public health, entitled "POLICY OF JUSTIFIED ADMISSION IN BELGIAN HOSPITAL SECTOR" was realized between 2003 and 2005. This study collected AEP (Appropriateness Evaluation Protocol) data in 23 acute hospitals in the country. It shows that among the 4 164 days of hospitalization of patients over 75 years, almost about 30% were unjustified. More particularly, in the geriatric unit, this rate rises to nearly 40%. The protocol does not say that these patients should not be hospitalized, it says that in 40% of the studied days, the state of the patient did not require, that day, an acute bed. If we study more in detail the reasons for inappropriateness, it appears that in 44% of the unjustified days the patient can leave the hospital but its discharge is delayed, in 26% patients are waiting for a non- operating room procedure and in 13%, they are waiting for a medical opinion.

2 OBJECTIVE AND RESEARCH QUESTIONS

The present report aims to investigate the "geriatric day hospital (GDH)" as a part of the care program for the geriatric patient in terms of efficiency and funding.

The three questions which underlie the study are:

- Is the Geriatric Day Hospital (GDH) justified by the international literature? Are there studies about the way to organize the financing of the structure and is it possible to transfer the experiments to Belgian health care system?
- What are the characteristics of patients attending the GDH and what are the differences compared with geriatric patients treated in classic hospitalisation?
- Which financing system can be developed and proposed taking into account the patients' profile and what is the impact on the budget of the health care system?

We are certainly aware that it is judicious to consider the impact of organizational and managerial care of the elderly in a structure such as the geriatric day hospital rather than a concentration of the activity (focus). However, we recall that this area under discussion is not one of the objectives of the present study and therefore the domain of the three questions above, and that it is a prerequisite.

The study does neither take into account the patient perspective in particular with regard to the financial aspect of the GDH.

Lastly, the alternatives possible to the hospital of day geriatric, such as for example the intervention of the general practitioner, were not analysed.

3 METHODOLOGY

The strategy to address the research questions consists of: a literature review, a descriptive analysis of available datasets with comparison of patients in geriatric day hospital and in classical hospital, and finally a proposition for a financing model.

3.1 LITERATURE REVIEW

The experiences of foreign countries in geriatric day hospital and the utility of GDH, are a point of interest in this study specially if there are studies concerning the funding, in particular cost-efficiency analysis of GDH. We chose to start this study with a review of the literature to see if other teams had already described some ways of functioning and financing GDH on the assumption that we could be perhaps inspired by it.

3.2 DATA-ANALYSIS

According to the questions listed before, the present research aims to compare the characteristics of geriatric outpatients admitted in day hospital with the characteristic of geriatric inpatients. The methodology of the data collection in GDH is based on a methodological note written by the KCE and presented in appendix.

The features of those patients study the socioeconomic profile, encountered diagnosis and the presence of geriatric syndromes.

3.3 FINANCING MODEL

This study will try to define a system of financing the geriatric day hospital which allows the correct orientation of geriatric patients to the appropriate service taking into account their geriatric profile. Also the budgetary impact of these new methods of financing will be studied.

3.4 CONCLUSIONS

Finally, the literature findings and the results of data-analysis were used in order to answer the research questions and to formulate conclusions.

More details on research questions and methodology are available separately for each chapter.

4 LITERATURE REVIEW: CLINICAL AND COST EFFECTIVENESS OF THE GERIATRIC DAY HOSPITAL

4.1 RESEARCH QUESTIONS

One of the purposes of this research is to build a model for financing the geriatric day hospital (GDH). We chose to start this study with a review of the literature to see if other teams had already described some ways of functioning and financing GDH on the assumption that we could be perhaps inspired by it. In order to structure our research, we decide to analyse 3 aspects:

1. The organization, functioning, usefulness and efficiency of a day hospital
2. The type of patients reaching GDHs
3. The financing systems proposed by the team and its effectiveness

In order to reach the 3 purposes of the research, in the first part of the review, we shall verify the degree of evidence, classify literature and try to answer the following questions.

Trying to answer to the research questions namely the organization, functioning, usefulness and efficiency of the geriatric day hospital, the type of patients reaching GDHs and an eventual evolution in the types of activities and the effectiveness of financing systems in different countries, following questions were derived from the research questions:

1. Effectiveness: are GDHs effective? What are the activities developed in GDHs and how could their effectiveness be measured? Is there any evolution in the type of activities?
2. Is there any evidence on the setting of geriatric day hospitals?
3. Is there any evidence on the type of health care providers and on the tools that are used to assess elderly patients in the GDH?
4. What type of patients are reaching day hospital?
5. What is the satisfaction of the users of geriatric day hospital?
6. What is the cost-effectiveness of GDHs in literature?

What is the effectiveness of financing systems in different countries?

4.2 METHODOLOGY

We searched the literature from 1987. This year was chosen because the concept of GDH strongly evolved with time and after a brief scan of the literature, it appeared that the first relevant articles were published at the end of the eighties. Medical and economic databases were searched (Medline, Embase, Cochrane, CRD and EconLit), using their thesaurus supplementted by free text if necessary. Grey literature was also included and searched through OAister and Google. Only articles in English, French, Dutch and German were included.

The search strategies are detailed in the appendix from this chapter. Synthesis tables of all articles included are also presented in appendices.

4.2.1 Setting

Our first purpose is to define GDH, looking at the international literature. As GDH is a relatively new term in the database index, we also used combinations of (formerly used) less specific terms referring to outpatient services for elderly people.

It seems important to verify if a GDH has the same role in all countries, how it is included in the health care organization and if some confounding factors are present, such as confusion over day hospital and day centres, day care practitioners and geriatricians, diagnostic activities and rehabilitation.

4.2.2 Population

We focused on elderly patients (≥ 65 years) using day hospital services, with emphasis on the frail elderly. This age limitation corresponds to the MeSH of the different databases, although not corresponding to the criteria of the Belgian texts of law cited on chapter 1, which determinates 75 as the age, considered to define geriatric patient and specific geriatric activities.

Frailty is commonly used to define geriatric people at risk of functional decline. Frail elderly are in need of a comprehensive assessment, preferably in a multidisciplinary context, like a geriatric day hospital.

4.2.3 Activities

The Belgian texts of law define four main activities: preventive care, assessment, diagnosis and rehabilitation. Literature as well as proper experiences showed that the main activities of most day hospitals can be categorised into one or more of these four.

4.2.4 Outcome

No inclusion criteria were used to define treatment outcome.

4.2.5 Financial aspects

We searched

- costs related to the GDH
- ways of financing GDH
- cost-benefits of GDH

4.2.6 Study selection

Initially, the titles and abstracts (where available) identified from the search strategy, were scanned and excluded as appropriate by two independent reviewers. For the remaining studies, full text articles were ordered and appraised according to validity criteria defined hereafter.

Search strategy resulted in 117 articles. Of these, 77 full text articles were ordered and 61 were obtained. A further 11 articles did not meet the validity criteria. Finally, 50 articles (3 Systematic Reviews, 9 RCT, 35 cohort studies and 3 Reviews,) were selected for this review (see Flowchart in the Appendix). Other cited publications (e.g., those providing background material) are presented in the References.

4.2.6.1 Validity criteria

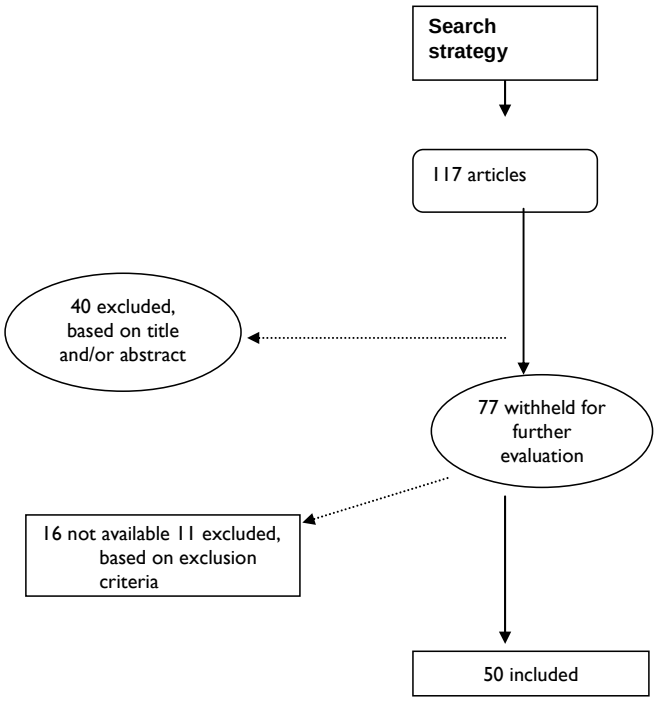
Each selected article was summarised and assessed through validity criteria listed below:

- Is the research question well stated?
- Is the study design appropriate?
- Data quality
- Analysis
    - Methods clearly explained
    - Appropriate statistics
    - Goodness of fit of the models
    - Validity of models tested
- Discussion
    - Internal validity
    - External validity
- Are conclusions supported by findings?

4.2.6.2 Study exclusion criteria

- letters to the editor, books and book chapters, editorials, expert opinion and comments
- studies conducted only in inpatient settings
- studies concerning psychiatric/psychogeriatric day hospitals because this activity is very specific, not always done by geriatric team and difficult to assess
- studies with inadequate description of methodology and/or results or significant error or methodological problems

Figure 5: Flow chart of literature selection



4.3 RESULTS

The research we have done was conducted to find out if an evolution in the activities, the patients, the providers, had been observed during the last 20 years and if some data about financial effectiveness was measured since that time

The first paper of interest was published nearly 20 years ago by Morishita [11] and was used here like a basic paper. More recently, papers using various methodologies were published.

We found 2 systematic reviews (SRs) one from Forster 1999 and one from Parker [12, 13] and 4 randomised controlled trials (RCTs) from Eagle, Hui, Roderick and Trentini [13-16]. We found also a health technology assessment (HTA) report [17] which includes the systematic review from Forster. There are also two descriptive analyses with a retrospective point of view from Fortney[18] and Stock [19]. Other papers were selected because they described tools of interest for our study like functional scales and outcomes.

More focused on cost or cost effectiveness, we found 4 systematic reviews, 10 RCTs, 9 case series studies and 1 opinion paper.

4.3.1 Activities and effectiveness in the GDH

4.3.1.1 Activities

Morishita described the activities of a geriatric day hospital (GDH), based on both the British day hospital and the North American geriatric evaluation units (GEU) experiences. The GDH provided a wide variety of services tailored to the needs of the frail elderly: ¾ of patients (mean age of 78 years) received a geriatric assessment, 13% were referred solely for evaluation of one specific problem and 8% for diagnostic investigations only. Four per cent received acute nursing care or post-acute hospital care. In 21% of cases, physicians would have referred the patient to the hospital if the day hospital did not exist. The author concluded that the GDH is an innovative service for cases in which traditional outpatient care is inadequate, yet acute hospitalization is inappropriate.

In a review published in 2005, D Black notes that although in the UK day hospitals have been traditionally associated with rehabilitation, from the beginning they took up different other roles in the provision of comprehensive geriatric care [20]

Black 2005 concludes his paper with: "Geriatric day hospitals have now been around for over 40 years. From the beginning they had multiple roles, functions and uses which have evolved over time. A weakness is the lack of controlled trial evidence for their major role in rehabilitation, but their strength is their flexibility of function for meeting patient needs".

4.3.1.2 Evaluation tools

In order to measure effectiveness of GDH, most clinical studies used several standard validated scales: Barthel scale, Lawton, Get up and go, Geriatric depression scale, Tinetti score,… These studies talk all about comprehensive geriatric assessment, functional assessment, multidisciplinary care…, but do not describe that precisely[21, 22]. The content of what is done[14 23, 24, 25], is not very precisely described. Nevertheless there is no homogeneity in practice. Moreover, the relation with a geriatric syndrome is not always clearly specified and the reason why a certain scale has been used instead of another one measuring quite the same function is not clear.

For example, Hui in a study to compare outcome in elderly stroke patients at GDH versus conventional medical management, used Barthel index, MMS, Geriatric depression scale to try to define the profile of the patients[15], while in a study realised in Israel to evaluate the rehabilitation program of the GDH, Hershkovitz measures the functional independence by FIM, the risk of falling by "timed get up and go" and also use the Nottingham extended ADL index[23].

Only the study of Glaesmer who realised in Germany a research to evaluate the efficiency of treatment in a GDH, describes a clear mention of the patient's profiles using scales which assess all the functions of a person[25].

Most relevant studies describe the main activities and the number of visits. There is no clear information/evidence on which outcome parameters need to be assessed in order to prove the effectiveness of day hospital care for the elderly.

4.3.1.3 Effectiveness

In some studies effectiveness is measured looking at improvement of functional abilities and maintaining the gains with or without day hospital practice. Some studies were only looking at death, re-hospitalisation and institutionalisation or quality of life

In a few studies improvement was seen for functional performance or status, mood, walking and quality of life, but it is not always a success[23 25, 26].

The randomized controlled study realized in Hamilton in Canada[14] shows no improvement in functional status or quality of life of elderly treated in day hospital compared with the control group treated in conventional care (inpatient geriatric unit, outpatient geriatric clinic, community follow up service). Type of management is not described in the control group, but at discharge patients were cared for in appropriate community services.

The systematic review from Forster has been published in 1999 [12] and was looking on 12 controlled trials. Those studies failed to find significant difference between day hospital and alternative services for endpoints of death, disability and use of resources. Nevertheless, they did find that subjects having comprehensive care in whatever environment, had lower odds of death or poor outcomes and they concluded that day hospital care seemed to be an effective service for elderly people who need rehabilitation but has no clear advantage over other forms of comprehensive geriatric care.

From a review published in 2004, Day concluded that the evidence for the effectiveness of specialist geriatric services in outpatient and geriatric day hospital settings compared to usual care was not supported by the published research[17]. Although, he shows that functional outcomes and physical and mental status could be more important outcomes than only reduced mortality. He mentioned that some patients with certain medical conditions like cardiac insufficiency or depression show a better improvement in initial gain. Perhaps it can be compared with a cardiac rehabilitation program. The results are not applicable for demented patients.

In a cohort study undertaken to determine which gains were made lasting longer than 6 months and to what sort of patients, Dasgupta and al suggested that certain types of patients, specifically people with cardiac conditions and depression were more likely to make initial gains with GDH intervention and may be more likely to benefit, at least initially, from day hospital program[26]. The most common persistent functional, psychosocial or medical gains were improved socialization or outdoor activities, improved mood and mobility, improvement in other ADLs and pain.

4.3.1.4 Conclusion

This review of the literature shows little evolution since 1989 and the study of Morishita. The same questions persist and only a small number of responses have been obtained.

The activity is quite heterogeneous, not always clearly described and despite rehabilitation activity, one can say that geriatric assessment and interventions irrespective of where they are realised, have an improvement on functional ability, mood and socialization.

However, there is no real consensus on which variables can prove the efficiency of GDH, but all the outcomes defined and studied in the papers are quite relevant for a better patient's outcome but also for the utility and effectiveness of geriatric interventions in public health.

Key messages

- **Some data demonstrate the efficacy of specialist geriatric team services for ambulant patients compared with no specific approach although the setting of offering this approach (hospital, day hospital, day care, home) is not really determined**
- **Certain types of patients, specifically people with cardiac conditions and depression seem to be more likely to make initial gains with GDH intervention and may be more likely to benefit, at least initially, from day hospital**

4.3.2 Setting and patients

4.3.2.1 Setting

We found 2 systematic reviews, 3 reviews , 4 RCTs and 4 cohort studies.

Reviewing the literature, many types of settings are described as geriatric day hospitals. Activities organised in the hospital as well as outside the hospital are described and sometimes the location of the GDH is not specified[14 23 27 24]. Moreover the setting to which geriatric day hospital activity is compared differs also from study to study.

Activity is compared to activities in geriatric in-hospital setting or to other hospital services.

However, the location does not influence the results. Obtaining significant outcome data depends rather on the quality of the geriatric assessment and interventions than on the setting where the activity is organised[14]. Significant outcome data for geriatric assessment and interventions are mainly obtained in the prevention of functional decline and quality of life.

Concerning the need of places in GDH there are no studies looking at the necessity of GDH places in correlation with the public health. There are even only a few studies mentioning the number of places in the GDH[22, 24].

A study conducted in France shows that the term geriatric day hospital does not cover a homogenous setting. An organism called association for the promotion of day care units for older adults (APHJPA) promotes three categories of day care unit and defined, gerontological evaluation day care unit, evaluation and rehabilitation unit and psycho-geriatric unit[28]. Even in that study, the authors used the term day unit and not day hospital, but state that APHJPA includes 80% of French geriatric day hospitals.

So, selection of literature only by searching on the term geriatric day hospital is quite dangerous. Therefore a broad search on geriatric day care has to be performed. The question is of day care for specific pathologies should be included. As those studies not only included geriatric patients and the settings are not really comparable with geriatric day hospital where often patients with multi-factorial problems and poly-pathology are looked for, they were not included.

4.3.2.2 Patients

The papers were studying quite heterogeneous populations, except for the fact that all patients were ambulatory.

In the systematic review by Forster[29] only that it were medical patients more than 65 is mentioned. In Parker's systematic review [13] participants were elderly people aged at least 65 years, receiving acute, post- and sub-acute rehabilitation care.

Patients of 65 years of age and over, with a clinical diagnosis of cerebrovascular accident, without previous history of stroke or dementia and with a low Barthel Index score are described by Hui[15] but Baumgarten [30] studies patients with deteriorating functional status believed to have rehabilitation potential, Eagle checks elderly patient at risk of hospitalisation[14], Rodderick takes care of stroke patients[31] and Boult et al talk about "eligible patients"[32].

The other studies (cohort studies and economic evaluations) [18, 33-38] are less precise in the description of the type of patients. Only Gerard[34] mentions the need of personal assistance in daily living; the other authors include outpatients, and elderly patients

4.3.3 Type of health care providers

Most often neither the total number of staff nor the different members of the multidisciplinary team were specified.

Sometimes there are no geriatricians, the tools used to assess patients are only described but who does the job is not really mentioned. Anyway, most studies introduced coordinated multidisciplinary care, but the composition of the team seems to be dependent on local necessity or general health organisation of the surrounding[14, 24, 25, 39].

We do not know how many patients are managed per day; sometimes, we only can verify is the number of patients included during a period and for how long they have been followed. Only Martin[22] mentions a number of patients per day going and planned for follow up.

The author gives information about the waiting time for the patients before attendance, about the planned or emergency hospitalisation in GDH and about the average treatment period but it is difficult to know what it is concerned in this period.

Nevertheless, in this study it is important to note that General Practitioners (GP) consider functional assessment to be the most important function of GDH.

4.3.4 Satisfaction of the users

Only a few studies are studying the degree of satisfaction of GP[40 22] and of patients[22]. GP find the management interesting, for patients recently discharged but they would welcome an increased proportion of reviews performed at home by liaison nurse. Patients did like more company and occupational aspects but a lot of patients had no dislikes.

4.3.5 Cost-effectiveness of GDH

4.3.5.1 Overview of the literature

Table 1 to 3 describe the type of literature we found

Table 1: Systematic reviews – Meta-analyses

Author	Year	Type	Experimental group	Control group	Cost-effective
Baumgarten[30]	2002	RCT	GDH	waiting list (usal care)	No but NS
Boult[32]	2001	RCT	Evaluation and Management (GEM)	usal care	Yes
Eagle[14]	1991	RCT	GDH	usal care	No cost variables
Hui[15]	1995	RCT	GDH	conventional medical management	Yes
Roderick[31]	2001	RCT	GDH	domiciliary rehabilitation service	No difference
Trentini[16]	2001	RCT	Geriatric assessment	standard care	Yes
Gerard[34]	1988	CS	Day hospital	specialist centre	No
Maciejewski[35]	2002	CS	Outpatient Clinics	primary care clinics	Yes
Powell[37]	2002	CS	GDH	day centre and outreach services	No

RCT = Randomised Controlled Trials - CS = Cohort Study

Table 2: Cohort Studies

Author	Year	Subject
Dang[41]	2002	multiplier or "flow-through" effect of a senior clinic on its parent's medical center.
Daniels[33]	1990	evaluating the performance of an existing geriatric clinic
Fortney[18]	2005	organizational innovations are likely to be cost neutral for outpatient services
McCallum[36]	1996	model predicting the cost of post-acute services
Tousignant[38]	2003	benefits related to a GDH exceeded the costs.

Table 3: Case Study

Author	Year	Subject
McAtee[42]	2005	geriatric day clinic may have generated a profit

We do not find unreserved positive results in favour of the GDH.

The GDH is more expensive than other settings

Some studies show that GDH is significantly more expensive than alternative settings (Gerard[34], Powell[37]).

For Gerard[34], the cost comparisons indicate that social centre is cheaper than specialist centre and day hospital more expensive than specialist centre to care for frail elderly people. The specialist centre may be regarded as having more appropriate attributes than either substitute in which case this could justify its cost being greater than the social centre.

In the paper of Powell[37], the author shows that the day hospital was substantially more expensive in total than the other settings (day centre and outreach services). Nevertheless, we can put here the question of the comparability of the involved services.

The author concedes himself that the cost difference was mainly due to the broader range of medical services offered, the substantially more expensive transport and the purpose-built nature of its accommodation and range of equipment.

The GDH is cost-saving

Other authors find positive results in terms of costs (Boult[32], Dang[41], Maciejewski[35], Hui[15], Tousignant[38]) or rehabilitation or preservation of functioning (Boult[32], Hui[15], Trentini[16]).

Boult[32] shows that geriatric evaluation and management (GEM) may produce cost savings and even greater preservation of function.

The study of Dang[41] shows the multiplier or "flow-through" effect of a senior clinic on its parent's medical centre. For every $1 billed in professional charges in the senior health centre, $17 was billed elsewhere in the hospital system. Although senior clinics may be a cost centre when viewed in isolation, these clinics are actually revenue generators when viewed from the perspective of the entire health system.

Maciejewski[35] shows that Community-Based Outpatient Clinics (CBOC) may be an alternative approach to provide care to veterans at a lower cost than traditional delivery models.

For Hui[15], compared with conventional medical management, care in the geriatric day hospital hastened functional recovery and reduced outpatient visits in elderly stroke patients without additional cost.

The cost-benefit analysis of Tousignant[38] shows that the benefits related to a Geriatric Day Hospital programme exceeded the costs. In others words that for each dollar invested in a GDH programme, a benefit of 2.14 dollars is recovered. This estimate relies only on functional autonomy (SMAF) changes and must be viewed as the lower limit of the global benefit of the GDH programme. For this reason, the willingness to pay in a cost-benefit approach is not used in most of the health care in cost-effectiveness studies. Instead, cost-effectiveness analysis defines the benefit an individual receives from an intervention by changes in the individual's level of health that result from that intervention.

The study of Trentini[16] reached its primary purpose of demonstrating that geriatric assessment and management in Italy can provide selected elderly patients with more substantial benefits than standard care, without inflating the health care costs. GEM units do not increase health care expenditures through frequent and sophisticated exams, expensive therapies, or unnecessary admissions to hospital and nursing home. On the contrary, they can effectively address the care of the elderly by improving patient functioning through rehabilitation, avoiding iatrogenic illness, reducing prolonged hospitalization, and postponing nursing home placement.

No difference or unclear information

If some authors find results clearly neutral, showing an absence of significant difference between GDH and other settings (Fortney[18], Roderick[31]), other analysts are not able to decide between GDH and other settings (Baumgarten[30], Parker[13]).

Roderick[31] shows no significant differences were detected in the effectiveness of the geriatric hospital day-care versus a domiciliary rehabilitation service.

In Fortney[18] the policy interpretation of the instrumental variables analysis of outpatient costs is that such organizational innovations are likely to be cost neutral for outpatient services.

In the literature review conducted by Parker[13], the authors concluded that, despite considerable recent development of different forms of care for older patients, evidence regarding effectiveness and costs is weak.

In the study of Baumgarten[30], the difference was not statistically significant although the total cost was higher in the experimental group (GDH). The experimental group had higher mean costs than the control group for medical and professional care, institutional long-term care, and acute hospital care.

However, the mean cost in the experimental group for home-based long-term care was lower than in the control group. None of the differences in cost for the individual service categories was statistically significant.

4.3.6 Effectiveness of financing system

Attempts to demonstrate the effectiveness of day hospital care have been hampered by methodological problems and have produced equivocal results. Some of these methodological problems such as comparability, defining outcomes and measuring costs are now considered.

4.4 DISCUSSION

4.4.1 Comparability

Comparability of the results requires the homogeneity of the focused concept. We have remarked that the definition of GDH is characterized by a great variety. If the term of GDH is generally used strictu sensu[14, 15, 30, 33, 38] , we find also light alternatives like Adult Day Health Care[43], outpatient clinic[18, 35, 41, 42], Day Hospital[12, 13, 31, 34, 37]. Sometimes the denomination employed evokes the multidisciplinary program of care: Program for All-inclusive Care for the Elderly (PACE)[43], Outpatient Geriatric Evaluation and Management (GEM)[16, 32], Home and Community Care (HACC) Program[36], geriatric assessment units (GAU)[13]. The used comparator is also heterogeneous.

Other source of lack of comparability is the age of the patients. Some studies concern geriatric patients without other precision[29, 33, 43, 44] where the majority of the studies fix an age limit as criterion of eligibility: 60 years and over[29, 36] or 65 years and over[12, 14, 15, 34, 41, 42], 70 years and over[32], and finally 75 years and over[16]. Two studies concerned Veterans Affairs and thus involved much younger patients[18, 35]. A paper by Roderick et al[31] studies stroke patients over 55 years. And other papers give directly the average age of the patients: 77.2[30] , 79.6[37], 77[19], 76.8[38].

Finally, the morbidity status of the patients is not standardized exacerbating the heterogeneity problem.

4.4.2 The heterogeneity of the analysed outcomes

We're confronted with the same problem of heterogeneity when we consider the analysed outcomes. A basic outcome is clearly the mortality [12-16, 19, 32, 38, 44] but some authors consider, not only the length of life, but also the quality of life[14, 16, 31, 36, 44].

More precise studied outcomes are

- the functional status measured by Multidimensional Functional Assessment Questionnaire[30], Sickness Impact Profile: Physical Functioning Dimension (SIP:PFD)[32], Barthel Index[14, 15, 31], SMAF[38], Katz[16];
- the mental status evaluated by scales like the Center for Epidemiologic Studies Depression Scale (CES-D)[30], the Geriatric Depression Scale (GDS)[16], the Philadelphia Geriatric Center Morale Scale[31], the Mini-Mental State Examination (MMSE)[16, 30];
- the health status[14, 15] or the Bed Disability Days index[32]
- the institutionalisation rate[12, 16, 19, 36-38, 43]

4.4.3 The measurement of costs

Given the heterogeneity characterizing the studies about the GDH, the heterogeneity of the considered cost is not surprising. Not only the type of cost is heterogeneous but also the ways to calculate or find them is not standardized between the studies. Some cost are based on billed data (Dang et al[41], McAtee & Beverly[42]) or on predicted modelisation of costs (McCallum et al[36]).

4.4.4 Limitations of the literature study

The limitations of this literature study are linked to the heterogeneity concerning the definition of the patients and the settings on one hand and the definition of the costs and outcomes on the other hand. This heterogeneity explains the absence of evidence or the weak evidence in favour of the GDH compared with other alternative settings.

4.5 CONCLUSION

For the outcomes on patients managed in the day hospital:

A better outcome is observed in patients undergoing a geriatric assessment and intervention compared to no geriatric approach at all.

However no clear evidence is available on the benefit of geriatric day hospital over in hospital geriatric care because a lot of confounding factors are observed in the studies. Methodology, recruitment, outcomes are often different and the results can not be compared.

More studies are necessary to assess the effectiveness of practice. A problem in studying GDH effectiveness is the heterogeneity of the population. Perhaps the GDH should focus on organising care for certain specific problems. Dementia, stroke, cardiac insufficiency, could be good models to investigate the efficiency of geriatric assessment and interventions within the setting of a GDH. In those specific populations, results of GDH interventions are more evident because type of patients is more homogenous.

The lack of consensus concerning the outcome to reach by a GDH leads to the heterogeneity of analyzed outcomes which complicate the evaluation of the cost effectiveness of this structure.

Key messages

- **A better outcome is observed in patients who had a geriatric assessment and intervention compared to no geriatric care at all. (level of evidence: Ia)**
- **There is no evidence of benefit of a geriatric day hospital compared with classical geriatric care. The classical care should be understood as in hospital geriatric care because all studies comparing geriatric approaches with settings not specific for geriatric patients demonstrate efficiency of geriatric care (level of evidence: Ia)**
- **There is no consensus on what the setting of a geriatric day hospital should be and confusion over definitions is often noted, moreover terms are used interchangeable and are not always covering the same setting. (day unit, day hospital, day care,...)**
- **There is no consensus on the different members of the geriatric multidisciplinary team and the role of these participants.**
- **Little information is found on "the diagnostic activities at the GDH", more information is available on rehabilitation activity. Rehabilitation is often developed for specific subgroups such as stroke patients, dementia patients, cardiac patients or patients with other chronic diseases and shows good results in the GDH (level of evidence Ia).**
- **There is an enormous heterogeneity in studies. Different sets of outcome parameters and contradictory results make it almost impossible to draw conclusions concerning the costs and the cost-effectiveness of the GDH**

5 COMPARISON OF PATIENTS IN GERIATRIC DAY HOSPITAL AND IN CLASSICAL HOSPITALISATION

5.1 INTRODUCTION

In order to propose a financial tool that guarantees the best management of the geriatric patient, considering his/her pathology(ies) but also the geriatric complexity and frailty profile, we need to know which geriatric patients could use the GDH instead of the classic hospital.

Therefore, we try to isolate the group of geriatric patients whose hospitalization could have been totally or partly avoided by a geriatric assessment at the day hospital or by an evaluation visit before the hospitalization in the same structure. We will thus use two databases, one for each setting, and match patients on the same characteristics. This procedure will result in a database containing twin patients.

5.2 METHODOLOGY

5.2.1 The matching procedure

To be able to match patients, subjects included for analyses while coming from 2 distinct settings, have to be equivalent on base of a series of variables.

The current study design is thus an observational study where we try to realize a one to many matching between GDH cases and RCM/MKG-FY2003 admissions.

It is not a strict matched case-control study. Indeed, we have not made a random sampling of cases but we used the entire population of national GDH patients for a three-months period. These GDH patients were matched with similar cases from RCM/MKG-FY2003 data. The RCM/MKG-FY2003 data were extracted from all the acute bed hospitalization; they are not 'controls' of the GDH outpatients but rather 'twin inpatients'.

For every GDH patient, one or more RCM/MKG paired-cases similar to that GDH patient are selected. They are matched on the profile of their underlying pathological conditions.

5.2.2 Data sources

To answer this question, we have compared two databases:

- Geriatric Day Hospitals (GDH) data:
  Data[b] results from a prospective, multicenter study on the evaluation of geriatric day hospitals in Belgium. The study was sponsored by the Federal Public Service (FPS) of Public Health and managed by University Hospital of Ghent and University Hospital of Liège.
  During a 3-month period, from October 1 till December 31st 2006, all patients admitted in 45 GDH were registered (n=2750). For each admission following variables were registered: patient demographics, activities performed (diagnosis, assessment, therapy, revalidation) and assessment instruments used.
- RCM/MKG data (RCM/MKG-FY2003)[c]:
  In the order to carry the present study we used a coupled database of administrative data from the fiscal year 2003 (FY2003) – "Registration of Minimal Clinical data" (RCM/MKG) and "Registration of Minimal Financial Data" (RFM/MFG).

b From now on named GDH
c From now on named RCM/MKG-FY2003

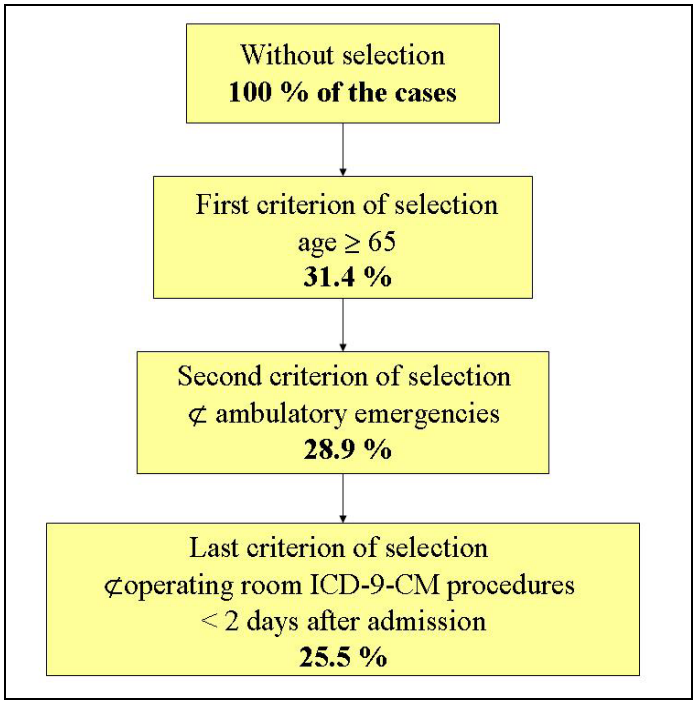
5.2.3 Selection of administrative data (RCM/MKG-FY2003)

We select administrative data from the whole of RCM/MKG-FY2003 database.

Criteria to exclude patients were (see Figure 6):

- hospital admissions of patients less than 65 years
- ambulatory emergency admissions
- patients who underwent an operating room procedure less than 2 days after admission

Figure 6: Exclusion of patients' process



5.2.4 Definitions and organisation of the data for the matching

5.2.4.1 Activities that can be found in the GDH database

In a GDH as in the GDH study, the main reasons for patient's admission are classified in four categories:

1. Diagnosis (85.1%)
2. Revalidation (2.1%)
3. Therapeutic acts (16.9%)
4. Other (3.4%)

Obviously a patient can be admitted for several reasons. As we see, a majority of the patients consult for a diagnosis procedure.

Revalidation and therapeutic acts could be easily found in the administrative database and could be relatively easy used for matching.

However, the diagnostic activity of the day hospital can not be found so immediately in the database.

Indeed, diagnostic activities cover three sectors of geriatric assessment:

- finding/uncovering specific medical problem,
- finding/uncovering geriatric syndromes
- implementation of preventive measures for geriatric syndrome.

In the table below, we see that diagnosis is missing for 15% of the patients. Approximately 23% of cases are admitted just for a specific medical problem, 31% for geriatric syndromes, and only 2.3% for preventive measures. Finally, in nearly 19% of patients, both geriatric syndromes and specific medical problem are detected.

Table 4: Diagnosis activities in GDH

Specific medical problem	Geriatric syndromes	Preventive measures for geriatric syndrome	Frequency	%
∅	∅	∅	409	14.9
√	∅	∅	631	22.9
∅	√	∅	852	31.0
∅	∅	√	64	2.3
√	√	∅	524	19.1
√	∅	√	41	1.5
∅	√	√	88	3.2
√	√	√	141	5.1
		Total	**2750**	**100**

It is absolutely crucial that the matching process between both databases has to be the most rigorous achievable with regard to the motive of admission. Therefore we define in both databases as clearly as possible firstly, what is a specific medical problem and secondly, what is a geriatric syndrome.

5.2.4.2 *Definition of 'Specific Medical Problem' (SMP)*

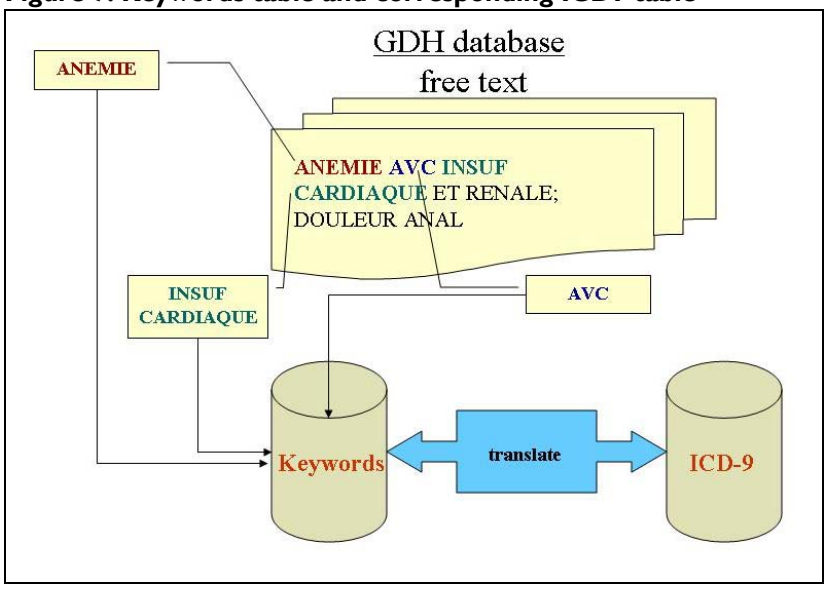
SMP in the GDH database

In the GDH study, the presence of a specific medical problem as cause of admission was specifically asked for each patient. Responses were introduced into the database with free text.

To compare patients in terms of pathology and to be able to match data, we decided to translate this free text into ICD-9 codes.

Firstly, we extracted keywords and put them into a table. Secondly, keywords were classified and translated into ICD9 codes as shown in Figure 7. This operation was repeated for all the terms of the sentence.

Figure 7: Keywords table and corresponding ICD9 table

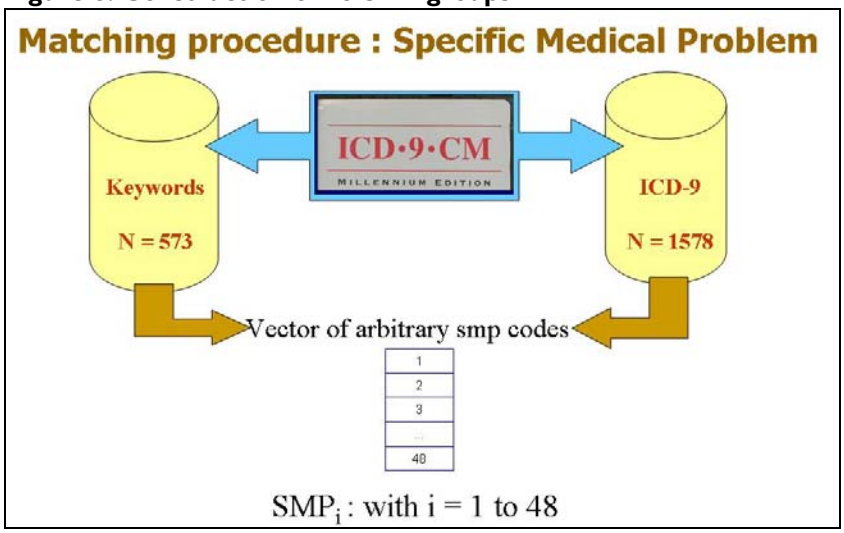


As a consequence, every GDH patient was defined by his clinical pattern in the form of a sequence of codes.

Initially, we retrieved 573 keywords from the GDH database. To define them in ICD-9 language, we used 1578 codes of pathologies (see Figure 8).

To describe all the pathological situations met in the GDH study, we first defined 166 'specific medical problems' (SMP) groups. These 166 groups were reduced to 48 final clusters after having been pooled together, by analogy or following an examination by geriatricians.

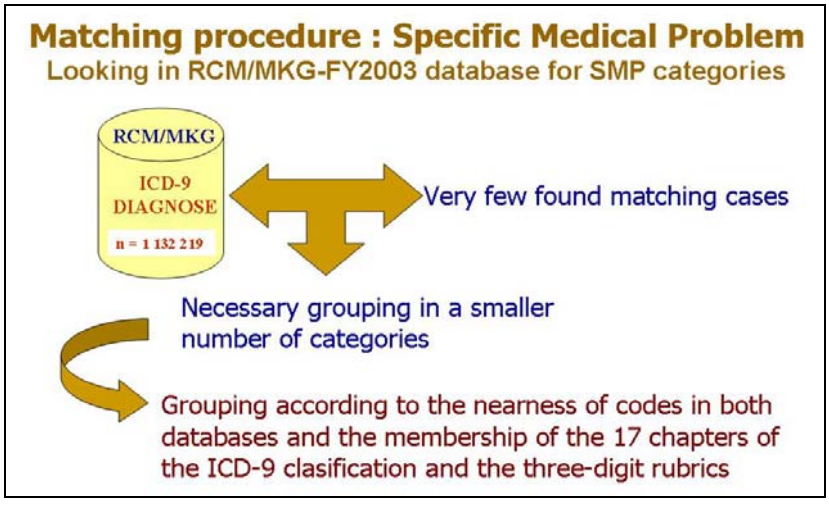
Figure 8: Construction of 48 SMP groups



Matching the GDH – RCM/MKG-FY2003 databases on SMP

The following step consists in looking if, in the "DIAGNOSE" file of the RCM/MKG-FY2003 database, we can locate among the 1,132,219 records, paired patients for whom we shall find a similar clinical pattern by means of the similarity in terms of ICD-9 codes (see Figure 9).

Figure 9: Search for matched patients in RCM/MKG database



In ***appendix I***, we give for the 48 final SMP groups, the number of related patients in GDH study and the number of records in the RCM/MKG diagnosis file. In the ***appendix II***, a thesaurus of the 48 groups of specific medical problems is presented. It is classified in the order of the ICD-9 chapters. For each SMP-group, we give the list of keywords from GDH patients and we discuss the opportunity in the choice of ICD-9 codes.

After that, in ***appendix III***, we give the list of the 1 578 selected ICD-9 codes by SMP category. For every code, we also provide the corresponding ICD section as well as the number of present diagnosis found in the RCM/MKG database.

5.2.4.3 Definition of geriatric syndromes

Brief introduction to the geriatric syndromes

Winograd, Berg, Rockwood showed that fall, malnutrition, delirium, incontinence, sensorial difficulties and poly-pharmacy are associated with length of stay, mortality and risk of institutionalisation. Poly-pathology, chronic diseases, gait disease,… are also considered as frailty markers and influence the profile of the person and so the risks.

Those situations are more often described as geriatric syndrome. It is not really an illness, but a clinical situation, frequent in the old population. It is the consequences of oldness and chronic diseases on top of which, acute stress (medical or social) put an imbalance and of course influence the way to react against the aggression. So the importance of the pathology varies because of the state of the organism it attacks and in that way, many authors consider that in the hospitalization of the elderly, patient profile is more predictive of complications, length of stay and mortality than pathology itself.

Frailty plays an important role in the outcomes of hospitalisation especially in geriatric patient.

Geriatric syndromes are commonly mistaken as consequences of normal aging, resulting in delayed evaluation and intervention for the underlying aetiologies, many of which can be reversible if detected early. Appropriate intervention can significantly benefit patients with geriatric syndromes resulting in reduced mortality and hospital admissions, improved physical and cognitive function and increased likelihood of living in the Community, as opposed to institutionalization[45].

The purpose of assessment and intervention in a geriatric patient is to describe the current level of functioning and the risk factors for functional decline in order to maintain and to optimize the functionality of the patient. Therefore it is necessary to find parameters describing the underlying risk factors for frailty and geriatric syndromes as those are influencing the need for assessment and interventions in the elderly population. Moreover these parameters seem also strongly correlated with the risk on adverse outcomes in a hospitalised population. Geriatric syndromes are often caused by underlying multiple pathologies which should be described in defining the risk factors of the syndrome. However, describing pathologies is not enough for defining the necessary diagnostic and therapeutic interventions in the elderly population due to the interference with other factors not defined in the existing classification of pathologies.

Multiple pathologies cause differences in the pattern of illness in older people. Many studies have shown that multiple pathologies are the norm. Therefore when dealing with older people illness may present with non-specific symptoms and there may be more than one diagnosis.

Hence this section covers many of the non-specific states of illness which will complement the more system/disease orientated approach of the previous chapter.

The geriatric thesaurus

In Belgium, the financial system which "pays for pathology", do not consider profile of the patient and cannot explain longer stay for example, for the same pathology between a young and an old person.

Of course, secondary diagnosis can abort the complexity of the patient but DRG and ICD9 codes are not defined to check frailty profile.

In a previous work, in 1996 Petermans, Ceulemans et al. tried to show influence of some frailty parameters on the length of stay in Belgian geriatric hospitalized patients.

Considering that the ICD9 codes are used to check pathology all over the world and are validated, it was really not reasonable to build a specific tool for geriatric patient (even if it could be very useful), and so, they decided to assess frailty using the tools of the usual financing system.

The purpose was to use ICD 9 codes and to try to group codes in order with frailty parameters. We called it "geriatric thesaurus". Therefore all of the ICD9 codes were reviewed to identify which could be associated with frailty and which could have influence on outcomes of person, especially on functional decline.

For example, falls was associated with codes "gait trouble", vertigo, extrapyramidal syndrome because we considered that these states, described by RCM/MKG codes are associated with falling risk and so can identify the risk of falling. Fall is a frailty factor and so predictive of risk of falling too.

This method of grouping was tested and approved by experts of the Belgian geriatric society. The study was conducted in the G beds of 17 hospitals in Belgium and during a period of 3 months, identification of frailty was realised in the patients admitted. Therefore, it was possible to explain longer stay and institutionalisation risk according to frailty parameters defined. The authors concluded that frailty can improve DRG case mix for geriatric patients.

Selection of ICD-9 codes to identify geriatric syndrome

We decided to use the same method of grouping geriatric syndromes and checking ICD codes that the one use to build the 'geriatric thesaurus' (see general introduction above). This method should conduct to classify patient at risk of frailty, on the one hand, using the data given by RCM/MKG for inpatients in the classic hospital and in the GDH and, on the other hand, using the data provided by a recent survey in the GDH.

A connection of ICD codes with geriatric syndromes as defined in the literature was thus realized. ICD codes were provided by RCM/MKG for classic hospital inpatients and by diagnoses reported in free text in the recent study of GDH (study SPF 2006 2007).

In GDH study, geriatric syndromes were classified in nine categories:

1. Fall
2. Reduced mobility
3. Memory problems
4. Depression
5. Incontinence
6. Malnutrition
7. Loss of weight
8. Frailty
9. Pain

For each of them, we select the corresponding ICD-9 codes in agreement with the thesaurus of the RGM study.

FALL

Falls are among the most common and serious problems met elderly persons. Falling is associated with considerable mortality, morbidity, reduced functioning, and premature nursing home admissions[46]. Hospital stays are almost twice as long in elderly patients who are hospitalized after a fall than in elderly patients who are admitted for another reason. Compared with elderly persons who do not fall, those who fall experience greater functional decline in activities of daily living (ADLs) and in physical and social activities, and they are at greater risk for subsequent institutionalization[47].

Falls and concomitant instability can be markers of poor health and declining function[48]. In older patients, a fall may be a non specific presenting sign of many acute illnesses, such as pneumonia, urinary tract infection or myocardial infarction, or it may be the sign of acute exacerbation of a chronic disease[49].

Major injuries, including head trauma, soft tissue injuries, fractures and dislocations, occur in 5 to 15 per cent of falls in any given year.

In 1982, Murphy described a semiological pattern involving problems with walking and posture occurring in the outcome of a fall he called "post-fall syndrome"[50]. Most falls do not end in death or result in significant physical injury. However, the psychological impact of a fall or near fall often results in a fear of falling and increasing self-restriction of activities. The fear of future falls and subsequent institutionalization often leads to dependence and increasing immobility, followed by functional deficits and a greater risk of falling.

The risk of sustaining an injury from a fall depends on the individual patient's susceptibility and environmental hazards. The frequency of falling is related to the accumulated effect of multiple disorders superimposed on age-related changes. The literature recognizes a myriad of risk factors for falls[51],[48]. The likelihood of falling increases with the number of risk factors[52].

The risk factors responsible for a fall can be intrinsic (i.e., age-related physiologic changes, diseases and medications) or extrinsic (i.e., environmental hazards)[53]. It is essential to remember that a single fall may have multiple causes, and repeated falls may each have a different aetiology. Thus, it is critical to evaluate each occurrence separately.

In a review of the literature, Berg notes as intrinsic risk factors of fall with strong proofs:

- Older than 80 years
- Difficulties in activities of daily living
- Reduced mobility
- Parkinson's disease
- Dementia
- Incontinence
- A loss of strength of the lower limb
- Reduced visual acuity
- Abnormalities of the march
- A walking speed reduced
- A dynamic equilibrium altered
- A difficulty to get up from a chair
- Mental confusion
- Depressed mood
- The use of sedatives, hypnotics, anxiolytics, antidepressants[54]

Estimating the risk of falls as a geriatric syndrome rather than diagnosis leads us to look for indicators forecast of associated disease. From the RGM study and in accordance with the studies above, we selected the ICD-9 codes in the next table.

Table 5: ICD-9 codes for fall syndrome

ICD Codes	Wordings	nDiag
3314	Obstructive hydrocephalus	262
3320	Paralysis agitans	4145
3321	Secondary Parkinsonism	143
33390	Unspecified extrapyramidal disease and abnormal movement disorder	437
71970	Difficulty in walking involving joint site unspecified	1058
71975	Difficulty in walking involving joint of pelvic region and thigh	1849
71976	Difficulty in walking involving lower leg joint	775
71977	Difficulty in walking involving ankle and foot joint	157
71978	Difficulty in walking involving joint of other specified sites	144
71979	Difficulty in walking involving joint of multiple sites	544
7812	Abnormality of gait	2545
7813	Lack of coordination	285
E8809	Accidental fall on or from other stairs or steps	149
E8842	Accidental fall from chair	55
E8859	Fall from other slipping, tripping, or stumbling	728
E8880	Fall resulting in striking against sharp object	2
E8881	Fall resulting in striking against other object	22
E8888	Other fall	317
E8889	Unspecified fall	3417

We excluded osteoporosis that is a risk of fracture if the patient falls but cannot be associated to the risk to fall or difficulty in walking.

It is necessary to distinguish the notion of established fall from the risk of fall. So, E codes must be understood as history of fall rather that as current fall. We have to keep in mind that an antecedent of fall is itself a risk factor for another fall.

REDUCED MOBILITY

Impaired mobility is one of the most misunderstood, yet highly prevalent geriatric syndromes[45]. Insufficient clinical appreciation and detection of this syndrome can lead to deleterious consequences from the disability[55]. Predominant causes contributing to the decline in mobility were neurological and musculoskeletal impairments. Impaired mobility, like other geriatric syndromes, is a common pathway by which a host of diseases in older individuals produce functional disability. While not all of the causes may be preventable, many of the adverse effects of immobility can potentially be. Furthermore, improvement in mobility is possible in many instances, especially if the underlying aetiologies are arrested early

In a literature review, Rubenstein attests that the important interaction between mobility disorders and falls is further highlighted by epidemiologic case–control studies conducted to identify risk factors that increase the likelihood of falling. Taken together, these studies indicate that lower extremity weakness, gait and balance disorders, previous falls, functional impairment, visual deficits, cognitive impairment, depression, and polypharmacy are the most important risk factors for falls[56].

Then, the RGM study gives the following ICD-9 codes:

Table 6: ICD-9 codes for reduced mobility syndrome

ICD Codes	Wordings	nDiag
3320	Paralysis agitans	4145
3573	Polyneuropathy in malignant disease	34
3575	Alcoholic polyneuropathy	185
3576	Polyneuropathy due to drugs	62
3599	Myopathy, unspecified	34
71970	Difficulty in walking involving joint site unspecified	1058
71975	Difficulty in walking involving joint of pelvic region and thigh	1849
71976	Difficulty in walking involving lower leg joint	775
71977	Difficulty in walking involving ankle and foot joint	157
71978	Difficulty in walking involving joint of other specified sites	144
71979	Difficulty in walking involving joint of multiple sites	544
72402	Spinal stenosis of lumbar region	1424
7242	Lumbago	796
7243	Sciatica	621
725	Polymyalgia rheumatica	659
7282	Muscular wasting & disuse atrophy, not elsewhere classified	827
72887	Muscle weakness (generalized)	0
7810	Abnormal involuntary movements	199
7812	Abnormality of gait	2545
8088	Unspecified closed fracture of pelvis	74

MEMORY PROBLEMS

Memory complaint is very common in the general population and refers mostly to a minor but measurable memory disorder, a concept which has been the subject of many formulations like "late life forgetfulness", "benign senescent forgetfulness" or "mild cognitive impairment (MCI)". Of all those names, MCI is the most effective to designate this cognitive decline, it remains unclear whether it represents a own clinical entity or if it is a pre-dementia state[57], [58].

Dementia is a clinical syndrome rather than a specific disease, although lay people often use the term incorrectly in referring to all dementias as "Alzheimer's". Dementia is described as a global impairment of every aspect of the intellect, memory and personality, without any alteration of consciousness. However, it is more accurately defined clinically as: "a significant decline in two or more areas of cognitive functioning, including memory, without impairment of consciousness"[59].

A person showing cognitive decline may not always have dementia - there is a continuum of impairment. As people age, they usually experience some benign cognitive changes such as slower information processing and memory impairment. Dementia is progressive and disabling and not a natural part of ageing.

Mild cognitive impairment is a syndrome defined as cognitive decline greater than expected for an individual's age and education level but that does not interfere notably with activities of daily life. Prevalence in population-based epidemiological studies ranges from 3% to 19% in adults older than 65 years[60]. Some people with mild cognitive impairment seem to remain stable or return to normal over time, but more than half progress to dementia within 5 years[61]. Mild cognitive impairment can thus be regarded as a risk state for dementia, and its identification could lead to secondary prevention by controlling risk factors. The amnestic subtype of mild cognitive impairment has a high risk of progression to Alzheimer's disease, and it could constitute a prodromal stage of this disorder. Other definitions and subtypes of mild cognitive impairment need to be studied as potential prodromes of Alzheimer's disease and other types of dementia[62] .

At the other end of the continuum there may be a pre-dementia state - each year, 10-15% of patients with mild cognitive impairment progress to mild dementia, mostly Alzheimer's Disease (AD). However, it has not been established whether this represents progression of age related cognitive decline (ARCD) to dementia or a de novo condition in somebody who has had ARCD[63]. Unfortunately, a variety of other terms have been coined to describe mild cognitive impairment in the absence of dementia; some of these are further discussed in the section on "specific medical problems". The RGM study did not retain cognitive problems as a geriatric syndrome. Thus, we selected all the ICD-9 codes which refer to amnesia.

Table 7: ICD-9 codes for memory problems syndrome

ICD Codes	Wordings	nDiag
2940	Amnestic syndrome	62
29410	Dementia in conditions classified elsewhere without behavioral disturbance	1475
29411	Dementia in conditions classified elsewhere without behavioral disturbance	1156
2948	Other specified organic brain syndromes (chronic)	514
2949	Unspecified organic brain syndrome (chronic)	441
3101	Organic personality syndrome	504
4377	Transient global amnesia	31
4380	Cognitive deficits	482
7809	Other general symptoms	708

DEPRESSION

In the RGM study, depressive disorders are not approached. We thus confronted the ICD-9 codes which refer to mention of depression with a review of the literature.

Psychiatric co morbidity is to be expected in persons who have depression. Most studies evaluating the effectiveness of chronic disease models of depression care have excluded patients with bipolar disorder, schizophrenia, and severe alcohol and substance use disorders. The studies have usually included patients with co-occurring panic disorder and generalized anxiety disorder. Few have systematically measured post-traumatic stress disorder. Limited data indicate that the depression chronic care model is most likely to improve outcomes for patients with new episodes of depression and mild to moderate psychiatric co morbidity.

Patients with depression is usually defined in[64],[65] as patients with the diagnosis of major depression (ICD-9 code 296.20-296.3), dysthymia or chronic depression (ICD-9 code 300.4), depression NOS (ICD-9 code 311), and adjustment disorder with depression, or minor depression (ICD-9 code 309.0).

Certain authors[66, 67] are more restrictive with selected codes, but add the use of antidepressant medications.

According to MCHP[68] and Spettell [69], we added bipolar disorders, but only in the depressed phasis (296.5) and when it was unspecified (296.8)

As PQRI [70], we included depressive type psychosis (298.0) and prolonged depressive reaction (309.1). Like Hansen[71] we also retained dementias when depressive features are mentioned (290.13, 290.21 and 290.43). Finally, we added the depressive character or personality (301.12).

On the other hand, we did not retained schizophrenia (295) and substance abuse: alcohol-induced mental disorders (291), drug-induced mental disorders (292), alcohol dependence syndrome (303), drug dependence (304) and non-dependent abuse of drugs (305)

Table 8: ICD-9 codes for depression syndrome

ICD Codes	Wordings	nDiag
29013	Presenile dementia with depressive features	17
29020	Senile dementia with delusional features	174
29021	Senile dementia with depressive features	280
29043	Vascular dementia with depressed mood	187
29620	Major depressive affective disorder single episode unspecified degree	328
29621	Major depressive affective disorder single episode mild degree	43
29622	Major depressive affective disorder single episode moderate degree	63
29623	Major depressive affective disorder single episode severe degree without psychotic behavior	112
29624	Major depressive affective disorder single episode severe degree specified as with psychotic behavior	83
29625	Major depressive affective disorder single episode in partial or unspecified remission	8
29626	Major depressive affective disorder single episode in full remission	3
29630	Major depressive affective disorder recurrent episode unspecified degree	175
29631	Major depressive affective disorder recurrent episode mild degree	23
29632	Major depressive affective disorder recurrent episode moderate degree	74
29633	Major depressive affective disorder recurrent episode severe degree without psychotic behavior	185
29634	Major depressive affective disorder recurrent episode severe degree specified as with psychotic behaviour	65
29635	Major depressive affective disorder recurrent episode in partial or unspecified remission	6
29636	Major depressive affective disorder recurrent episode in full remission	1
29650	Bipolar i disorder, most recent episode (or current) depressed unspecified degree	19
29651	Bipolar i disorder, most recent episode (or current) depressed mild degree	1
29652	Bipolar i disorder, most recent episode (or current) depressed moderate degree	3
29653	Bipolar i disorder, most recent episode (or current) depressed severe degree without psychotic behaviour	17
29654	Bipolar i disorder, most recent episode (or current) depressed severe degree specified as with psychotic behaviour	5
29655	Bipolar i disorder, most recent episode (or current) depressed in partial or unspecified remission	4
29656	Bipolar i disorder, most recent episode (or current) depressed in remission	0
29680	Manic-depressive psychosis, unspecified	166
29681	Atypical manic disorder	0
29682	Atypical depressive disorder	33
29689	Bipolar disorder, other	9
2980	Depressive type psychosis	74
3004	Neurotic depression	2690
30112	Chronic depressive personality disorder	81
3090	Adjustment reaction with brief depressive reaction	290
3091	Adjustment reaction with prolonged depressive reaction	276
311	Depressive disorder, not elsewhere classified	4056
V790	Screening for depression	0

INCONTINENCE

In RGM study, the incontinence syndrome is identified with the set of codes concerning urinary and fecal incontinence. Fecal incontinence is defined as the loss of regular control of the bowels while urinary incontinence (UI) refers to any involuntary leakage of urine. In Stothers et al.[72], authors add, for urinary incontinence, codes 596.51 (Hypertonicity of bladder, also know as overactive bladder), 596.52 (low bladder compliance), 596.59 (other functional disorder of bladder).

In the four-digit 599.8 (other specified disorders of urethra and urinary tract), they also retain, in addition of the code 599.82, the codes 599.81 (urethral hypermobility), 599.83 (urethral instability) and 599.84 (other specified disorders of urethra). In Spinal cord injury-related incontinence, the code 344.61 (Cauda equina syndrome with neurogenic bladder) was also included.

Finally, we also have to take into account temporary incontinences which we can meet more frequently during hospitalization. Some inpatients will develop incontinence on the occasion of severe medical illness. In addition, patients may return after acute hospitalization with an indwelling catheter placed for purposes of accurate input and output or for the convenience of hospital staff. The nursing facility must assess the continuing need for the catheter and make a treatment plan for it, or remove it and do a trial of voiding. Sometimes, removal of the indwelling catheter may be accomplished only a short time before the patient is discharged to the nursing facility. After its removal, the patients are often temporarily incontinent.

Table 9: ICD-9 codes for incontinence syndrome

ICD Codes	Wordings	nDiag
56400	Constipation, unspecified	3123
56401	Slow transit constipation	124
56402	Outlet dysfunction constipation	13
56409	Other constipation	561
5959	Cystitis, unspecified	261
5964	Atony of bladder	178
59654	Neurogenic bladder nos	184
59655	Detrusor sphincter dyssynergia	15
59982	Intrinsic (urethral) sphincter deficiency [ISD]	3
6180	Prolapse of vaginal walls without mention of uterine prolapse	221
6256	Stress incontinence, female	268
7876	Incontinence of feces	1394
7881	Dysuria	181
78820	Retention of urine, unspecified	1443
78821	Incomplete bladder emptying	147
78829	Other specified retention of urine	468
78830	Urinary incontinence, unspecified	3010
78831	Urge incontinence	284
78832	Stress incontinence, male	38
78833	Mixed incontinence (female) (male)	286
78834	Incontinence without sensory awareness	92
78835	Post-void dribbling	2
78836	Nocturnal enuresis	40
78837	Continuous leakage	98
78838	Overflow incontinence	0
78839	Other urinary incontinence	438
78841	Urinary frequency	163
78842	Polyuria	53
78843	Nocturia	105
7885	Oliguria and anuria	146
78861	Splitting of urinary stream	1
78862	Slowing of urinary stream	1
78863	Urgency of urination	0
78869	Other abnormality of urinary stream	37
7887	Urethral discharge	0
7888	Extravasation of urine	1
7889	Other symptoms involving urinary system	301

MALNUTRITION

In geriatric syndromes, distinction must be made between malnutrition and loss of weight although the latter is a symptom of the former. In the study of Kennedy [73], the author notes that a decrease in the nutritional status of elderly patients has a progression of physical effects. She searches in ICD-9 codes, Nutrition-Related Sentinel Events. All the chosen codes is a part of the range 260 to 269, Nutritional Deficiencies. In Swails[74], the author claims that the definitions for the current ICD-9-CM malnutrition diagnosis codes were developed principally in relation to clinical syndromes of primary protein-energy malnutrition (PEM) seen in pediatric age groups in less developed countries, rather than in relation to syndromes seen in hospitalized adult patients in industrialized societies.

Considering what precedes, we did not consider Kwashiorkor (260) and, conversely, we included cachexia (799.4). Cachexia is symptom defined as weight loss and deterioration in physical condition. It is associated with various serious illnesses including;

- Many types of cancer. Particularly of the pancreas, stomach, oesophagus, colon and rectum.
- HIV/AIDS.
- Congestive Heart failure
- Rheumatoid Arthritis.
- Tuberculosis, COPD, cystic fibrosis.
- Crohns disease.

It is also seen in the elderly without any apparent associated disease.

Table 10: ICD-9 codes for malnutrition syndrome

ICD Codes	Wordings	nDiag
261	Nutritional marasmus	365
262	Other severe protein-calorie malnutrition	284
2630	Malnutrition of moderate degree	77
2631	Malnutrition of mild degree	13
2632	Arrested development following protein-calorie malnutrition	1
2638	Other protein-calorie malnutrition	255
2639	Unspecified protein-calorie malnutrition	478
2651	Other & unspecified manifestations of thiamine deficiency	16
267	Ascorbic acid deficiency	48
2698	Other nutritional deficiency	35
2699	Unspecified nutritional deficiency	62
2811	Other vitamin B12 deficiency anemia	141
2812	Folate-deficiency anemia	235
2814	Protein-deficiency anemia	10
2818	Anemia associated with other specified nutritional deficiency	7
2819	Unspecified deficiency anemia	456
36802	Deprivation amblyopia	0
7994	Cachexia	1515
E9041	Accident due to lack of food	0
V772	Screening for malnutrition	0
V781	Screening for other & unspecified deficiency anemia	0

LOSS OF WEIGHT

Substantial, unintentional weight loss is a symptom of acute or chronic illness, especially if other evidence is present. It is an important indicator of significant decline in health and function, resulting in a higher risk for infection, depression, and death. The major causes of weight loss in the elderly are psychosocial, medical and age-related.

Clinicians should seek common treatable causes of weight loss in elderly patients. One approach is to distinguish among four basic causes of weight loss: anorexia, dysphagia, socioeconomic factors, and weight loss despite normal intake[75].

Involuntary weight loss is commonly observed in the older population, affecting 13% of ambulatory patients and 50% to 60% of nursing-home residents[76].

Table 11: ICD-9 codes for loss of weight syndrome

ICD Codes	Wordings	nDiag
7830	Anorexia	2351
78321	Loss of weight	1012
78322	Underweight	24
7833	Feeding difficulties & mismanagement	197
7839	Other symptoms concerning nutrition, metabolism, & development	4

FRAILTY

Frailty is usually defined as a physiological syndrome characterised by decreased reserve and diminished resistance to stressors, resulting from cumulative decline across multiple physiological systems, and causing vulnerability to adverse outcomes[77]. For this, a phenotype of physical frailty has been proposed as the combination of weight loss, fatigue, impaired grip strength, diminished physical activity or a slow gait[4]. On the other hand, a proposal to operational the definition as a clinical measure includes several features, such as cognitive, functional and social circumstances, that go well beyond just the physical aspects[51]. Another approach taken by the Canadian Initiative on Frailty and Aging, which has summarised frailty definitions as belonging to one of four classes: (i) physiological definitions; (ii) definitions based on frailty as a complex syndrome; (iii) frailty based on a balance model (which adds to the complex syndrome social elements); (iv) frailty defined on the basis of a geriatric syndrome, such as delirium and falls [78]. The lack of an adequate evidence base for a single definition means that the nature of frailty must be an active area of enquiry, if we are to face up to the challenges that it poses[7].

Most definitions of frailty describe a syndrome of loss of muscle mass and strength, energy and exercise tolerance, decrease in gait perimeter with associated increased vulnerability to physiologic stressors, such as acute illness, hospitalization, or extreme heat or cold. Most of these definitions include measures of strength, low energy, low physical activity, inadequate nutrition and unintentional weight loss, slowed performance, and decreased mobility[79], [4,77], [51]; some have also included cognitive or psychological components, such as cognitive impairment and depression[6].

It is important to note that individuals who are classified as frail may certainly have disability, multiple comorbid illnesses, and advanced age, but frailty may be present in the absence of these. These factors may predispose one to the development of frailty. This review shall examine several potential risk factors of frailty. Beyond that, Fried have hypothesized that the clinical presentation marks those at risk of adverse outcomes because it results, itself, from dysregulation of multiple physiologic systems, leading to characteristic clinical manifestations as well as attendant vulnerability.

Iatrogenic diseases are common in the elderly, particularly in the hospitalized patient. Adverse outcomes may be induced by poor communication with patients, inadequate history and examination, and inappropriate use of diagnostic resources. However, even when resources are used appropriately, adverse outcomes do occur, hence the price paid for sophisticated medical and surgical techniques.

Frailty is therefore a state. It corresponds to that of a person physically and functionally declined. Therefore, a "frailty" person appears completely unable to respond effectively to any disruptive element whether internal (eg. infection, dehydration, drug side effects) or external (emotional shock, difficult mourning experience or significant degradation of its socio-economic environment), it is brutal (trauma, stroke …) or progressive (the aging itself, problems with locomotion…). Vetta proposes the concept of "homeostatic balance failure syndrome" [Vetta et al., 1999]. Frailty is not equivalent to comorbidity, nor that of disability, incapacitation or social disadvantage (or disability).

The term "frailty" that geriatricians are currently using too thoroughly deserves a deeper conceptual approach. It is now certain that the "fragility" is a state that appears inevitable with the extreme extension of life. This is the result of a "process of weakening", which corresponds to the progressive reduction of reserves functional organ in addition to co-morbidities, impairment and multiple disabilities.

In accordance with an operational methodology, in the RGM study[80], the frailty syndrome was defined by the conjunction of four categories of risks:

- Frailty
- Iatrogenic risk
- Sensory status
- Social status

Frailty

Table 12: ICD-9 codes for frailty

ICD Codes	Wordings	nDiag
11284	Candidal esophagitis	380
25040	Diabetes mellitus with renal manifestations type ii or unspecified type not stated as uncontrolled	1036
25050	Diabetes mellitus with ophthalmic manifestations type ii or unspecified type not stated as uncontrolled	814
25061	Diabetes mellitus with neurological manifestations type i not stated as uncontrolled	128
25070	Diabetes mellitus with peripheral circulatory disorders type ii or unspecified type not stated as uncontrolled	1066
2510	Hypoglycemic coma	22
261	Nutritional marasmus	365
2630	Malnutrition of moderate degree	77
2631	Malnutrition of mild degree	13
2639	Unspecified protein-calorie malnutrition	478
2760	Hyperosmolality &/or hypernatremia	567
2765	Volume depletion disorder	3438
2769	Electrolyte & fluid disorders not elsewhere classified	514
2818	Anemia associated with other specified nutritional deficiency	7
2920	Drug withdrawal syndrome	49
2930	Acute delirium	1644
2939	Unspecified transient organic mental disorder	669
311	Depressive disorder, not elsewhere classified	4056
5070	Pneumonitis due to inhalation of food or vomitus	787
5078	Pneumonitis due to other solids & liquids	9
5964	Atony of bladder	178
7070	Decubitus ulcer	3040
78820	Retention of urine, unspecified	1443
78821	Incomplete bladder emptying	147
78829	Other specified retention of urine	468
7994	Cachexia	1515
9916	Hypothermia	79
E8880	Fall resulting in striking against sharp object	2
E8881	Fall resulting in striking against other object	22
E8888	Other fall	317
E8889	Unspecified fall	3417
E9041	Accident due to lack of food	0
E9042	Accident due to lack of water	0
E911	Inhalation and ingestion of food causing obstruction of respiratory tract or suffocation	7
V070	Need for isolation	358
V600	Lack of housing	37

With this set of codes, we try to describe a paradoxical situation that even a number of physiologic alterations have been associated with frailty. Some studies shows that frailty is a distinct physiologic entity with characteristic changes in physiology, including activated inflammation, decreased immune function, anemia, endocrine system alterations, and musculoskeletal alterations [81]. Furthermore, the ICD codes which evoke an unintentional loss of weight were included according to Fried's frailty model for which inadequate nutrition is recognized clinically as a marker of frailty[4].

Iatrogenic risk

Table 13: ICD-9 codes for iatrogenic risk

ICD Codes	Wordings	nDiag
2910	Alcohol withdrawal delirium	58
2920	Drug withdrawal syndrome	49
29212	Drug-induced hallucinosis	35
2922	Pathological drug intoxication	2
29281	Drug-induced delirium	102
29284	Drug-induced organic affective syndrome	1
2929	Unspecified drug-induced mental disorder	3
30400	Opioid type dependence unspecified use	4
30410	Sedative, hypnotic or anxiolytic dependence unspecified use	51
30460	Other specified drug dependence unspecified use	26
30580	Nondependent antidepressant type abuse unspecified use	6
3321	Secondary Parkinsonism	143
33382	Orofacial dyskinesia	97
9690	Poisoning by antidepressants	15
9694	Poisoning by benzodiazepine-based tranquilizers	86
9720	Poisoning by cardiac rhythm regulators	21
9721	Poisoning by cardiotonic glycosides & drugs of similar action	121
9744	Poisoning by other diuretics	5
E8795	Insertion of gastric or duodenal sound	4
E8796	Urinary catheterization	21
E9300	Penicillins causing adverse effects in therapeutic use	93
E9305	Cephalosporin group causing adverse effects in therapeutic use	18
E9308	Other specified antibiotics causing adverse effects in therapeutic use	83
E9320	Adrenal cortical steroids causing adverse effects in therapeutic use	863
E9323	Insulins and antidiabetic agents causing adverse effects in therapeutic use	89
E9328	Antithyroid agents causing adverse effects in therapeutic use	16
E9347	Natural blood and blood products causing adverse effects in therapeutic use	0
E9364	Anti-parkinsonism drugs causing adverse effects in therapeutic u	51
E9370	Barbiturates causing adverse effects in therapeutic use	3
E9376	Mixed sedatives not elsewhere classified causing adverse effects in therapeutic use	1
E9378	Other sedatives and hypnotics causing adverse effects in therapeutic use	13
E9379	Unspecified sedatives and hypnotics causing adverse effects in therapeutic use	18
E9390	Antidepressants causing adverse effects in therapeutic use	65
E9391	Phenothiazine-based tranquilizers causing adverse effects in therapeutic use	3
E9392	Butyrophenone-based tranquilizers causing adverse effects in therapeutic use	5
E9393	Other antipsychotics neuroleptics and major tranquilizers causing adverse effects in therapeutic use	127
E9394	Benzodiazepine-based tranquilizers causing adverse effects in therapeutic use	60
E9395	Other tranquilizers causing adverse effects in therapeutic use	11
E9396	Psychodysleptics (hallucinogens) causing adverse effects in therapeutic use	0
E9397	Psychostimulants causing adverse effects in therapeutic use	0
E9398	Other psychotropic agents causing adverse effects in therapeutic use	23
E9399	Unspecified psychotropic agent causing adverse effects in therapeutic use	17
E9420	Cardiac rhythm regulators causing adverse effects in therapeutic use	456
E9421	Cardiotonic glycosides and drugs of similar action causing adverse effects in therapeutic use	217
E9443	Saluretics causing adverse effects in therapeutic use	46

Iatrogenicity is a very common, often preventable, hazard of hospitalization and is associated with significantly longer hospital stays, increased patient mortality and cost. It refers to any unintended and untoward consequence of well-intended healthcare interventions. It is something that develops as the consequence of treatment and often as physician-induced illness[82].

Long waiting times in acute care for geriatric rehabilitation increases the risk of iatrogenic illness (e.g. infection, skin ulcers, greater functional decline), which can delay rehabilitation, increase functional decline and prolong overall length of stay in both acute care and rehabilitation hospitals.

Iatrogenicity occurs most frequently among the oldest, most functionally impaired patients and those with a higher severity of illness upon admission.

Patients 65 years and older suffer twice as many diagnostic complications, two and one half times as many medication reactions, four times as many therapeutic misstaps, and nine times as many falls as those younger patients. Age-related factors that predispose the older patient to iatrogenesis include:

1. Diminished physiologic reserve
2. Impaired compensatory mechanisms
3. Atypical presentation of illness, which complicates accurate diagnosis and treatment
4. More co-morbid, chronic medical conditions, that require more diagnostic procedures and medications
5. Polypharmacy - The prescription, administration or use of more medications than clinically indicated
6. Greater numbers of prescribed medications
7. Increased cognitive and functional impairment
8. Other risk factors for iatrogenic complications include:
9. Increased severity of illness and complexity of care
10. Admission from nursing home or other acute care facility
11. Longer length or stay
12. Lack of attention to functional impairment by physicians upon admission[83, 84]

Cascade iatrogenesis is a series of adverse events triggered by an initial medical or nursing intervention initiating a cascade of decline. For example, inappropriate use or excessive dosing of psychotropic medications in the elderly is common and can lead to a variety of adverse drug events including falls, sedation, and cognitive impairment[85].

The most common iatrogenic events result from: (i) adverse reactions to medications conditioning by modifications of pharmacokinetics and pharmacodynamics in the elderly, (ii) adverse reactions to diagnostic, therapeutic and prophylactic procedures make worse by polymedication, self-medication and poor adherence to treatment, (iii) nosocomial conditions such as hospital-acquired infections, delirium, deconditioning, malnutrition, faecal impaction, incontinence and pressure ulcers, (iiii) the intricacy of acute and chronic pathologies in the elderly.

Sensory status

Table 14: ICD-9 codes for sensory status

ICD Codes	Wordings	nDiag
3619	Unspecified retinal detachment	18
36230	Retinal vascular occlusion, unspecified	26
36231	Central retinal artery occlusion	28
36232	Arterial branch occlusion	3
36233	Partial arterial occlusion	0
36234	Transient arterial occlusion	18
36235	Central retinal vein occlusion	15
36236	Venous tributary (branch) occlusion	4
36250	Macular degeneration (senile), unspecified	263
36511	Primary open angle glaucoma	27
36610	Senile cataract, unspecified	580
3689	Unspecified visual disturbance	54
3693	Unqualified visual loss, both eyes	39
38610	Peripheral vertigo, unspecified	40
38611	Benign paroxysmal positional vertigo	245
38612	Vestibular neuronitis	69
38619	Other peripheral vertigo	24
3862	Vertigo of central origin	123
V410	Problems with sight	12
V412	Problems with hearing	26
V413	Other ear problems	0
V414	Problems with voice production	0
V415	Problems with smell & taste	1
V416	Problems with swallowing & mastication	62

The mainly hearing and visual sensory performances play a very important role in the risk of functional decline. Several studies indicate that they not take into account that visual and hearing problems are associated with significantly morbidity risk increased by functional decline and by mortality[86], [87], [88], [89]. We thus have to consider that sensory changes in taste, smell, vision and hearing are an important part of the evaluation of the frailty.

Social status

Table 15: ICD-9 codes for social status

ICD Codes	Wordings	nDiag
30151	Chronic factitious illness with physical symptoms	6
E9040	Abandonment or neglect of infants and helpless persons	1
E9041	Accident due to lack of food	0
E9042	Accident due to lack of water	0
V600	Lack of housing	37
V601	Inadequate housing	289
V602	Inadequate material resources	266
V603	Person living alone	5794
V604	No other household member able to render care	2653
V608	Other specified housing or economic circumstances	124
V6282	Bereavement, uncomplicated	109
V631	Medical services in home not available	430
V632	Person awaiting admission to adequate facility elsewhere	2919

There is no doubt that patient isolation, management of home, income level and education are factors known to influence the risk of functional decline. They are also part of the evaluation of frailty profile defined frail elderly people as "old debilitated individuals who cannot survive without substantial help from others," emphasizing the social consequences of frailty[90]. Rockwood explains the model of Brocklehurst who used a balance between biomedical and psychosocial components to elaborate a dynamic model of frailty [91]. His model of breakdown included many factors that affect whether a person can live in the community. On one side of the balance are aspects, which help a person to maintain his or her independence in the community: health, functional capacity, a positive attitude toward health and other resources (social, spiritual, financial and environmental). On the other side are deficits, which threaten independence: ill health (particularly chronic disease), disability, dependence on others for the activities of daily living and burden on caregivers. For those dependent on others, a caregiver is a crucial aspect and the burden on the caregiver an equally important deficit. From this approach we derived a dynamic model of frailty. For most elderly people, the assets heavily outweigh the deficits: they are well. For others, the deficits outweigh the assets, so these people can no longer maintain their independence in the community: they are the frail elderly people who live in institutions. A third group comprises those for whom the assets and the deficits are in a precarious balance: they are frail but still live in the community[92].

Lower socioeconomic status (SES), as measured by low education and/or low annual income, has been associated with frailty in several cross-sectional studies[8], [93], [94]. It is likely that high SES does not intrinsically confer less risk of frailty, but that this relationship between SES and frailty is modified by lifestyle factors that are likely to co-exist with low SES.

Some variables like the social condition, not observed by the econometrician, may have an effect on the length and, consequently, the cost of the stay. They may also be correlated with the probability to be avoidably re-admitted.

Similarly, social isolation is a risk factor in itself for poor outcomes, including institutionalization[95] and death[96]. Berkman and Syme[97] showed that persons who lacked social and community ties were more likely to die during the follow-up period than were those with more extensive contacts.

In focus groups, older patients and their caregivers emphasised emotional and social domains of frailty, in addition to the physical ones[51].

Lack of adequate caregiving support can generate considerable use of medical care resources, particularly among frail elderly patients and disabled patients.

PAIN

A classification based on inferred pathophysiology, broadly divides pain syndromes into nociceptive, neuropathic, psychogenic, mixed, or idiopathic[98].

Pain can be acute due to trauma or surgery or chronic due to medical illnesses and their sequels. Acute pain begins suddenly, often in response to an obvious cause (e.g. trauma, surgery). When pain is severe, autonomic signs (e.g. tachycardia, pallor, diaphoresis, mild hypertension) are common.

Chronic pain is characterized by a distant and often vague onset: failed backs and necks, headaches, reflex sympathetic dystrophy, trigeminal neuralgia, atypical facial pain, fibromyalgia, abdominal pain. Chronic pain often results from a chronic disorder (e.g. diabetic neuropathy, osteoarthritis, osteoporosis,…) but may be unapparent. Sometimes the cause is clear, but the pain lasts longer than the expected time for healing. Autonomic signs are usually absent[99].

Chronic pain in elderly patients may gradually lead to lassitude, insomnia, other sleep disturbances, decreased appetite, loss of taste for food, weight loss, decreased libido, and constipation. Patients may become preoccupied with physical symptoms, become inactive, and withdraw socially, depression is common. Psychological and social impairment may severely limit function and activity.

Inactivity can lead to deconditioning, impaired ambulation, and delayed rehabilitation. Pain may lead to polypharmacy (prescription of multiple drugs) and increased use and costs of health care resources[100].

The risk of "cascade" is now well known, the pain patient quickly shows other troubles: disability, disorders related to nutrition, depression, sliding syndrome.

Table 16: ICD-9 codes for pain syndrome

ICD Codes	Wordings	nDiag
30780	Psychogenic pain site unspecified	10
38871	Otogenic pain	1
44022	Atherosclerosis of the extremities with rest pain	284
71940	Pain in joint site unspecified	15
71941	Pain in joint involving shoulder region	182
71942	Pain in joint involving upper arm	35
71943	Pain in joint involving forearm	49
71944	Pain in joint involving hand	13
71945	Pain in joint involving pelvic region and thigh	292
71946	Pain in joint involving lower leg	136
71947	Pain in joint involving ankle and foot	42
71948	Pain in joint involving other specified sites	36
71949	Pain in joint involving multiple sites	124
7295	Pain in limb	251
7841	Throat pain	22
78650	Chest pain, unspecified	491
78651	Precordial pain	953
78659	Other chest pain	299
78900	Abdominal pain unspecified site	404
78901	Abdominal pain right upper quadrant	39
78902	Abdominal pain left upper quadrant	22
78903	Abdominal pain right lower quadrant	61
78904	Abdominal pain left lower quadrant	39
78905	Abdominal pain periumbilic	26
78906	Abdominal pain epigastric	278
78907	Abdominal pain generalized	109
78909	Abdominal pain other specified site	201

In the RGM study, the choice of ICD-9 codes is rather based on the presence of the word "pain" in the wordings of the classification. Therefore, all types of pain are selected some of their systemic origin.

5.2.4.4 Validation of the choice of ICD-codes

Eight experts in geriatrics were asked to give their opinion on the methodology we used to identify geriatric syndrome in RCM/MKG database and if the grouping of ICD codes behind frailty markers we suggested, seems pertinent.

In order to standardize their job, they were asked to answer a few questions (see ***appendix IV***) and complete a worksheet to agree or not with the ICD codes gathered and particularly those gathered under the 'frailty' geriatric syndromes. Experts reached consensus during a workshop meeting where every code were discussed. Every ICD-9 code is confronted with the approval of the experts and the number of positive and negative answers is collected. If a majority of positive answers are noticed, the code is then kept. The results of this process can be consulted in the ***appendix V***.

Some ICD-9 codes are duplicated in different categories of geriatric syndromes (GS). This concerns 28 codes on 263. This duplicity can be found between a category of GS and a subcategory of the frailty. If a patient is in this situation, it implies an increase of the degree of severity by the only presence of an ICD code.

For example, if a patient presents the code 596.4 (Atony of bladder), he will be classified in the group " Incontinence " as well as in the group "frailty". This implicates that this patient will have a stronger weight in the case-mix of the hospital. We kept this duality to conserve the mind of the RGM study. Even if the impact on the whole model is marginal, if we had to build a more formal model, it would be necessary to try to obtain a consensus on this point.

5.2.4.5 Repartition of geriatric syndromes in both databases

In the table below, we give the rate of the different geriatric syndromes in the two settings. In the last columns, we give the results of Chi-square tests. A p-value of less than 0.05 indicates that there is a significant difference in the inpatient and GDH patient population.

Table 17: Geriatric syndromes rates in inpatients and GDH patients

		Inpatients		GDH patients		Chi-Square Tests	
		n	%	n	%	Value	p
1.	Fall	15,266	12.2	289	10.5	7.15	0.00749
2.	Reduced mobility	14,159	11.3	330	12.0	1.28	0.25832
3.	Memory problems	5,199	4.1	1,090	39.6	7249.2	0.00000
4.	Depression	9,347	7.5	248	9.0	9.35	0.00223
5.	Incontinence	11,273	9.0	126	4.6	64.85	0.00000
6.	Malnutrition	3,808	3.0	70	2.5	2.25	0.13327
7.	Loss of weight	3,353	2.7	133	4.8	47.29	0.00000
8.	Frailty	32,055	25.6	221	8.0	440.26	0.00000
9.	Pain	4,269	3.4	184	6.7	86.23	0.00000

In the GDH database, we find 10.5% (n=289) of the patients with falling syndrome. If we test the existence of, at least, one of the selected codes in the RCM/MKG diagnose file, we find 15 266 patients (12.2%). Although significant, this difference is not very important.

For reduced mobility, we found 330 patients (12%) in the GDH database. In the diagnose file, we found 14 159 patients (11.3%) who presented at least one of the ICD codes. Chi-square test shows that this difference is not significant. If we consider that fall and reduced mobility are interlocked, we can sum the two groups and reduce differences.

In memory problems, however, the study GDH shows a very high prevalence rate of 39.6%, what points out the burden of these troubles in geriatric assessment. If we check the occurrence of selected codes in RCM/MKG data, we found a prevalence rate of only 4.1%, thus nearly ten times less than in GDH data. This considerable difference can be explained by the fact that cognitive evaluation takes place mainly in outpatient settings.

In GDH study, we found 248 patients (9%) with depressive syndrome while, in RCM/MKG database, 9 347 patients (7.5%) are in the same circumstances.

On the other hand, we found 126 incontinent GDH patients (4.6%) and 11 273 incontinent RCM/MKG patients (9%). Such a difference can be explained notably by the fact that in the GDH study, incontinence was perhaps understood only as urinary. It will be necessary to seek if the results are compatible with the prevalence rates of urinary, faecal and double incontinence in the elderly.

For the malnutrition, both sources of data show no significant difference. On the other hand, the loss of weight seems to be more frequent, or in any cases, more frequently raised in GDH setting.

In GDH study, 8% of patients are mentioned with the frailty geriatric syndrome. In RCM/MKG data, we found 25.6% patients who suffered of one of the components of frailty, which are:

Table 18: Frailty syndrome components (RCM/MKG data FY 2003)

Frailty syndrome components	N	%
Frailty	21,797	17.0
iatrogenic risk	2,901	2.3
sensory status	1,643	1.3
social status	10,498	8.2
Total	36,839	28.8

It is clear that the situations are very different between in and outpatients. Frailty prevalence in classic hospitalization remains widely superior. It would be interesting to verify if this situation does not occur in the course of hospitalization.

5.2.4.6 Measurement of the severity in both databases

Charlson comorbidity index (CCI)

One of the main concerns of the study consists in ascertaining that the procedure of matching does not select patients who would present a clinical picture requiring a hospitalization and thus excluding an outpatient care. To carry out this control, we chose the index of Charlson as indicator of severity of inpatient cases.

A comorbidity is a clinical condition that exists before a patient's admission to the hospital. It is not responsible of the hospitalization, and it is likely to be a significant factor influencing mortality and resource use in the hospital [101]. Comorbidities are so diverse that a systematic account of every possible diagnosis and degree of severity would simply create an unmanageable amount of information, especially when these data are gathered for clinical study or prognostic purposes. Therefore, some selection and pooling of the information has to be done. Furthermore, the prognostic impact of a disease may be different according to its severity. Therefore, several indices have introduced a way to rate the severity of the diseases considered [102].

Probably the best known of these indices is the Charlson comorbidity index [103]. Mary Charlson selected a list of 19 diseases and produced a weighted index, which took into account both the number and the seriousness of the comorbidities. The Charlson index assigns weights, from 1 to 6, for a number of major conditions present among secondary diagnoses. The index score is the total of assigned weights, and represents a measure of the burden of comorbid disease. The comorbidity index developed by Charlson et al. [103] is a validated method of classifying comorbidity to predict short- and long-term mortality from medical records. It replaces direct measures of the severity of an illness, which require a prospective data collection. Due to relative inexpensiveness and availability of administrative databases, researchers usually used different compositions of ICD-9 codes to construct their adapted Charlson indices [104] [105] [106] [101].

As part of this study, we used the classical form of calculating the Charlson comorbidity index as indicated in the next figure.

Figure 10: Scoring the comorbidity index[105]

Weights	Conditions	ICD-9 codes
1	Myocardial infarct	410, 411
	Congestive heart failure	398, 402, 428
	Peripheral vascular disease	440–447
	Dementia	290, 291, 294
	Cerebrovascular disease	430–433, 435
	Chronic pulmonary disease	491–493
	Connective tissue disease	710, 714, 725
	Ulcer disease	531–534
	Mild liver disease	571, 573
2	Hemiplegia	342, 434, 436, 437
	Moderate or severe renal disease	403, 404, 580–586
	Diabetes	250
	Any tumor	140–195
	Leukemia	204–208
	Lymphoma	200, 202, 203
3	Moderate or severe liver disease	070, 570, 572
6	Metastatic solid tumor	196–199

Associated geriatric syndromes

If we want to try to establish a similarity with regard to the system of classification in homogeneous groups of diseases, such as DRGs, we are brought to associate an index of severity dependent on the comorbidity.

In geriatrics, it should be based using geriatric syndromes as an indicator of aggravation of the patient's general state, or at least, as an index of complexity of care. We will thus use the number of associated geriatric syndromes

5.2.5 Refined matching procedure

Obviously, we could expect that the ICD9 coding in the RCM/MKG database is more exhaustive than in the GDH study. Therefore, to obtain a valid matching, we will have to refine the matching procedure: Indeed, patient must have the same pathological profile, with few comorbidities that would make them suitable for 'substitution' between classic hospitalisation and day hospitalisation.

Exclusion criteria:

These criteria indicate that substitution from acute hospitalisation towards a geriatric day hospitalisation is not appropriate:

- Patients with an operating room procedure.
- Patients with a surgical DRGs
- Patient in intensive care unit (ICU):
- Patient with Severity of illness > 2

Additional useful criteria:

- Complication and comorbidity (CC): If we want to further minimize the influence of comorbidity on paired patients, it is useful to examine the complications and comorbidities (CC) status of their ICD diagnosis. To do this, we will compare these codes to the list transmitted by the Federal Public Service of Health and which flags the CC status.
- Principal and secondary diagnosis:
    - **Principal Diagnosis (PDx)** refers to the condition established after study to be chiefly responsible for occasioning the patient's admission to the hospital. The selection of principal diagnosis is determined by the circumstances of admission, diagnostic workup and/or therapy provided.

- **Secondary diagnosis,** also known as **Other Diagnoses (ODx),** is a condition that either coexist at the time of admission or develop subsequently and affect patient care for the current hospital episode. "Affecting patient care" signifies conditions requiring any of the following: clinical evaluation, therapeutic treatment, diagnostic procedures, extended the length of hospital stay, or increased nursing care and/or monitoring. Thus, a diagnosed condition causing consumption of significant additional hospital resources is considered as a valid secondary diagnosis.

According to circumstances, the selected ICD-9 diagnosis codes will have to present a status of principal or secondary.

5.3 RESULTS

We can distinguish two geriatric patients' profiles:

- the old patient which presents a main mono pathology (one SMP)
- the old patient which presents several simultaneous pathologies (or co-morbidities).

In both cases, these pathological states will possibly be complicated by the presence of one or several geriatric syndromes and / or with a frailty profile.

5.3.1 Monopathologic patients

First, we are going to consider the patients admitted in the day hospital for a single specific medical problem and to apply the procedure of matching, higher described, on the hospitalized patients database.

5.3.1.1 Final sample of monopathologic patients

In ***appendix VI***, we give the results of matching process on monopathologic patients of the 48 SMP categories. The successive columns of the table show the evolution of the number of paired patients according to the application of the diverse previously defined limitations. The result of the complete matching process gives, for the 984 patients in GDH, 8192 similar patients in classic hospitalization.

5.3.1.2 Characteristics of monopathologic patients in both settings

Age

Table 19: Age of monopathologic for inpatients (IN) and GDH patients (GDH)

		GDH	IN
N		937	8192
Mean		79.4	74.6
Std. Deviation		6.8	6.6
Minimum		65	65
Maximum		104	105
Percentiles	5	68	66
	10	70	67
	25	74	69
	50	80	74
	75	84	79
	90	87	83
	95	91	87

Patients in GDH are significantly older than inpatients; the difference is about 5 years ($p_{Student\ t} < 0.0001$).

Figure 11: Histogram of age for inpatients (IN) and GDH patients(GDH)

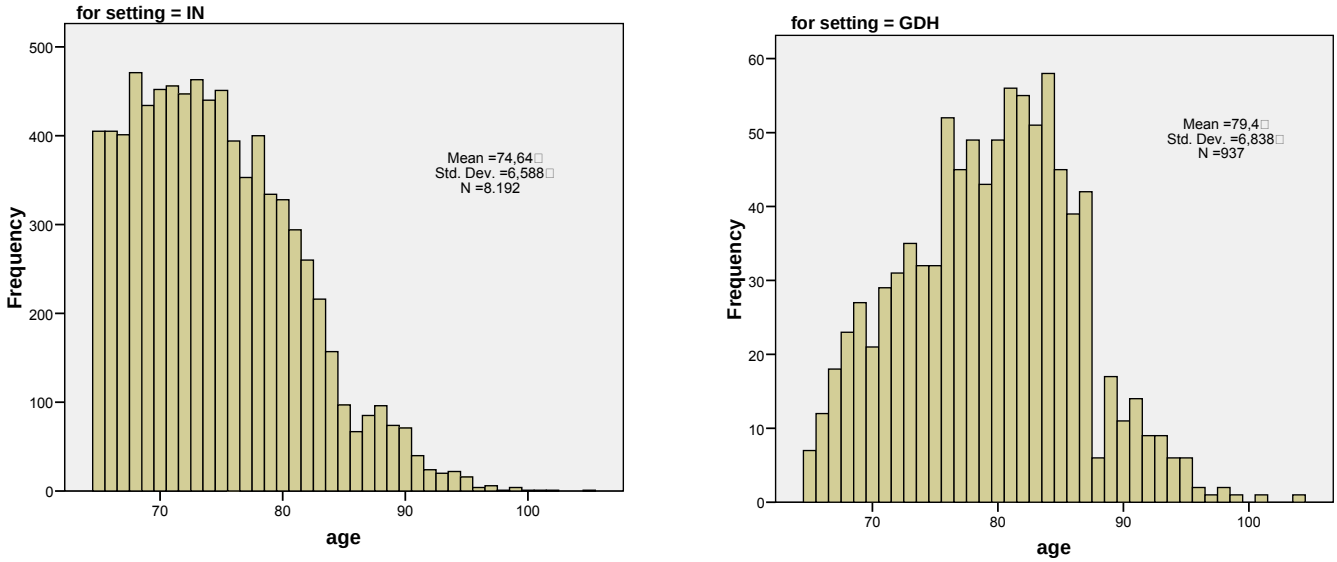
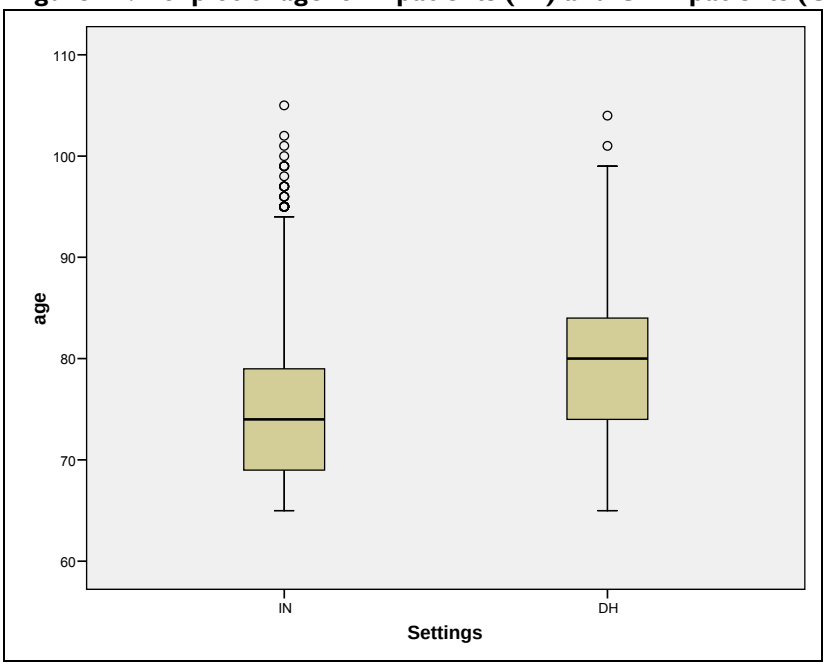


Figure 12: Boxplot of age for inpatients (IN) and GDH patients (GDH)



We then categorized age in three groups: (i) patients younger than 75 years, (ii) patients between 75 and 84 years old and finally (iii) patients older than 84 years old. There is still more clearly the difference in age distribution between the two settings ($p\chi^2 < 0.0001$).

Table 20: Age groups for inpatients and GDH patients

	Inpatients		GDH		Total	
	N	%	N	%	N	%
<75	4374	53.4	235	25.1	4609	50.5
75 - 84	3187	38.9	490	52.3	3677	40.3
85+	631	7.7	212	22.6	843	9.2
Total	8192	100	937	100	9129	100

The differences in age between the two structures are important because GDH patients are about 5 years older. If we compare the means age in both structures for patients of more than 75 years, a difference of 2 years older is maintained in favour of the GDH.

Sex of patients

Table 21: Gender of monopathologic for inpatients and GDH patients

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Man	4074	*49.7*	381	*39.0*	4455	*48.6*
Women	4118	*50.3*	595	*61.0*	4713	*51.4*
Total	8192	*100*	976	*100*	9168	*100*

The geriatric day hospital recruits about 10% of women over classical hospitalization.

Origin of patients

Table 22: Origin of monopathologic inpatients and GDH patients

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	0	*0.0*	21	*2.1*	21	*0.2*
From home	7441	*90.8*	787	*80.0*	8228	*89.7*
Hospital	533	*6.5*	0	*0.0*	533	*5.8*
Home for the elderly and residential care	140	*1.7*	176	*17.9*	316	*3.4*
Others	78	*1.0*	0	*0.0*	78	*0.9*
Total	8192	*100*	984	*100*	9176	*100*

Table 22 shows that:

- A very large majority of the patients come from their residence;
- There is no direct transfer between the hospitalization and the GDH;
- More patients in outpatient care are referred from the resting and nursing home

Patients sent by

Table 23: Monopathologic inpatients and GDH patients are addressed by

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	21	*0.3*	0	*0.0*	21	*0.2*
Own-initiative	675	*8.2*	45	*4.6*	720	*7.8*
General Practitioner (GP)	1396	*17.0*	339	*34.5*	1735	*18.9*
Medical Specialist	6001	*73.3*	567	*57.6*	6568	*71.6*
Others	99	*1.2*	33	*3.4*	132	*1.4*
Total	8192	*100*	984	*100*	9176	*100*

Patients visiting the GDH are twice more often referred by the general physician than patients referred to hospital. Here medical specialists are in 73% the referring persons.

Destination of the patient at discharge

Table 24: Destination at discharge of monopathologic inpatients and GDH patients

	Inpatient		GDH		Total	
	N	%	N	%	N	%
At home	7132	*87.1*	737	*74.9*	7869	*85.8*
Hospital	417	*5.1*	25	*2.5*	442	*4.8*
Home for the elderly and residential care	306	*3.7*	159	*16.2*	465	*5.1*
Died	302	*3.7*	2	*0.2*	304	*3.3*
Others	35	*0.4*	61	*6.2*	96	*1.0*
Total	8192	*100*	984	*100*	9176	*100*

We see that, if 1.7% of the inpatients came from nursing home, the rate at discharge to the nursing home has increased to 3.7% for the inpatients. There is also more death in the classical hospitalization and patients return more often home than the GDH population

Severity

CHECK FOR THE SELECTED PATIENTS IN TERMS OF CO-MORBIDITY

In ***appendix VII***, we give samples size and mean values of the Charlson comorbidity index (CCI) for the inpatients the 48 SMP groups in three circumstances: (i) for final matched patients, (ii) for matched patients before refined matching and (iii) for non-matched patients in the same SMP category.

These results show that, in the case of refined matched patients, means CCI values are always smaller than for the group of the matched patients and even much more small compared with the values of the patients of the same category but non-matched. In addition to all the precautions that we set to avoid selecting patients with a too heavy profile to be handled in GDH, these results confirm the property of our selection through a simple indicator of co-morbidity.

ASSOCIATED GERIATRIC SYNDROMES

In the following table, we notice that, among the 48 SMP groups, the distributions of the frequencies of the associated geriatric syndromes are rather different between both settings: there are more geriatric syndromes in the GDH patients than in classic inpatients.

Table 25: Associated geriatric syndromes

Number of geriatric syndromes	Inpatient		GDH		Total	
	N	%	N	%	N	%
0	6133	74.9	589	59.9	6722	73.3
1	1519	18.5	191	19.4	1710	18.6
2	462	5.6	95	9.7	557	6.1
3+	78	1.0	109	11.1	187	2.0
Total	8192	100	984	100	9176	100

Patients coming to GDH have more geriatric syndromes than inpatients.

Characteristics available only for inpatients

LENGTH OF STAYS (LOS)

The length of stay is an essential indicator of hospital cost. It is used as basis of our hospital financing system and allows to define the justified activity.

In the following table, we show the length of stay in classic hospitalization. We used the number of days billed for classical hospitalisation because this variable is also used by the authorities to calculate hospital funding.

In day hospitalization, we asked to the participating hospitals to record, for every admitted patient, dates of the visits necessary for the diagnosis or for the treatment of the problem having caused the admission. In most of cases, hospitals declared only a single visit (83.4%). If we consider the data as valid, we have to conclude that this type of structure accelerates patient care considerably. The comparison of length of stay between both types of hospitalization is thus not really valid because, structurally, we are in the presence of organization radically different.

For the classical hospitalization, results show an average of 5.77 days with a strongly asymmetrical distribution in the high values. This situation is classic and get in fact certain authors to prefer the logarithmic transformed rather than the native variable.

Although, if we consider, instead of arithmetic mean, robust estimators of central tendency such as the Huber's estimator, and, especially in our case, Tukey's estimator, the length of stay be close to 2 days. As we show in ***appendix X***, the Tukey's estimator gives no weight to outliers.

Table 26: Length of stay of monopathologic inpatients

N		8192
Mean		5.77
Median		2
5% Trimmed Mean		4.01
Huber's M-Estimator		2.73
Tukey's Biweight		2.09
Std. Deviation		10.93
Minimum		1
Maximum		178
Percentiles	5	1
	10	1
	25	2
	50	2
	75	6
	90	12
	95	20

The length of stay has to be observed separately in the different categories of ages. The following table shows the raise of stays according to the age of the patient.

Table 27: LOS by age groups

		<75	75 - 84	85+	Total
N		4374	3187	631	8192
Mean		4.80	6.44	9.12	5.77
Median		2	3	5	2
5% Trimmed Mean		3.36	4.50	6.76	4.01
Huber's M-Estimator		2.42	3.36	5.01	2.73
Tukey's Biweight		2.02	2.79	4.14	2.09
Std. Deviation		9.40	11.68	15.12	10.93
Minimum		1	1	1	1
Maximum		171	153	178	178
Percentiles	5	1	1	1	1
	10	1	1	1	1
	25	1	2	2	2
	50	2	3	5	2
	75	5	6	9	6
	90	10	14	21	12
	95	15	22	33	20

By analogy with financing system, length of stays must be considered separately according to degree of severity. We define it by the absence (0) or the presence of one (1) or more than one (2+) geriatric syndromes.

Table 28: LOS by geriatric syndromes groups

		0	1	2+
N		1786	927	1203
Mean		9.87	16.64	26.71
Median		4	8	17
5% Trimmed Mean		6.74	12.30	22.85
Huber's M-Estimator		4.59	8.75	18.43
Tukey's Biweight		3.63	7.11	15.81
Std. Deviation		18.34	26.49	29.67
Minimum		1	1	1
Maximum		235	217	228
Percentiles	5	1	1	2
	10	1	2	3
	25	2	4	8
	50	4	8	17
	75	9	18	33
	90	22	40	65
	95	41	63	90

HOSPITAL BED INDEX

Table 29: Hospital bed index of monopathologic inpatients

	<75		75 - 84		85+		Total	
	N	%	**N**	%	**N**	%	**N**	%
Medical bed	3541	*81.0*	2260	*70.9*	334	*52.9*	6135	*74.9*
Surgical bed	624	*14.3*	563	*17.7*	135	*21.4*	1322	*16.1*
Geriatric bed	79	*1.8*	203	*6.4*	102	*16.2*	384	*4.7*
Revalidation bed	130	*3.0*	161	*5.1*	60	*9.5*	351	*4.3*
Total	4374	*100*	3187	*100*	631	*100*	8192	*100*

The main part of monopathologic patients stays take place in medical beds. However, although the surgical DRG have been eliminated, 16% of the stays are in surgical beds. The qualification of the beds in surgical and medical beds has no more sense. However, it is essential to note that only 4.7% of the patients are admitted to a geriatric unit. If we analyze patients' presence by age groups, we see the increase in G beds, and in a lesser measure in rehabilitation beds, with an increase in age.

5.3.2 Polypathologic patients

In the GDH database, in addition to the patients admitted for a single pathology, there is a lot of patients who have several pathologies, among our 48 groups of pathologies.

5.3.2.1 Final sample of polypathologic patients

Among the binary combinations of the 48 SMP categories, which can represent 2.8 10^{14} potential associations, one note in our database that 271 patient classified in 197 poly-pathological groups (see ***appendix IX)***.

As in the case of the monopathologies, quite same matching procedure of GDH patients with those being hospitalized and presenting the same pathological profile is applied. The same limitations as previously are present, except that the restriction of diagnostic codes as the only main ones does not have senses in case of poly- pathological patients. Indeed, in the study GDH, in presence of several pathologies, it is impossible to discern which diagnosis is the main one. Finally, we have matched 3,916 inpatients at the 271 GDH patients.

5.3.2.2 *Characteristics of polypathologic patients in both settings:*

Age

Table 30: Age of polypathologic for inpatients (IN) and GDH patients (GDH)

		GDH	IN
N		270	3916
Mean		80.36	77.12
Median		81	77
5% Trimmed Mean		80.45	76.91
Huber's M-Estimator		80.77	76.84
Tukey's Biweight		80.88	76.73
Std. Deviation		7.02	7.23
Minimum		56	65
Maximum		100	103
Percentiles	5	68	66
	10	71	68
	25	76	71
	50	81	77
	75	85	82
	90	89	87
	95	91	90

Polypathologic patients in GDH are approximately 3 years older than polypathologic inpatients ($p_{Student\ t} < 0.0001$).

Figure 13: Histogram of age for inpatients (IN) and GDH patients (GDH)

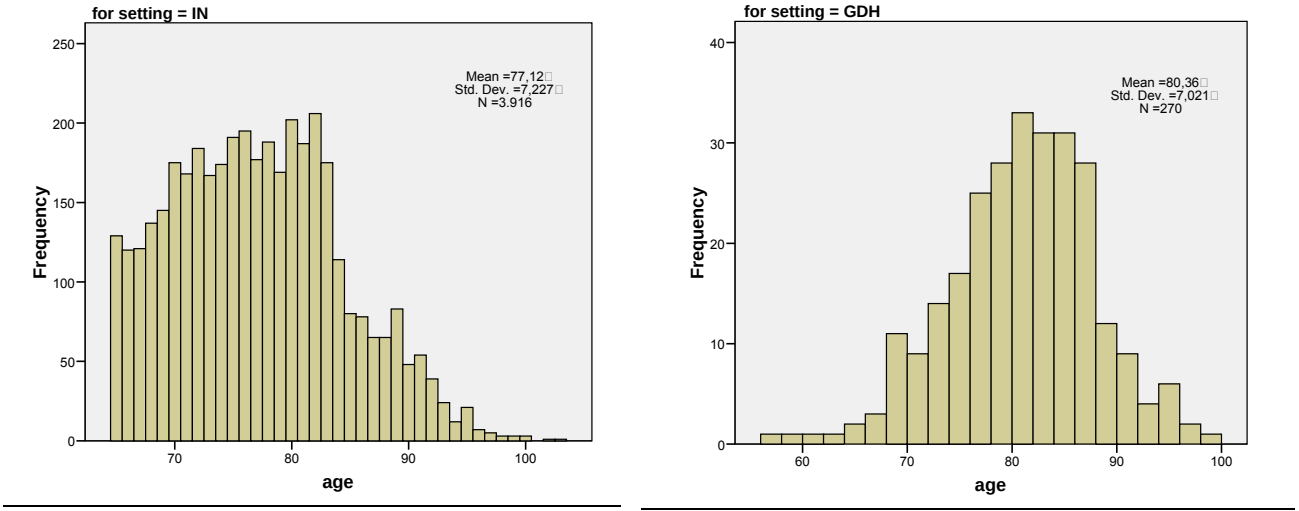
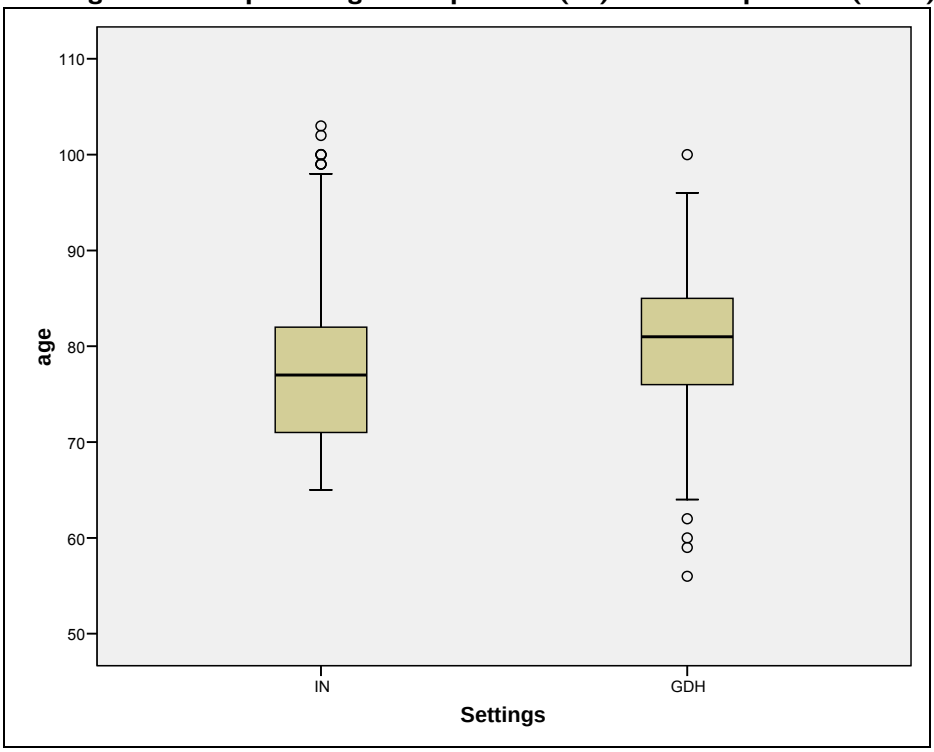


Figure 14: Boxplot of age for inpatients (IN) and GDH patients (GDH)



The same groups of age as for monopathologic patients are chosen: (i) patients younger than 75 years, (ii) patients between 75 and 84 years old and finally (iii) patients older than 84 years old. A clear difference remains in age distribution of polypathologic patients between the two settings ($p_{\chi^2} < 0.0001$).

Table 31: Age groups for polypathologic patients

	Inpatient		GDH		Total	
	N	%	**N**	%	**N**	%
<75	1520	38.8	50	18.5	1570	37.5
75 - 84	1804	46.1	146	54.1	1950	46.6
85+	592	15.1	74	27.4	666	15.9
Total	3916	100	270	100	4186	100

Again, classical hospitalisation recruits more patients under 75 years. However selecting only the patients of 75 years or older, no age-related difference is found between both settings.

Gender of patients

Table 32: Gender for polypathologic patients

	Inpatient		GDH		Total	
	N	%	**N**	%	**N**	%
Man	1360	34.7	96	35.7	1456	34.8
Women	2556	65.3	173	64.3	2729	65.2
Total	3916	100	269	100	4185	100

For these polypathologic patients, the distribution by sex is almost identical in both settings (χ^2 = N.S.).

Origin of patients

Table 33: Origin of polypathologic inpatients and GDH patients (GDH)

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	0	0.0	9	3.3	9	0.2
From home	2820	72.0	194	71.6	3014	72.0
Hospital	901	23.0	1	0.4	902	21.5
Home for the elderly and residential care	150	3.8	67	24.7	217	5.2
Others	45	1.1	0	0.0	45	1.1
Total	3916	100	271	100	4187	100

As for monopathologic patients, table 37 shows that:

- A large majority of the patients come from their home;
- There is no direct transfer between the hospitalization and the GDH;
- More patients in outpatient care are referred from the home for the elderly

Patients sent by

Table 34: Polypathologic inpatients and GDH patients (GDH) are addressed by

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	11	0.3	0	0.0	973	23.2
Own-initiative	279	7.1	14	5.2	293	7.0
General Practitioner (GP)	909	23.2	120	44.3	120	2.9
Medical Specialist	2664	68.0	130	48.0	2794	66.7
Others	53	1.4	7	2.6	7	0.2
Total	3916	100	271	100	4187	100

Patients visiting the GDH are more often referred by the general physician (44%) than patients referred to hospital. Here medical specialists are in 68% the referring persons.

Destination

Table 35: Destination at discharge of polypathologic inpatients and GDH patients (GDH)

	Inpatient		GDH		Total	
	N	%	N	%	N	%
At home	3173	81.0	178	65.7	3351	80.0
Hospital	134	3.4	11	4.1	145	3.5
Home for the elderly and residential care	499	12.7	61	22.5	560	13.4
Died	80	2.0	0	0.0	80	1.9
Others	30	0.8	21	7.7	51	1.2
Total	3916	100	271	100	4187	100

Inpatients with multiple pathologies are discharged in 12.7% to a resting or nursing home although only 3.8% were admitted from this setting. This is also a higher percentage than patients with only one pathology, suggesting that the risk of institutionalization is higher in patients with severe underlying disease.

Severity

CHARLSON COMORBIDITY INDEX (CCI)

In table 33, we compare the Charlson index for the matched inpatients' mono versus polypathology. We notice that the mean CCI is very low in both groups although the difference is statistically significant ($p_{Student\ t} < 0.0001$). The population we study here is thus eligible for GDH.

We can see that, even if the difference is logically significant in the statistical point of view, in fact, the polypathologic condition does not have a determining impact on the average of CCI

Table 36: CCI of mono and polypathologic inpatients

	N	Mean	S.D.
Mono-pathologies	8192	1.37	3.53
Poly-pathologies	3916	1.57	2.74

Associated geriatric syndromes

Table 37: Associated geriatric syndromes in polypathologic inpatients

Number of geriatric syndromes	Inpatient		GDH		Total	
	N	%	N	%	N	%
0	1786	45.6	112	41.3	1898	45.3
1	927	23.7	52	19.2	979	23.4
2	716	18.3	44	16.2	760	18.2
3+	487	12.4	63	23.3	550	13.1
Total	3916	100	271	100	4187	100

The rates of geriatric syndromes are very similar between the inpatient and the patient in the GDH. These findings are different from findings in the group with monopathologies where less inpatients has GS. This suggests that the profile of the patient in the GDH is much more similar to the profile of the polypathologic inpatient than of the monopathologic inpatient.

Length of stays

Table 38: Length of stay of polypathologic inpatients

		IN
N		3916
Mean		16.65
Median		8
5% Trimmed Mean		12.61
Huber's M-Estimator		8.86
Tukey's Biweight		7.03
Std. Deviation		25.33
Minimum		1
Maximum		235
Percentiles	5	1
	10	2
	25	3
	50	8
	75	18
	90	43
	95	68

Average LOS rises from 5.77 days in monopathologies to 16.7 days in polypathologies, that is an increase of 11 days. In Tukey's robust estimator, the increase is of 7 days. There is difference in median LOS of 6 days (2 days in monopathologies and 8 days in polypathologies)

Hospital bed index

Table 39: Hospital bed index of polypathologic inpatients

	<75		75 - 84		85+		Total	
	N	%	N	%	N	%	N	%
Medical bed	993	65.3	874	48.5	177	29.9	2044	52.2
Surgical bed	195	12.8	215	11.9	54	9.1	464	11.9
Geriatric bed	145	9.5	380	21.1	236	39.9	761	19.4
Revalidation bed	187	12.3	335	18.6	125	21.1	647	16.5
Total	1520	38.8	1804	46.1	592	15.1	3916	100.0

19% of the multipathologic patients are admitted in geriatric unit while they were only 4.7% in monopathological cases. Also, only 4.8% of the monopathologies were admitted in revalidation unit but this rate rises to 16.5% in the case of polypathologies. As in monopathological situation, we see also the association between hospitalisation in G beds, and in a lesser measure in revalidation beds, and the increasing age of the patient.

5.3.3 Patients with geriatric syndromes

In this last category of patients, we find hospital admissions, not for one or several specific medical problems, but only for the evaluation of geriatric syndromes.

5.3.3.1 Final sample of patients with geriatric syndromes

We implement the same limitations as previously.

The restriction of the ICD 9 codes at secondary diagnosis follows a recommendation of the geriatricians of the RGM study (1996).

The complete process of refined matching led to match, at the 974 GDH patients, 430 inpatients.

5.3.3.2 Characteristics of the patients with geriatric syndromes in both settings

Age

Table 40: Age of inpatients (IN) and GDH patients (GDH) for geriatric syndromes group.

		GDH	IN
N		909	430
Mean		79.62	77.41
Median		80	77
5% Trimmed Mean		79.92	77.22
Huber's M-Estimator		80.14	77.05
Tukey's Biweight		80.29	76.93
Std. Deviation		7.17	7.09
Minimum		52	65
Maximum		98	97
Percentiles	5	67.5	67
	10	71	68
	25	76	72
	50	80	77
	75	85	82
	90	87	88
	95	90	90

GDH patients of geriatric syndrome group are significantly older than inpatients, the difference is about 2.2 years ($p_{Student\ t} < 0.0001$).

We applied the same groups of age as below: (i) patients younger than 75 years, (ii) patients between 75 and 84 years old and finally (iii) patients older than 84 years old.

There is a difference in age distribution of patients with geriatric syndrome(s) between the two settings ($p_{\chi^2} < 0.0001$).

Table 41: Age groups for geriatric syndromes patients

	Inpatient		GDH		Total	
	N	%	N	%	N	%
<75	157	36.5	180	18.5	337	24.0
75 - 84	209	48.6	563	57.8	772	55.0
85+	64	14.9	231	23.7	295	21.0
Total	430	100	974	100	1404	100

Sex of patients with geriatric syndrome(s)

Table 42: Gender for geriatric syndromes patients

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Men	130	30.2	331	34.4	461	33.1
Women	300	69.8	631	65.6	931	66.9
Total	430	100	962	100	1392	100

For these patients, the distribution by sex is identical between both settings (χ^2 = N.S.).

Origin of patients

Table 43: Origin of geriatric syndromes inpatients and GDH patients(GDH)

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	3	0.7	9	0.9	12	0.9
From home	312	72.6	812	83.4	1124	80.1
Hospital	108	25.1	2	0.2	110	7.8
Home for the elderly and residential care	7	1.6	151	15.5	158	11.3
Others	0	0.0	0	0.0	0	0.0
Total	430	100	974	100	1404	100

More GDH patients are coming from their own houses, comparable with the situation in the group of the patient with polypathologies.

Patients sent by

Table 44: Geriatric syndromes inpatients and GDH patients(GDH) are addressed by

	Inpatient		GDH		Total	
	N	%	N	%	N	%
Unknown	2	0.5	0	0.0	2	0.1
Own-initiative	24	5.6	66	6.8	90	6.4
General Practitioner (GP)	76	17.7	378	38.8	454	32.3
Medical Specialist	325	75.6	466	47.8	791	56.3
Others	3	0.7	64	6.6	67	4.8
Total	430	100	974	100	1404	100

As in the previous results, patients in GDH are more often referred by their general physician.

Destination

Table 45: Destination at discharge of geriatric syndromes inpatients and GDH patients(GDH)

	Inpatient		GDH		Total	
	N	%	N	%	N	%
At home	381	88.6	643	66.0	1024	72.9
Hospital	12	2.8	19	2.0	31	2.2
Home for the elderly and residential care	28	6.5	106	10.9	134	9.5
Died	2	0.5	1	0.1	3	0.2
Others	7	1.6	205	21.1	212	15.1
Total	430	100	974	100	1404	100

The most important fact is that, Comparable with previous results, elderly inpatients are more often discharged to an MR/MRS/ROB/RVT. The ratio between admission and discharge, from and to, nursing home was near 4.0.

Hospital bed index

Table 46: Hospital bed index of geriatric syndromes inpatients

	<75		+75 - 84		85		Total	
	N	%	N	%	N	%	N	%
Medical bed	59	37.6	68	32.5	13	20.3	140	32.6
Surgical bed	53	33.8	65	31.1	23	35.9	141	32.8
Geriatric bed	6	3.8	20	9.6	14	21.9	40	9.3
Revalidation bed	39	24.8	56	26.8	14	21.9	109	25.4
Total	157	36.5	209	48.6	64	14.9	430	100.0

In G beds, we found 9.3% of the cases. This represents an intermediate situation between monopathology (4.7%) and polypathology (19%). On the other hand, 25.3% cases are admitted in revalidation (Sp) compared with 4.3% in monopathological cases and 16.5% in the polypathologic cases. A quarter of older patient with a geriatric syndrome stay in Sp beds, suggesting a higher need for rehabilitation to restore functions in this population. Probably, many of these patients where first hospitalised in a Geriatric bed for diagnostic purposes. In contrast with the patients with mono- and polypathology there is only a relation between age and the presence in Geriatric beds and not for the presence in revalidation beds.

Charlson comorbidity index (CCI)

The mean CCI is 0.14. With regard to other situations, we are not here in the presence of proven pathologies but rather of clinical patterns, which is confirmed by a very low CCI.

Relationship in DRG system

In the table below, we looked the main DRG that we find in the situation of geriatric syndromes patients. As we could expect it, we isolate low specific DRG which correspond well enough to the definition of the geriatric syndromes.

Table 47: Relationship between GS and DRG

	DRG		Freq	%	Cum %
1	862	OTHER FACTORS INFLUENCING HEALTH STATUS	128	29.77	29.77
2	860	REHABILITATION	119	27.67	57.44
3	347	MEDICAL BACK PROBLEMS	18	4.19	61.63
4	348	OTHER BONE DISEASES	15	3.49	65.12
5	058	OTHER DISORDERS OF NERVOUS SYSTEM	11	2.56	67.67
6	244	DIVERTICULITIS & DIVERTICULOSIS	10	2.33	70.00
7	250	OTHER DIGESTIVE SYSTEM DIAGNOSES	9	2.09	72.09
8	812	POISONING & TOXIC EFFECTS OF DRUGS	9	2.09	74.19
9	042	DEGENERATIVE NERVOUS SYSTEM DISORDERS	7	1.63	75.81
10	048	CRANIAL & PERIPHERAL NERVE DISORDERS	7	1.63	77.44
11	082	OTHER DISORDERS OF THE EYE	7	1.63	79.07
12	342	FRACTURE OR DISLOCATION EXCEPT FEMUR & PELVIS	7	1.63	80.70

Length of stays

Table 48: Length of stay of geriatric syndromes inpatients

Number of geriatric syndromes	N	Mean	Std. Deviation	Minimum	Maximum
1	323	13.41	19.044	1	185
2	86	21.06	20.760	1	84
3+	21	32.14	24.782	4	103
Total	430	15.86	20.227	1	185

Average LOS rises from 13.4 days for one GS to 32.1 days for three or more GS.

5.4 DISCUSSION

5.4.1 Basis hypothesis

The purpose of the matching procedure is to find, in classic hospitalization, a group of patient for whom the hospitalization could have been partially or totally avoided. To select such patients, we applied a sequence of limitations to exclude patients for whom hospitalization was necessary. The people we are interested therefore consists of patients whose state of health allows for outpatient care and whose admission to hospital has done to diagnosis. To illustrate this last assertion, we have to look for the procedures performed during their stay. To be more exhaustive, we chose to analyze billing data, and more particularly the file of the medical benefits, in term of nomenclature INAMI / RIZIV.

In the ***appendix 11 to 13 of chapter 5***, we shall find the number and the proportion of procedures grouped into chapters of the nomenclature. From the 8 192 monopathologic patients, we find 7 coupled records in the billing file. For the 3 916 polypathologic patients, we find 3 745 coupled records and for the 430 geriatric syndromes patients, we obtain 406 coupled records.

In all three situation, the majority of the benefits concern intellectual and medical-technical procedures (clinical biology and medical imaging).

In monopathological situation (see ***appendix 11***), 4 345 patients are concerned by cardiological examinations, 1 407 by gastroenterological examinations and 751 by pneumological examinations. The list of benefits is also given in ***appendix 11***. 873 resuscitation procedures are also found. That concerns essentially cardiac function monitoring in the SMP group 21, 'Ischemic heart disease'. For 1 218 patients, we found anesthesia procedures.

These acts are performed in fact during technical examinations for gastroenterological pathologies, in nearly 60% of the cases, and for cancer pathologies in 25% of cases. Finally, towards the results of the table, we notice that it lives some surgical procedures in spite of the exclusion of surgical DRGs and ICD-9 operating-room procedures. If we had to elaborate a more finished model, it would be necessary to proceed to a more detailed examination of the cases.

The same remarks can be formulated for polypathologies and for geriatric syndroms (GS) patients. In ***appendix 12*** (polypathologies) and ***13*** (GS), we give the INAMI procedures grouped into chapters. For polypathologies, we tabulate the detailled nomenclature for the cardiology and the neuropsychiatry chapters. Finally, we note for GS, the growing importance of physiotherapy and kinesitherapy procedures.

5.4.2 Limitations

Our results have to be interpreted with the methodological limitations in mind:

5.4.2.1 Study design

It is clear that a prospective randomized control study would be a better approach to select matching patients. As it was not the main purpose of this study, and because of the time schedule to give an answer to the decisions makers, the use of the existing data bases to collect the results, was made. The way of selecting the patient populations seems as quite rigorous and feasible as possible and was validated by a panel of experts during the progression of the survey.

Although the purpose of this study was not a cost-benefit study, looking at the current stage of evidence of GDH, a longitudinal randomized control study with patients undergoing no comprehensive geriatric assessment, would be a better study design. However, in this design many variables as the composition of the ideal team, the ideal tools used for a comprehensive geriatric assessment, the necessary personal means to do this assessment even as the outcome parameters should be defined carefully before starting such a longitudinal study. At the moment it seams to early as most GDH are in the implementing phase due to the recent start of the projects.

Another advantage of this kind of study is the prospective measurement of the time and means necessary to give the care to a geriatric patient visiting the GDH. So a financing model taking into account the profile of the geriatric patient could be developed prospectively.

5.4.2.2 The choice of the population for the matching

As the main objective of the GDH is to prevent hospitalisation the real control group should be the patient at home, cared by a GP. Unfortunately, no database of these patients is available. Therefore, a hospitalised population was selected through the RCM/MKG database on a rigorous way, validated by some experts.

However, the homogeneity of the two populations can be discussed. Indeed, data were collected at two different periods, one in 2003 and the second in 2007. However, these two different periods were express chosen to allow comparisons of the patients without the confounding effect that GDH were already available and therefore inpatients reflect already particular patients, not 'suitable' for day hospitalisation. Finally, there are little differences in the two populations especially for the social description. Age, origin and discharge are not exactly the same, but the geriatric profile is quite homogenous in order with the classification described, mono or polypathologic without or with geriatric syndromes.

Although concerning the law on the GDH, the age limit is 75 years old, the age limit of the patients for the RCM/MKG data base was chosen on a limit of 65 years old. This was done as because in the GDH database 20% of the patients were at least younger than 75 years old.

Moreover, the inclusion of patients was not limited to the Geriatric departments as many patients with geriatric profile are hospitalised on other departments and also can benefit from evaluation and treatment in the GDH.

Of course as physicians not used to treating geriatric patients often miss important diagnosis in the geriatric patients, it is not sure that the patients are coded for all their underlying pathologies. This can explain the finding that the hospitalised patients have a less severe patient profile than patients in the geriatric day hospital.

5.4.2.3 Limitation of the databases

The RCM/MKG database

The DRG are collected for financial reasons and not for epidemiological purposes as they are used in this study to describe and compare patients. However RCM/MKG databases are more and more used for quality purposes and benchmarking, so have reliable data to compare patient populations.

The main problem is that RCM/MKG relies on diagnosis and pathology defined groups and not on geriatric syndromes defined as a group of signs and symptoms corresponding to several pathologies. Although some previous work was done to define geriatric syndromes in terms of RCM/MKG codes and this work was validated during this study by geriatricians, a certain bias in the RCM/MKG related definitions of syndromes could be possible. Moreover as the interpretation of the RCM/MKG codes has been made by physicians and not by people experienced in the coding rules, combinations of codes will probably not always take into account the specific rules of coding. Nevertheless, the method has been approved by experts and can make the bridge between clinical practice and financial system.

The GDH database

The fact that GDH data results from data collection in the context of a pilot project linked with specific financial conditions probably sensitizes the responder to make the collection of data as good as possible. However the registration of some pathologies could be incomplete because these pathologies were not linked with the reason of visiting the day hospital fee the low percentage of patients with arterial hypertension. Another explanation, and probably the main one, could be that the physicians in geriatric day hospital were more focusing on geriatric syndromes and not on pathologies without correlation with the syndrome.

The recent start of the GDH structure implies that we are not sure that the patients for whom data were collected are those for who the structure was created: it is possible that new GDHs, fearing that they may have insufficient activity to justify their existence, have admitted 'inappropriate' patients.

Finally, it is impossible to know if all the patients had been really encountered.

Comparability of databases

Both types of data were not collected with the same goals: the RCM/MKG data are collected routinely and with financial purposes. On one hand, as the second diagnosis define the severity of the patient and thus its financing, a tendency to code as much codes as possible is observed[107, 108]. On the other hand, the GDH data were collected in the context of a one-off data collection for evaluation of the new activities purposes. Moreover, data were coded differently: for the patients reaching GDH service, in the SPF observational study 2006, free text was used to check, either medical problems or geriatric syndromes. In the text, "significant word" has to be chosen. It is subjective and the correspondence of the word depends on the experience of the person who chooses the word.

Both databases collect different information and the features were completed by different types of profession: the RCM/MKG data are encoded by coders, based on the medical file. In addition, the information registered is very exhaustive (see above). At the opposite, GDH data are registered by a questionnaire filled in by the physicians directly.

5.4.3 Discussion of the results

In the matching of the inpatients with the GDH patients there are important differences between the two populations concerning age of the patients, place of stay before admissions and the referring person. The place of stay before admission can be linked to the age of the patient as more people are living in residential care at higher age. It is too early to conclude that residential care is more often referring patients to the day hospital. Therefore figures from RCM/MKG should be compared for 2003 and 2006. A decline in admissions from residential care should be demonstrated before we can draw this conclusion. In the RCM/MKG database the figures for the referring person can be misleading as patients are often admitted through the emergency department and are than in some hospitals registered as being referred by a hospital physician. Another point of attention is that percentages of referral by the general physician for the GDH could be really higher as a consequence of the restriction that the geriatrician needs a referral from the general physician to honour a multidisciplinary consult.

The differences in age are certainly a consequence of the used methodology by selecting patients from the age of 65 years old as described above.

The presence of less geriatric syndromes in the patients with monopathology can be a result of underdiagnosing the geriatric syndromes on departments not used to treat geriatric patients as only a smaller part of these patients are staying at the geriatric department. In non geriatric hospital setting, only the pathology responsible of the hospitalization is referred, patient profile is not often taking into account. However the other outcome parameters as LOS and nursing home placement confirm the difference in this patient population compared with patients with multiple pathologies and geriatric syndromes.

It is clear that in an elderly population the Charlson comorbidity index (CCI) is of no use in defining the health related outcomes of the elderly as LOS and nursing home admission. The CCI can learn only something about the number of pathology related diseases and nothing about the functionality of our elderly patient. Therefore the results of the matching should be interpreted carefully. However there are some interesting findings in matching the patient populations.

Interesting to see is that the population in GDH is more comparable with the population with multiple pathologies and geriatric syndromes than with the population with only one pathology. This suggests the geriatric aspects of the GDH and confirms the results of the FOD study. GDH is a geriatric structure with specific approaches which are not present in the classical hospital setting. Codification of geriatric data is usual and that is the reason why geriatric situation is better described in the GDH than in classical hospitalisation.

Even if these patients have a significant longer length of stayin classic hospitalisation and a significant higher risk of being admitted to a residential care facility after discharge, this population is visiting GDH and cared for in one day hospitalisation. It is too early to draw the conclusion that we can avoid LOS and nursing home admission in those elderly patients but results seems to be promising and further research to confirm these findings in longitudinal studies is necessary. Looking at the patients with the geriatric syndromes who are often treated in revalidation beds (Sp), also these patients can be looked for in GDH. Maybe physicians should consider earlier ambulatory rehabilitation in this kind of patients. Here also further studies are necessary to evaluate these possibilities.

6 FINANCING SYSTEM FOR GERIATRIC DAY HOSPITALS

6.1 INTRODUCTION

The elaboration of a financing system is never a trivial problem and is always multidimensional; the medical sector is certainly not an exception. We have to cover medical needs taking into account technological and budgetary constraints. Patients, medical practitioners and hospital managers are directly concerned with a multidimensional problem characterized by cost, efficacy and equity dimensions.

Cost-effectiveness and cost-utility analysis require an evaluation of effects, positive or negative, of care programs on the evolution of certain criteria measured on the patients. Consequently, these studies must adopt a longitudinal feature which could not be obtained within the annual character of the framework of the present study.

Moreover, during the GDH study, we asked to the day hospitals to estimate their costs. Unfortunately, the answers were not complete enough. It must be remembered that the geriatric day hospitals are relatively new structures in our country. Indeed, 66% of them are less than one year old and many institutions took advantage of the implementation of the experimental project to initiate it. Therefore, a detailed analysis of costs could be considered in the future when these structures will have attained an optimal size.

6.1.1 The specificities of the new financing system of day hospitals and of the geriatric activities

To build a funding model, we first observed how were financed other day hospitals. In the new National Agreement between hospitals and health insurers (HOP / 2007), a day hospital package (groups 1 to 7) is established as a replacement of mini and maxi packages, as well as packages call A, B, C and D. Following a survey with 95 hospitals, the real cost of services was calculated on 7 sections:

1. overheads and administrative costs;
2. patient comfort (bedding and laundry);
3. maintenance and heating;
4. nursing working time (preparation, arrangement of the room, time dedicated to the patient during the preparation, during the intervention and during the postcure);
5. the cost of the common material for anesthesia (for all the types of anesthesia);
6. the costs of the place of service, recovery room and patient room (common small material both single-use and resterilisable);
7. drinks and food.

Amounts cover, in an inclusive way, expenses resulting from the stay of the beneficiary and from caregiving for a series of procedures, the list of which appears in the Agreement. In the next table, we give the amounts of the seven packages.

Table 49: New categories of amounts used in day hospital in Belgium since 2007

Sections	Amounts
1	140 €
2	171 €
3	247 €
4	176 €
5	183 €
6	218 €
7	180 €

The analysis of this agreement shows that the methodology used is not completely and immediately transposable to the geriatric day issue. Indeed, geriatric activity is not, at present, codified in the nomenclature. The essential activity of the geriatric day hospital is a global coverage of the patient by a multidisciplinary team, especially in a purpose of diagnosis but also, to a lesser extent, of revalidation. Moreover, there is no complete consensus concerning the way to evaluate and measure the geriatric profiles and concerning the medical acts to activate. As example, in the GDH study, we found 38 different scales for cognitive assessment, 11 for walking assessment and 6 for functional assessment.

A certain level of standardization of the geriatric activities is a prerequisite for a cost analysis in GDH corresponding to the scheme used for day hospital. Such a progressive process could take a long time but cannot be excluded a priori to complete our analysis.

Day hospital and geriatric day hospital activities are sufficiently specific to be financed in a specific way. Nevertheless, these specificities do not exclude a common base which should be examined In the future.

We have chosen to use an existing funding basis, the financial resources budget of hospitals (Royal Decree of 04/25/2002) to explore the possibility of a structural financing system for the geriatric day hospital.

The hospital budget is composed by three kinds of funding:

1. Financial Resources Budget (price of the day-maintenance): 45% to 50% of total budget;
2. Medical fees-for-service: 40% to 50% of total budget;
3. Drugs, prosthesis and implants: 10% to 15% of total budget.

The direct costs represent all the spending directly attributable to the implementation and to the functioning of the day hospital (investment in buildings and in medical equipments, fees, salaries, drugs).

We can distinguish, on one hand, the variable costs, which are a function of the volume of the medical services (ex: single-use material and drugs) and, on the other hand, the fixed costs, which do not vary according to this volume, of least in the short term (ex: cooking, laundry). These costs can be classified according to the plan usually used in the definition of the Financial Resources Budget of the hospitals. The most important part (80%) is the part known as B covering operating costs which is divided in two sub-parts, B1 and B2.

Contrary to the other parts of the day price, based on fee-for-services or packages, the budget B1-B2 is distributed according to the structural characteristics, to the activity, the functions and the performances of the hospitals established on the basis of comparison with similar institutions. At this level the Lawmakers introduce the notion of justified activity according to case-mix (number and type of admissions) and national standardised length of stay by group of pathologies (APR-DRG).

Let us remind the reader that B2 is allocated to hospitals by the way of a fixed part (80%), distributed by twelfths on a fixed date, and a variable part (20%) paid per admission and per day of hospitalization. Admission and per diem fees are paid to hospitals based on invoices for every admission and day of stay in classic hospitalization and in case of admission in surgical day hospitalization at the time of which a service is carried out appearing in point 9 of the appendix 3 of the Royal Decree of 04/25/2002.

6.1.2 Current sources of financing of the GDH

The financing of the geriatric day hospital is currently based on lump sum linked to the B1, a lump-sum linked to the B2 and diverse fee-for-service.

6.1.2.1 Pilot project relating to the granting of a financial resources budget for the common services of the geriatric day hospital

A first source of financing, linked to sub-part B1, is a lump sum of ***121,312.96 €*** that is intended to cover the expenses of the common services. These services are defined by the article 12 of the Royal Decree of 04/25/2002.

The calculation, based on the sub-part B1 of licensed beds, breaks down in the following way:

Table 50: Amount of B1 per bed in isolated and non-isolated hospitals

	Amounts	No of beds	Amount / bed		No of G beds
Total B1 for isolated hospitals	8 917 643,21	552	16 155,15	(by G bed)	552
Total B1 for non-isolated hospitals	1 085 575 882,10	48,989	22 159,58	(by acute bed)	6 123
					6 675

B1 mean value = (16 155,15 X 552) + (22 159,58 X 6 123) / 6 675 G beds = **21 663,03 €**

Given the budget allocated for each GDH and the calculated B1 mean value, we can suppose that 70 % of the B1 was taken as base to determine the budget per hospital.

Hypothesis:

- 70% of B1: **15 164,12 €** by bed
- Namely 15 164,12 € X **8** beds = **121 312,96 €**

6.1.2.2 Pilot project aiming at the creation of the geriatric day hospital function within the framework of the geriatric care program

These second source of financing, linked to sub-part B2, foresees the payment of an annual ***137,643-€*** lump sum to finance 2 FTE of nursing staff and 1 paramedical FTE.

6.1.2.3 Fee-for-services

Currently, according to the results of the GDH study, we notice that the essential source of fees consists of the tarification of consultations and for fixed prices (mini, maxi).

If we want to keep an adequacy with the current legislation concerning the basic conditions for the billing of the available fixed prices in surgical and medical day hospital, we can be afraid that their use establishes confusion between the missions of these structures with regard to those of the geriatric day hospital. Some packages rather reflect medical, even surgical, day hospital activity, which should perhaps not have a place in GDH. In any case, it is necessary that the question is asked.

Nevertheless, this method of funding could be used to finance the geriatrician in the geriatric day hospital. In particular, we can find the following fee-for-service: "multidisciplinary geriatric assessment with report by the specialist in geriatrics (102233)"

This service must be prescribed by the general practitioner and is executed by the specialist in geriatrics, in the polyclinic section of the geriatric unit with the participation of the geriatric nursing staff and\or paramedical geriatric team and includes a physical, psychic and social functional evaluation of the patient of more than 75 years old, by means of validated functional tests.

6.1.3 Proposal for a system of funding of the geriatric day hospital

One of the assumptions of this study was to show that a large number of the geriatric patients for whom an assessment is required, is, at this moment, in classical hospitalization. We cannot exclude that a proportion of these patients are living at home or are resident of a nursing home. The quantitative evaluation of this part of patients could be realized in a future study. So we could expect the same phenomenon that when creating day hospitalization, both surgical and medical. Indeed, since the implementation of these structures, we can calculate a shift rate between classical hospitalization and one-day clinics.

It is intuitively easy to notice the utility that the decrease in days of hospitalization can bring. In geriatric day hospitalization, to the advantage of the decrease of the length of stay, we have to add that avoiding the hospitalization of an old patient represents a benefit in terms of decrease of the risk of frailty and particularly of iatrogenic.

6.2 METHODOLOGY OF FINANCING MODELS FOR GERIATRIC DAY HOSPITALS

6.2.1 Design

To build the model of financing, we are going to implement 3 components:

1. Fee-for-services: this constituent will only occur for the financing of the geriatrician
2. Fee-per-admission: the value of this package is obtained through the B2 of the hospitals.
3. Fee-per-pathology: the value of this package is calculated by multiplying two terms:
    - Fee-per-diem: the value is also obtained through the B2 of the hospitals
    - Length of stay (LOS): it is by this factor that we introduce a pathology-linked constituent into the model.

The fee-per-admission and fee-per-diem components are estimated by two methods:

- Standard value: a national standard value is applied to all the hospitals
- Hospital-specific value: we use the specific value of fees for each hospital

Finally, with all these components we constructed two kinds of models:

- A simplified model which used only standard values for fees and patients volume
- A complete model which used the real case mix of each hospital with:
    - standard values for fees (standard model), or
    - Specific values for fees (hospital-specific model)

6.2.2 Components of funding

In the different financing models presented hereafter, we will define a system by capitation combined with a fee-for-service system. We divide the sources of financing into three parts: a fee-for-service part, a, admission fee and a fee by pathology

6.2.2.1 Reasons to use the B2

The B1-B2 budget is distributed according to the structural characteristics, to the activity, the functions and the performances of the institutions established on base of comparison with similar hospitals. The subsection B1 concerns overheads, maintenance, heating, administrative expenses, laundry and food supplies. The subsection B2 is relate to the costs of the clinical services, such as the expenses of the nursing and nursing staff, the medical products and the expenses of reeducation and rehabilitation relative to the patients hospitalized in certain services. The notion of justified beds is used in the calculation of these subsections. These justified activity is evaluated on the basis of the data registered in the Minimum Clinical Summary (RCM). This mode of financing allows a best distribution of hospitals budgets reflecting more exactly the real financial needs of the establishments. The most direct means to introduce this notion of performance into our model is to replace B1, at present used in the pilot project, by the subsection B2. We thus chose to resume the same system of packages which are used during the admission in classic hospitalization as well as during certain day hospitalizations, namely the admission package (pseudocode 768003) and the day package (pseudocode 768025).

6.2.2.2 Fee-for-services (code 102233):

- Multidisciplinary geriatric assessment (code 102233):

  This fee (90.88 €) could be invoiced for each admission to the geriatric day hospital.

- Consultation of the specialist in internal medicine (code 102550):

  This honorary (32,31 €) could be used at every discharge of the geriatric day hospital for the patients who require several days of treatment or evaluation to resolve the problem having justified the admission.

This multidisciplinary geriatric assessment is only proposed to cover the remuneration of the geriatrician attached to the day hospital. On base of an annual gross salary, included employer's social security contributions, of 99,372.46 € (6 years of experience), and with 90.88 € by assessment, 1,093 new admissions a year would be necessary to assure the totality of the geriatrician's remuneration. With a mean value, observed in the GDH study, of 240 admissions a year, we found:

240 * 90.88 € = 21,811 € = 0.22 FTE

Finally, with 6 admissions per day (Belgian Geriatric College proposal), during 250 working days (1560 patients per year), we found:

1,560 * 90.88 € = 141,772.8 €, thus 1.43 FTE.
The results of this simple calculus should be confronted with the actual potential supply of geriatricians in Belgium.

6.2.2.3 Admission fee (pseudocode 768003):

This fee would be perceived for each admission in geriatric day hospital. It corresponds to admission fee used in classic hospitalization in the acute hospitals. This package does not depend on the pathology but is specific to the hospital institution.

6.2.2.4 Fee by pathology (pseudocode 768025):

The basic amount of this package corresponds to the per diem fee used in classic hospitalization. As the package by admission, it is specific to the hospital and does not depend on the pathology.

The pathology-related dimension is obtained by multiplying this package by the length of stay. We considered that this length of stay was a function of the gravity of the case which we can dread by the type of pathology, the age of the patient and the associated geriatric syndromes.

Thus, total amount of the fee by pathology will be calculated by multiplying the basic amount, specific to each hospital, by the average number of days when a similar patient stays in classic hospitalization.

6.3 RESULTS

6.3.1 Estimation of the maintenance day fees

Two different sources could be used to estimate admission and per diem fees: the national data from the INAMI/RIZIV and the RCM/MKG data.

For this study we used the 2003 data as explained in the chapter 4.

For the consistency of forthcoming financial computations, we used RCM/MKG-FY2003 values because we have all of the invoicing to the patients health insurance organisation.

The national data of INAMI are presented like verification of plausibility.

6.3.1.1 *Admission fee:*

INAMI data

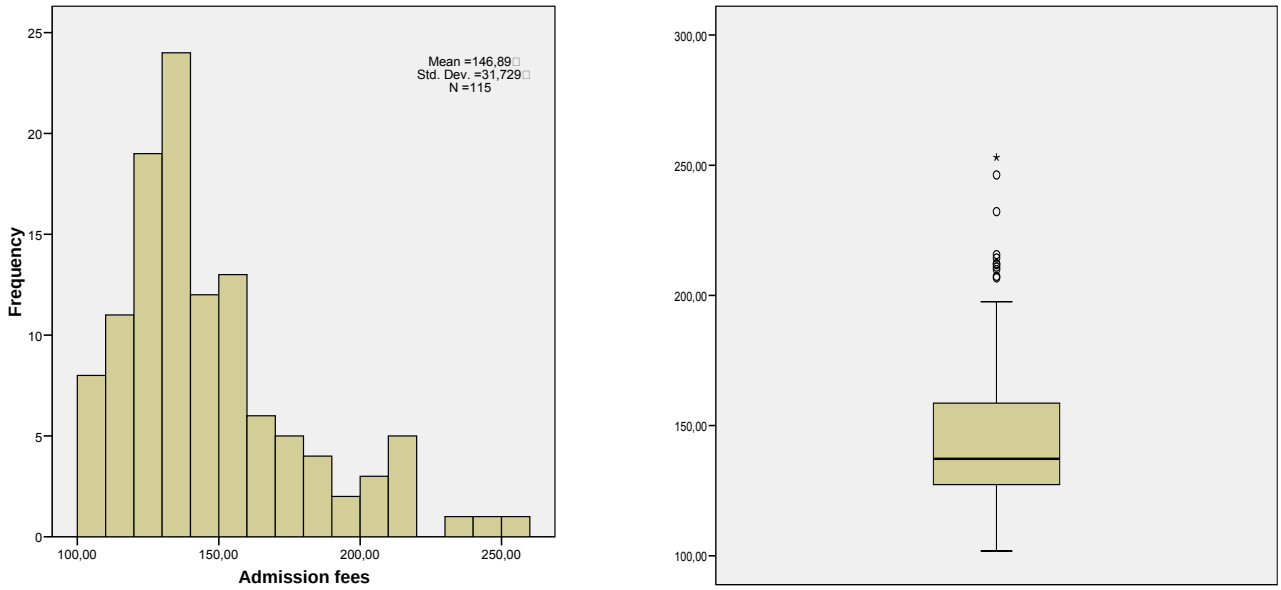
By analogy with the existing situation for classic hospitalization, we can bill this for each admission. The amount is specific to every hospitals. It is provided by the National Institute of insurance disease-incapacity (INAMI/RIZI)) that gives the list of this admission fees for each acute hospital in Belgium[d].

Using these national data, , we notice in the table below that admission fee can vary of about 102 € to 253 € depending on the hospital.

Table 51: National admission fee descriptive statistics

Number of acute hospitals		115
Mean		146.9
Median		137.2
5% Trimmed Mean		144.6
Huber's M-Estimator		140.3
Tukey's Biweight		136.9
Std. Deviation		31.7
CV		21.6%
Minimum		101.8
Maximum		253.0
Percentiles	5	107.7
	10	114.1
	25	126.6
	50	137.2
	75	159.2
	90	201.2
	95	212.7

Figure 15: National admission fee values – histogram and box plot



[d] http://www.riziv.fgov.be/care/fr/hospitals/specific-information/prices-day/xls/prices20080701.xls

RCM/MKG-FY2003 study data

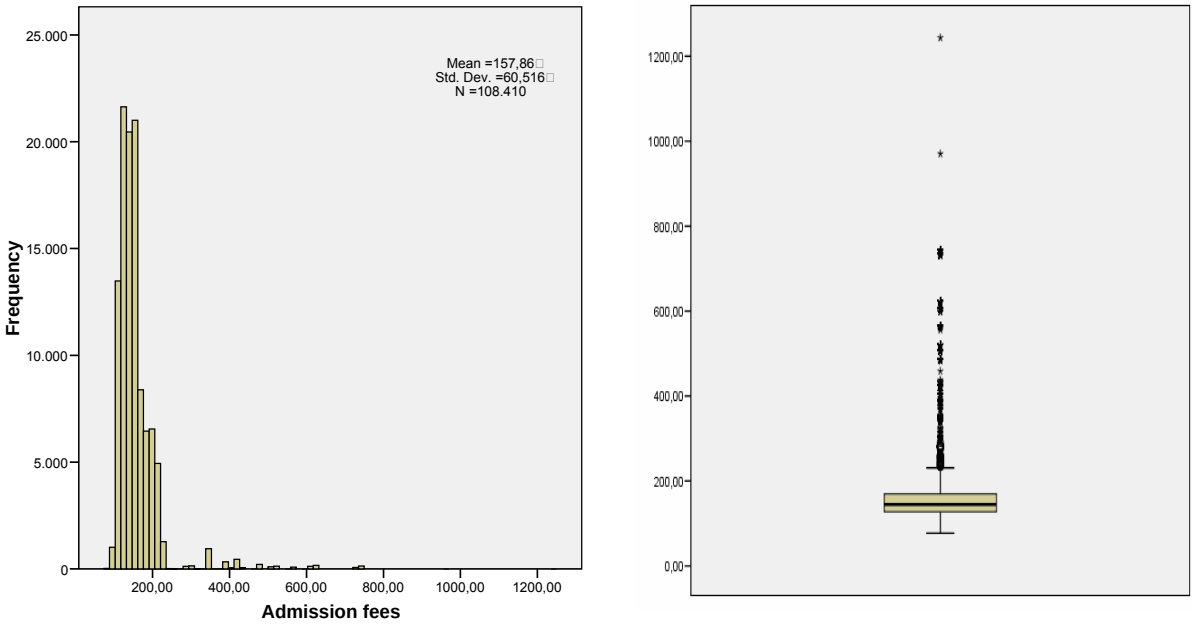
The second source of estimation of the admission fee results from the RFM/MFG (Registration of Minimal Financial Data) file containing the data of days of maintenance by patient. This file is a part of the RCM/MKG-FY2003 database. The package of admission (nomenclature code 768003) gives the following results:

Table 52: RCM/MKG-FY2003 admission fee descriptive statistics

Number of patients		108,410
Mean		157.9
Median		144.6
5% Trimmed Mean		150.1
Huber's M-Estimator		146.2
Tukey's Biweight		143.4
Std. Deviation		60.5
CV		38.3%
Minimum		77.0
Maximum		1243.5
Percentiles	1	105.0
	2.5	107.9
	5	111.1
	10	114.8
	25	127.6
	50	144.6
	75	169.5
	90	198.0
	95	218.4
	97.5	346.2
	99	431.0

This source of data gives values going from 77 to 1 243 €. The very important dispersion of values results from the use of billing data which do not take the mutual insurance scheme of patients into account.

Figure 16: INAMI data - admission fee values - histogram and box plot



Using this data, we observe a slightly more important mean than in the Table 51. The Huber's robust mean, on the other hand, shows a value similar to the average calculated on 115 hospitals.

Therefore, by minimizing the importance of the extreme values both in low and high values, we find again the national values communicated by the INAMI.

We can also merge this file with the RCM/MKG file. In this case, to every patient admitted, we attribute the amount of the code 768003 having been charged. The overall average remains of course unchanged, for against, we can now estimate the average fees per hospital.

Appendix 1 shows the number of admissions in 125 hospitals of the RCM/MKG file. The mean admission fees vary from 97,3 € to 736 €, the intra-hospital coefficient of variation varies from 0 to 23%.

In table below, the analysis of variance confirms the importance of the hospital effect on admission package value. To take into account the non-Gaussian character of the variable, the test was made on the logarithmic conversion.

Table 53: RCM/MKG-FY2003 admission fee - ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1382.9	124	11.152	29030.0	.000
Within Groups	41.6	108285	.000		
Total	1424.5	108409			

As we indicated before, the very important variation for the inter-hospital level is due to the mode of calculation which depends on B2 of the hospital. On the other hand, the intra-hospital variation depends on the fact that we are in the presence of yearly data while B2 is recalculated twice a year. Furthermore, these are data of invoicing to the patients and thus the amounts can vary depending on of the health insurance coverage of the patients.

6.3.1.2 Per diem fees

INAMI data

In the amount of the day-maintenance costs, we find the second package (code nomenclature 768025), which is calculated, not by admission but by day of hospitalization.

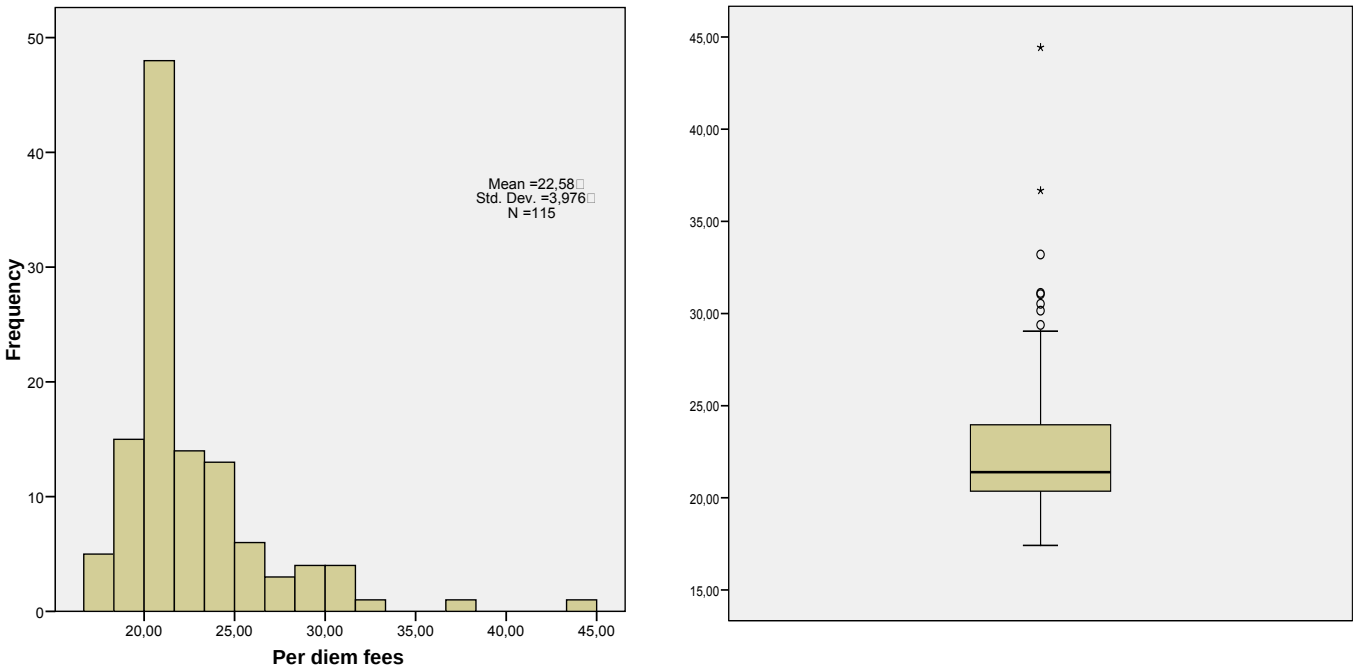
In its report of the 115 acute hospitals, the INAMI gives an average of 22.6 € with a minimum of 17.4 € and a maximum of 44.4 €.

It can also be seen as a CV of 17.6%, the values of this package are less dispersed than the values of admission packages.

Table 54: National per diem fee descriptive statistics

Number of hospitals		115
Mean		22.6
Median		21.4
5% Trimmed Mean		22.2
Huber's M-Estimator		21.6
Tukey's Biweight		21.2
Std. Deviation		4.0
CV		17.6%
Minimum		17.4
Maximum		44.4
Percentiles	5	18.4
	10	19.4
	25	20.4
	50	21.4
	75	24.0
	90	27.9
	95	30.6

Figure 17: RCM/MKG-FY2003 per diem fee values - histogram and box plot



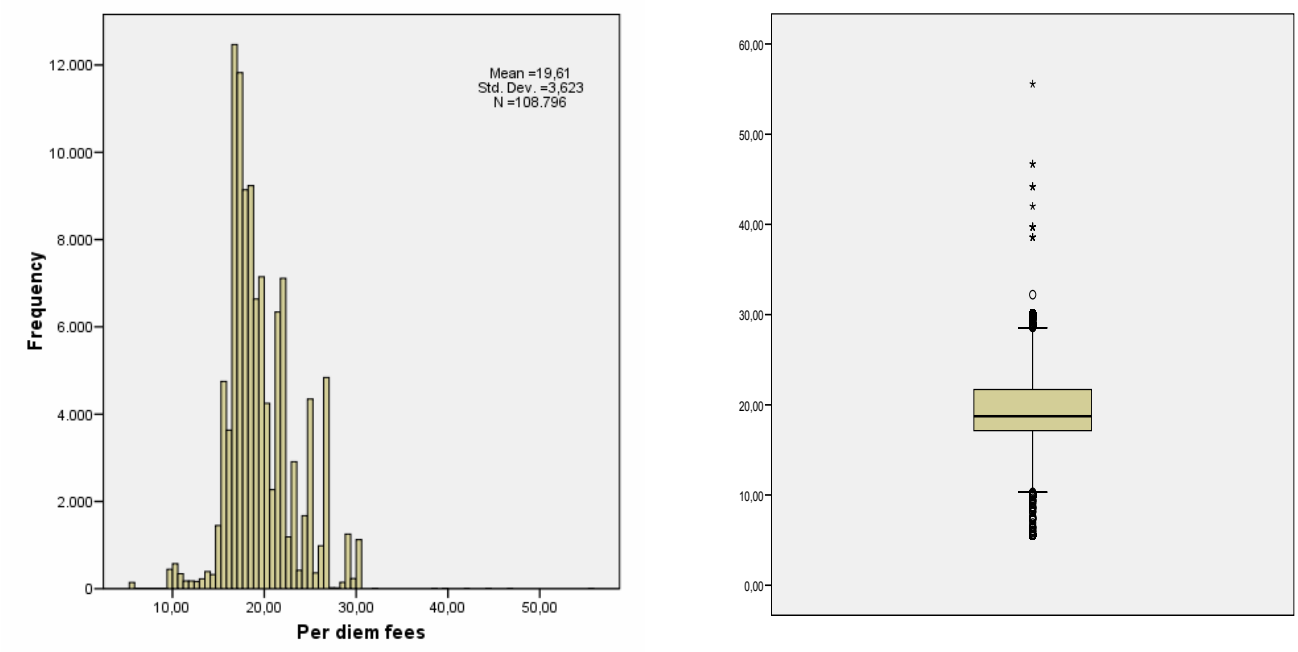
RCM/MKG-FY2003 study data

The data in the RMF file from RCM/MKG-FY2003 database gives an average of € 19.6, slightly below the national data.

Table 55: RCM/MKG-FY2003 per diem fee descriptive statistics

Number of patients		108,796
Mean		19.6
Median		18.7
5% Trimmed Mean		19.5
Huber's M-Estimator		19.0
Tukey's Biweight		18.7
Std. Deviation		3.6
CV		18.5%
Minimum		5.6
Maximum		55.6
Percentiles	1	10.4
	2.5	14.3
	5	15.5
	10	16.2
	25	17.1
	50	18.7
	75	21.7
	90	25.2
	95	26.7
	97.5	28.3
	99	30.0

Figure 18: RCM/MKG-FY2003 per diem fee values - histogram and box plot



Appendix II shows, for the 125 hospitals of the RCM/MKG-FY2003 file, the number of admissions and the descriptive statistics of the per diem fee.

The following analysis of variance confirms the importance of the hospital effect on day-package value.

Table 56: RCM/MKG-FY2003 per diem fee - ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1350649.4	124	10892.3	15340.3	0.000
Within Groups	77158.5	108667	0.710		
Total	1427807.9	108791			

As the admission fee, the per diem fee is also calculated from B2, it thus varies strongly from a hospital to another. Likewise for the intra-hospital variation, the same remark, as before, applies.

Finally, restrained values are 146.2 € corresponding to Huber's M-Estimator for the admission fee and 19.6 € that is the arithmetic mean of the per diem admission fee.

6.3.2 Modelisations

6.3.2.1 Simplified model

It is possible to estimate a first simple financing model applying the three parts of the funding on the average number of patients registered in GDH during three months of the SPF study. This number is extrapolated to a number of admissions per year

Table 57: number of patients admitted by year in GDH

Number of GDH		45
Mean		240.5
Median		168
5% Trimmed Mean		206.8
Huber's M-Estimator		185.9
Tukey's Biweight		173.1
Std. Deviation		245.7
Minimum		36
Maximum		1408
Percentiles	5	40
	10	44
	25	88
	50	168
	75	306
	90	463.2
	95	763.2

Figure 19: Number of patients admitted by year in GDH

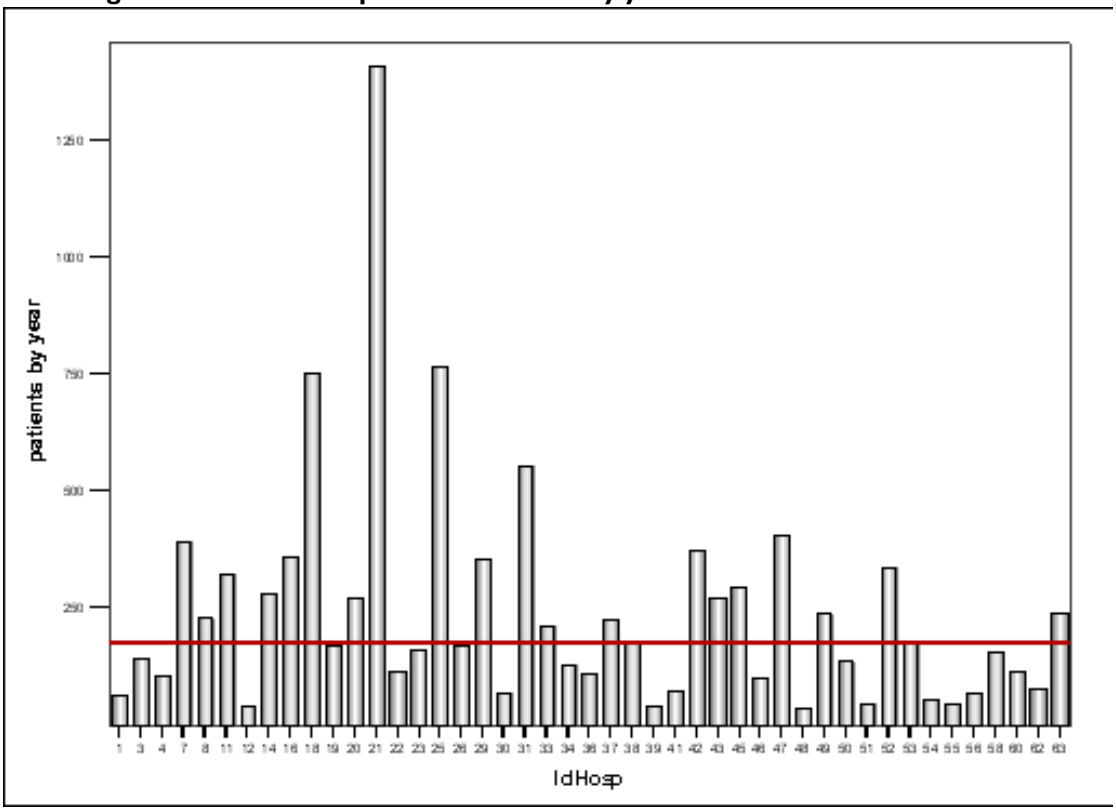


Table 58: GDH simplified financing model

	No. patients	Amount per unit (in €)	Average length of stay (in €)		Total amount (in €)
	A	B	C	Formula	
Admission fee	240	146.2		A * B	35,088
Per diem fee	240	19.6	4.64	A * B * C	21,827
				Total	**56,915**

This simplified model, that excludes case mix profiles, estimates at 56,915 € the funding by GDH per year.

6.3.2.2 *Model based on B2 and hospital's case mix*

Introduction

We saw previously that the influence of the hospital on the amount of admission fee and per diem fee was clearly identifiable. This link is a direct consequence of the definition of the day-care maintenance. We can measure if these amounts are related to hospital case mix that is to the distribution of the various pathologies.

ADMISSION FEES (768003)

Table 59: ANOVA of admission fee amount with case mix and hospital effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model[a]	54.&	1896	.029	83.6	.000
Intercept	4228.6	1	4228.6	12397800.5	.000
IdSet	**.017**	**45**	**.000**	**1.110**	**.284**
IdHosp	23.7	119	.199	583.66	.000
IdSet * idhosp	.619	1732	.000	1.047	.116

Error	1.906	5587	.000		
Total	35256.7	7484			
Corrected Total	56.0	7483			

The Table 59 shows a one-way ANOVA to test for differences among two factors: (i) the SMP group (IdSet) and (ii) the hospital (IdHosp). The model tests also if there is an interaction between the two factors (idset*idhosp). We see that there is only a hospital effect and thus that the admission fee does not vary according to pathology. To take into account the non-Gaussian character of the variable, the test was made on the logarithmic transformation.

Standard model

In this model we apply a standard admission fee of 146.2 € (cf. Table 52)

Hospital-specific model

In this model, we shall use, not a standard average admission fee, but the specific hospital fee. It is obvious that even if the results for all the hospitals remain unchanged, individually for each institution, the difference can be important. To do this, we had to ask to remove the anonymization of hospitals with a GDH. From the 45 GDH, we keep from this point 42 establishments. The loss of three elements results from two fusions and from a not corresponding identification number.

Table 60 shows, for all the GDH of the SPF study, the number of admissions and the descriptive statistics of the specific admission fees.

Table 60: Admission fee by GDH (n=42)

IdGDH	N	Mean	Median	S.D.	Min.	Max.
1	120	147.34	144.59	3.32	144.59	151.35
3	37	131.42	132.21	1.03	130.12	132.21
4	39	129.02	127.58	1.85	127.58	131.33
7	421	155.31	157.73	2.51	152.77	161.80
8	50	109.93	108.97	1.56	108.97	112.41
11	121	151.18	149.81	1.41	149.81	152.61
12	80	133.70	136.54	4.78	104.25	136.54
14	25	155.17	161.59	9.55	141.54	161.59
16	16	137.35	138.96	1.89	135.27	138.96
18	187	192.87	191.63	1.63	188.87	194.86
19	13	123.22	123.67	1.15	119.94	123.67
20	34	117.00	115.39	2.07	115.39	119.59
21	75	157.43	156.98	0.55	156.17	158.05
22	20	96.66	96.02	1.32	96.02	99.23
23	30	123.17	122.98	0.27	122.98	123.54
25	8	190.07	196.8	9.30	178.84	196.80
26	31	203.87	205.31	2.28	200.36	205.31
29	68	174.94	176.59	1.97	169.40	176.59
30	57	162.44	160.65	1.91	160.65	165.79
31	28	141.71	141.55	0.26	140.98	141.98
33	24	111.46	112.1	0.93	110.17	112.10
34	10	170.63	174.41	4.87	164.97	174.41
36	90	142.40	143.34	0.99	140.04	143.34
37	46	135.72	141.19	6.31	128.61	141.19
38	63	180.76	169.45	22.17	169.45	338.90
39	67	131.55	135.02	4.40	124.69	135.02
41	19	143.79	143.19	0.72	143.19	144.61
42	170	138.45	139.91	1.90	133.45	139.91

IdGDH	N	Mean	Median	S.D.	Min.	Max.
43	138	138.58	135.82	5.61	103.70	143.23
45	154	113.51	113.31	0.29	112.30	113.89
46	100	123.32	120.47	3.11	120.47	126.79
47	32	119.12	121.26	2.80	115.56	121.26
49	222	155.96	157.79	10.80	151.98	303.96
50	47	135.53	133.99	1.73	133.99	137.44
51	44	126.30	127.12	4.57	96.70	127.12
52	210	192.28	195.13	3.09	188.95	195.13
53	9	116.93	114.47	2.91	114.47	120.00
54	18	347.43	346.16	1.64	346.16	349.42
58	114	111.64	113.53	2.00	109.40	113.53
60	27	126.28	128.23	2.59	122.97	128.23
62	247	188.24	164.03	26.85	164.03	217.90
63	48	141.61	139.86	2.05	137.83	143.68
Total	**3359**	**6225.27**	**6215.33**	**162.93**	**5977.58**	**6655.27**
Mean	**80**	**148.22**	**147.98**	**3.88**	**142.32**	**158.46**

IdGDH: GDHs anonymous identification number
N: number of admission
Mean: mean admission fees
Median: median admission fees
SD: standard deviation of admission fees
CV: coefficient of variation
Min: admission fee minimal value
Max: admission fee maximal value

PER DIEM FEES (768025)

Table 61: Per diem fee by GDH

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model[a]	80181	1894	42.33	48.00	0.0000
Intercept	319167	1	319167	361859	0.0000
IdSet	**27**	**45**	**0.59**	**0.67**	**0.9534**
IdHosp	27625	119	232.1	263.19	0.0000
IdSet * IdHosp	1342	1730	0.78	0.88	0.9994
Error	4934	5594	0.88		
Total	3105288	7489			
Corrected Total	85115	7488			

Like for admission fee, per diem fee depends only on hospital effect. Here also, there is no case mix effect detectable.

Standard model

The amount retained for the per diem fee is 19.6 € (cf. Table 52)

Hospital-specific model

Table 62 shows, as for admission fees, for all the GDH of the SPF study, the number of admission and the descriptive statistics of the per diem fee.

Table 62: Per diem fee by GDH (n=42)

IdGDH	N	Mean	Median	S.D.	Min.	Max.
1	120	17.47	17.74	0.34	16.87	17.74
3	37	17.80	17.96	0.22	17.50	17.96
4	39	17.65	17.85	0.26	17.33	17.85
7	421	22.75	22.41	0.46	21.99	26.43
8	50	18.54	18.52	0.03	18.52	18.59
11	121	19.13	18.93	0.20	18.93	19.33
12	80	18.41	18.63	0.53	14.22	18.63
14	25	15.49	15.52	0.04	15.43	15.52
16	16	17.24	17.46	0.26	16.95	17.46
18	189	21.21	20.85	0.46	20.73	23.17
19	12	17.25	17.06	0.46	17.06	18.54
20	34	18.35	17.93	0.54	17.93	19.02
21	76	19.16	19.49	0.38	18.63	19.49
22	20	16.45	16.30	0.30	16.30	17.04
23	30	17.56	17.40	0.21	17.40	17.84
25	8	24.03	25.15	1.55	22.15	25.15
26	31	17.98	18.22	0.38	17.39	18.22
29	68	24.53	24.88	0.41	23.68	24.88
30	57	24.22	23.64	0.81	23.64	28.78
31	28	22.27	22.37	0.12	22.03	22.37
33	24	18.32	18.36	0.05	18.25	18.36
34	10	18.70	18.84	0.18	18.49	18.84
36	90	19.05	19.13	0.08	18.83	19.13
37	46	17.55	18.10	0.66	16.77	18.10
38	63	18.35	18.51	0.17	18.17	18.51
39	67	20.41	21.14	0.93	19.18	21.14
41	19	19.65	19.38	0.32	19.38	20.01
42	169	20.78	21.19	0.52	19.74	21.19
43	138	20.78	20.55	0.71	15.69	21.25
45	155	17.16	17.39	0.31	16.70	17.39
46	100	16.00	15.67	0.36	15.67	16.40
47	32	16.40	16.77	0.48	15.79	16.77
49	222	21.81	22.21	0.47	21.31	23.86
50	46	18.73	18.34	0.41	18.34	19.16
51	44	14.53	14.83	0.68	10.72	14.83
52	213	25.94	26.65	0.78	25.08	26.65
53	9	16.80	16.48	0.38	16.48	17.20
54	17	17.30	16.97	0.41	16.97	17.77
58	114	18.00	18.40	0.42	17.56	18.40
60	27	17.25	17.49	0.31	16.86	17.49
62	247	26.30	23.30	3.36	23.30	30.04
63	48	17.87	17.15	0.78	16.90	18.68
Total	**3362**	**805.17**	**805.16**	**20.75**	**770.84**	**835.18**
Mean	**80**	**19.17**	**19.17**	**0.49**	**18.35**	**19.89**

IdGDH: GDHs anonymous identification number
N: number of admission
Mean: mean admission fees
Median: median admission fees
SD: standard deviation of admission fees
CV: coefficient of variation
Min: admission fee minimal value
Max: admission fee maximal value

LENGTH OF STAY

We see above that admission and per diem fees are only hospital-dependent. It is clear that the case mix does not influence package amounts. If we consider the application of a per diem amount, it is necessary to verify in which measure the case mix modifies the length of stay distribution.

In the following analysis of variance, it appears that not only the length of stay is affected by the disease, but also by the hospital. Moreover, the highly significant interaction between the case mix and the establishment indicates that the distribution of pathologies among hospitals is not at random. To take into account the non-Gaussian character of the variable, the test was made on the logarithmic transformation.

Table 63: ANOVA on length of stay by pathologies and hospitals

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model[a]	920.1	2010	.458	5.209	.000
Intercept	305.7	1	305.è	3479	.000
IdSet	122.4	45	2.719	30.95	.000
IdHosp	63.38	132	.480	5.464	.000
IdSet * IdHosp	331.7	1833	.181	2.059	.000
Error	543.1	6181	.088		
Total	3432	8192			
Corrected Total	1463	8191			

The application of these various components will be made through a standard model, using mean values, and a specific model at every geriatric day hospital based on specific fees for each institution.

It should be noted that the component by pathology will be calculated by multiplying the per diem fee (standard or specific to the hospital) by the mean length of stay (LOS) of the patients admitted in classical hospitalization and matched to the patients of the geriatric day hospital. These lengths of stay were calculated taking into account the pathology, the age class and the degree of severity corresponding to the absence or presence of one or more than one geriatric syndrome (cf. ***appendix III***). The vector of length of stay will proceed as a multiplier applied to the fee per day. It is given here as an exercise in the sense that some cells have inadequate size and will be reassessed on a wider population.

6.3.2.3 Differentiated models

Component related to monopathologic patients

To build this model of financing by hospital and by pathology, we successively applied the various components which we defined previously, namely the component related to monopathologic patients, the component related to polypathologic patients and finally that related to the patients admitted only for one or several geriatric syndromes.

We apply the various parts of the financing model proposed on the sample of the patients having been admitted in the GDH quarterly study.

STANDARD MODEL

In the following table, besides the number of patients admitted in GDH (N), we find the components of the financing: (i) the admission fee and (ii) the fee per pathology obtained by multiplication of the per diem fee by the length of stay and by the sample size. The quarterly total is obtained by addition of the three components and finally, an annual amount is calculated.

Table 64: Standard financing model: monopathologic patients component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	5	731	488	1,219	4,876
3	13	1,901	1,364	3,265	13,060
4	10	1,462	3,276	4,738	18,952
7	22	3,216	3,742	6,958	27,832
8	31	4,532	4,598	9,130	36,520
11	53	7,749	10,070	17,819	71,276
12	6	877	2,021	2,898	11,592
14	43	6,287	5,071	11,358	45,432
16	54	7,895	5,815	13,710	54,840
18	6	877	948	1,825	7,300
19	22	3,216	3,464	6,680	26,720
20	38	5,556	2,663	8,219	32,876
21	138	20,176	11,730	31,906	127,624
22	15	2,193	2,406	4,599	18,396
23	20	2,924	3,074	5,998	23,992
25	79	11,550	23,623	35,173	140,692
26	11	1,608	1,271	2,879	11,516
29	14	2,047	2,240	4,287	17,148
30	6	877	729	1,606	6,424
31	26	3,801	2,770	6,571	26,284
33	20	2,924	2,280	5,204	20,816
34	12	1,754	1,728	3,482	13,928
36	8	1,170	2,990	4,160	16,640
37	17	2,485	2,863	5,348	21,392
38	13	1,901	2,534	4,435	17,740
39	3	439	320	759	3,036
41	9	1,316	1,439	2,755	11,020
42	34	4,971	4,412	9,383	37,532
43	18	2,632	3,375	6,007	24,028
45	21	3,070	2,664	5,734	22,936
46	16	2,339	2,121	4,460	17,840
47	59	8,626	8,279	16,905	67,620
49	7	1,023	2,056	3,079	12,316
50	6	877	900	1,777	7,108
51	5	731	715	1,446	5,784
52	34	4,971	6,319	11,290	45,160
53	17	2,485	3,247	5,732	22,928
54	5	731	2,803	3,534	14,136
58	3	439	867	1,306	5,224
60	10	1,462	3,885	5,347	21,388
62	4	585	807	1,392	5,568
63	45	6,579	10,602	17,181	68,724
Total	**978**	**142,984**	**158,566**	**301,554**	**1,206,216**
Mean	**23**	**3,404**	**3,775**	**7,180**	**28,719**

IdGDH: GDHs anonymous identification number
N: number of admissions in GDH
Quarterly Total: ∑(i; ii) (€)
Admission fee (i): N * 146.2 (€)
Fee per pathology (ii): LOS * 19.6 (€)
Annual amount: Quarterly Total * 4 (€)

HOSPITAL-SPECIFIC MODEL

Table 65: Hospital-specific financing model: monopathologic patients component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	5	737	435	1,172	4,688
3	13	1,708	1,239	2,947	11,788
4	10	1,290	2,950	4,240	16,960
7	22	3,417	4,344	7,761	31,044
8	31	3,408	4,349	7,757	31,028
11	53	8,012	9,826	17,838	71,352
12	6	802	1,898	2,700	10,800
14	43	6,673	4,009	10,682	42,728
16	54	7,417	5,114	12,531	50,124
18	6	1,157	1,026	2,183	8,732
19	22	2,711	3,048	5,759	23,036
20	38	4,446	2,493	6,939	27,756
21	138	21,725	11,469	33,194	132,776
22	15	1,450	2,019	3,469	13,876
23	20	2,463	2,754	5,217	20,868
25	79	15,015	28,956	43,971	175,884
26	11	2,243	1,166	3,409	13,636
29	14	2,449	2,804	5,253	21,012
30	6	975	901	1,876	7,504
31	26	3,685	3,147	6,832	27,328
33	20	2,229	2,131	4,360	17,440
34	12	2,048	1,649	3,697	14,788
36	8	1,139	2,906	4,045	16,180
37	17	2,307	2,563	4,870	19,480
38	13	2,350	2,372	4,722	18,888
39	3	395	333	728	2,912
41	9	1,294	1,442	2,736	10,944
42	34	4,707	4,678	9,385	37,540
43	18	2,494	3,579	6,073	24,292
45	21	2,384	2,333	4,717	18,868
46	16	1,973	1,731	3,704	14,816
47	59	7,028	6,929	13,957	55,828
49	7	1,092	2,288	3,380	13,520
50	6	813	860	1,673	6,692
51	5	632	531	1,163	4,652
52	34	6,537	8,364	14,901	59,604
53	17	1,988	2,783	4,771	19,084
54	5	1,737	2,474	4,211	16,844
58	3	335	97	432	1,728
60	10	1,263	763	2,026	8,104
62	4	753	5,213	5,966	23,864
63	45	6,372	736	7,108	28,432
Total	**978**	**143,652**	**150,699**	**294,355**	**1,177,420**
Mean	**23**	**3,420**	**3,588**	**7,008**	**28,034**

IdGDH: GDHs anonymous identification number; N: number of admissions in GDH; Admission fee (i): N * hospital admission fee (€); Fee per pathology (ii): LOS * hospital per diem fee (€); Quarterly Total: ∑(i; ii) (€); Annual amount: Quarterly Total * 4 (€)

Component related to polypathologic patients

After the monopathological patient's component, we introduce the second part attributed to the polypathological patients. They are patients presenting a combination of two or more specific medical problems (SMP). The complexity of the pathological profiles of these patients does not allow, given the number of cases observed, separating them by categories of age and according to the presence of geriatric syndromes associated. To estimate the length of stay (LOS) which takes place in the calculation of the fee by pathology, we just calculated the mean value of the number of days billed by category. If, for one of these categories, we do not obtain any matched patient, we define the length of stay as the maximum value of the variable from the different SMP component. The list of the possible combinations of SMP with their lengths of stay can be consulted in the ***appendix IV***. Concerning the size of the cells of the length of stay matrix, the same remark applies as for monopathological cases.

STANDARD MODEL

Table 66: Standard financing model: polypathologic patients component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	1	146	470	616	2,464
4	6	877	2,422	3,299	13,196
7	5	731	837	1,568	6,272
8	17	2,485	4,834	7,319	29,276
11	7	1,023	1,215	2,238	8,952
12	4	585	1,165	1,750	7,000
14	8	1,170	1,696	2,866	11,464
16	5	731	1,919	2,650	10,600
19	3	439	717	1,156	4,624
20	2	292	335	627	2,508
21	9	1,316	1,110	2,426	9,704
22	7	1,023	1,412	2,435	9,740
23	3	439	575	1,014	4,056
25	41	5,994	15,643	21,637	86,548
26	4	585	1,176	1,761	7,044
29	1	146	291	437	1,748
30	1	146	535	681	2,724
31	7	1,023	1,916	2,939	11,756
33	2	292	1,099	1,391	5,564
34	4	585	965	1,550	6,200
36	2	292	749	1,041	4,164
37	4	585	1,326	1,911	7,644
38	7	1,023	1,348	2,371	9,484
41	2	292	838	1,130	4,520
42	6	877	1,833	2,710	10,840
43	1	146	42	188	752
45	10	1,462	2,814	4,276	17,104
46	6	877	1,554	2,431	9,724
47	13	1,901	3,990	5,891	23,564
49	2	292	709	1,001	4,004
50	3	439	642	1,081	4,324
52	23	3,363	7,582	10,945	43,780
53	3	439	1,016	1,455	5,820
54	7	1,023	3,021	4,044	16,176
58	1	146	163	309	1,236
60	17	2,485	6,337	8,822	35,288
62	14	2,047	4,411	6,458	25,832
63	8	1,170	2,439	3,609	14,436
Total	**266**	**38,889**	**81,144**	**120,033**	**480,132**
Mean	**7**	**1,023**	**2,135**	**3,159**	**12,635**

IdGDH: GDHs anonymous identification number; N: number of admissions in GDH; Admission fee (i): N * 146.2 (€); Fee per pathology (ii): LOS * 19.6 (€); Quarterly Total: ∑(i; ii) (€); Annual amount: Quarterly Total * 4 (€).

HOSPITAL-SPECIFIC MODEL

Table 67: Hospital-specific financing model: polypathologic patients component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	1	147	419	566	2,264
4	6	774	2,181	2,955	11,820
7	5	777	971	1,748	6,992
8	17	1,869	4,573	6,442	25,768
11	7	1,058	1,186	2,244	8,976
12	4	535	1,094	1,629	6,516
14	8	1,241	1,340	2,581	10,324
16	5	687	1,688	2,375	9,500
19	3	370	631	1,001	4,004
20	2	234	313	547	2,188
21	9	1,417	1,085	2,502	10,008
22	7	677	1,185	1,862	7,448
23	3	370	515	885	3,540
25	41	7,793	19,174	26,967	107,868
26	4	816	1,079	1,895	7,580
29	1	175	364	539	2,156
30	1	162	661	823	3,292
31	7	992	2,177	3,169	12,676
33	2	223	1,027	1,250	5,000
34	4	683	921	1,604	6,416
36	2	285	728	1,013	4,052
37	4	543	1,188	1,731	6,924
38	7	1,265	1,262	2,527	10,108
41	2	288	840	1,128	4,512
42	6	831	1,944	2,775	11,100
43	1	139	45	184	736
45	10	1,135	2,464	3,599	14,396
46	6	740	1,269	2,009	8,036
47	13	1,549	3,339	4,888	19,552
49	2	312	788	1,100	4,400
50	3	407	613	1,020	4,080
52	23	4,422	10,036	14,458	57,832
53	3	351	871	1,222	4,888
54	7	2,432	2,666	5,098	20,392
58	1	112	150	262	1,048
60	17	2,147	5,577	7,724	30,896
62	14	2,635	5,919	8,554	34,216
63	8	1,133	2,224	3,357	13,428
Total	**266**	**41,721**	**84,507**	**126,233**	**504,932**
Mean	**7**	**1,098**	**2,224**	**3,322**	**13,288**

IdGDH: GDHs anonymous identification number; N: number of admissions in GDH; Admission fee (i): N * hospital admission fee (€); Fee per pathology (ii): LOS * hospital per diem fee (€); Quarterly Total: ∑(i; ii) (€); Annual amount: Quarterly Total * 4 (€)

Components related to geriatric syndromes treatments

This last part of the financing model concerns patients not having been admitted in the geriatric day hospital for a specific medical problem but for care of one or several geriatric syndromes. To estimate the length of stay to be applied in the model, we consider only three groups of patients:

1. those for whom we find only one geriatric syndrome: the mean length of stay (LOS) of this category of patients in classic hospitalization is 12.24 days,
2. those for whom we find two geriatric syndromes: the mean length of stay (LOS) of this category of patients in classic hospitalization is 15.95 days,
3. those for whom we find more than two geriatric syndromes: the mean length of stay (LOS) of this category of patients in classic hospitalization is 29.38 days

STANDARD MODEL

Table 68: Standard financing model: geriatric syndrome component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	7	1,023	1,752	2,775	11,100
3	20	2,924	4,871	7,795	31,180
4	2	292	1,152	1,444	5,776
7	69	10,088	19,106	29,194	116,776
8	5	731	1,200	1,931	7,724
11	19	2,778	4,995	7,773	31,092
14	11	1,608	2,975	4,583	18,332
16	13	1,901	3,527	5,428	21,712
18	180	26,316	52,567	78,883	315,532
19	14	2,047	5,475	7,522	30,088
20	21	3,070	5,111	8,181	32,724
21	7	1,023	1,970	2,993	11,972
22	3	439	1,056	1,495	5,980
23	13	1,901	3,863	5,764	23,056
25	35	5,117	16,179	21,296	85,184
26	25	3,655	6,697	10,352	41,408
29	63	9,211	18,238	27,449	109,796
30	9	1,316	2,159	3,475	13,900
31	83	12,135	20,130	32,265	129,060
33	7	1,023	1,752	2,775	11,100
34	15	2,193	6,241	8,434	33,736
36	13	1,901	5,235	7,136	28,544
37	26	3,801	8,236	12,037	48,148
38	25	3,655	9,267	12,922	51,688
39	4	585	1,032	1,617	6,468
41	5	731	1,200	1,931	7,724
42	36	5,263	9,191	14,454	57,816
43	42	6,140	11,738	17,878	71,512
45	39	5,702	9,574	15,276	61,104
46	1	146	240	386	1,544
47	10	1,462	3,435	4,897	19,588
49	46	6,725	18,482	25,207	100,828
50	22	3,216	5,759	8,975	35,900
51	6	877	2,593	3,470	13,880

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
52	23	3,363	6,217	9,580	38,320
53	15	2,193	4,897	7,090	28,360
54	1	146	576	722	2,888
58	34	4,971	8,157	13,128	52,512
60	1	146	576	722	2,888
62	1	146	240	386	1,544
63	3	439	720	1,159	4,636
Total	**974**	**142,399**	**288,378**	**430,780**	**1,723,120**
Mean	**24**	**3,473**	**7,034**	**10,507**	**42,027**

IdGDH: GDHs anonymous identification number; N: number of admissions in GDH; Admission fee (i): N * 146.2 (€); Fee per pathology (ii): LOS * 19.6 (€); Quarterly Total: ∑(i; ii) (€); Annual amount: Quarterly Total * 4 (€)

HOSPITAL-SPECIFIC MODEL

Table 69: Hospital-specific financing model: geriatric syndrome component (n=42)

IdGDH	N	Admission fee	Fee per pathology	Quarterly Total	Annual amount
1	7	1,031	1,562	2,593	10,372
3	20	2,628	4,423	7,051	28,204
4	2	258	1,037	1,295	5,180
7	69	10,717	22,180	32,897	131,588
8	5	550	1,135	1,685	6,740
11	19	2,872	4,873	7,745	30,980
14	11	1,707	2,352	4,059	16,236
16	13	1,786	3,102	4,888	19,552
18	180	34,717	56,883	91,600	366,400
19	14	1,725	4,818	6,543	26,172
20	21	2,457	4,784	7,241	28,964
21	7	1,102	1,926	3,028	12,112
22	3	290	886	1,176	4,704
23	13	1,601	3,461	5,062	20,248
25	35	6,652	19,831	26,483	105,932
26	25	5,097	6,143	11,240	44,960
29	63	11,022	22,828	33,850	135,400
30	9	1,462	2,668	4,130	16,520
31	83	11,762	22,870	34,632	138,528
33	7	780	1,638	2,418	9,672
34	15	2,560	5,955	8,515	34,060
36	13	1,851	5,088	6,939	27,756
37	26	3,529	7,374	10,903	43,612
38	25	4,519	8,675	13,194	52,776
39	4	526	1,075	1,601	6,404
41	5	719	1,202	1,921	7,684
42	36	4,984	9,745	14,729	58,916
43	42	5,820	12,447	18,267	73,068
45	39	4,427	8,385	12,812	51,248
46	1	123	196	319	1,276
47	10	1,191	2,874	4,065	16,260
49	46	7,174	20,561	27,735	110,940
50	22	2,982	5,504	8,486	33,944
51	6	758	1,923	2,681	10,724
52	23	4,422	8,230	12,652	50,608
53	15	1,754	4,198	5,952	23,808
54	1	347	508	855	3,420
58	34	3,796	7,492	11,288	45,152
60	1	126	507	633	2,532
62	1	188	322	510	2,040
63	3	425	656	1,081	4,324
Total	**974**	**152,438**	**302,317**	**454,754**	**1,819,016**
Mean	**24**	**3,718**	**7,374**	**11,092**	**44,366**

IdGDH: GDHs anonymous identification number; N: number of admissions in GDH; Admission fee (i): N * hospital admission fee (€); Fee per pathology (ii): LOS * hospital per diem fee (€); Quarterly Total: ∑(i; ii) (€); Annual amount: Quarterly Total * 4 (€)

6.3.2.4 *Final models*

In these final models, we present the most complete models. The specific version will constitute our proposal for financing.

STANDARD MODEL

Table 70: Final standard financing model (n=42)

IdGDH	Quarterly size				%	Yearly size	Day size	Annual Amounts		
	nAdm	SMP	GS	Total				SMP	GS	Total
18	205	6	180	186	90.7%	744	3.10	7,300	315,532	322,832
25	197	120	35	155	78.7%	620	2.58	227,240	85,184	312,424
31	138	33	83	116	84.1%	464	1.93	38,040	129,060	167,100
7	98	27	69	96	98.0%	384	1.60	34,104	116,776	150,880
21	352	147	7	154	43.8%	616	2.57	137,328	11,972	149,300
29	91	15	63	78	85.7%	312	1.30	18,896	109,796	128,692
52	84	57	23	80	95.2%	320	1.33	88,940	38,320	127,260
49	60	9	46	55	91.7%	220	0.92	16,320	100,828	117,148
11	82	60	19	79	96.3%	316	1.32	80,228	31,092	111,320
47	101	72	10	82	81.2%	328	1.37	91,184	19,588	110,772
42	94	40	36	76	80.9%	304	1.27	48,372	57,816	106,188
45	73	31	39	70	95.9%	280	1.17	40,040	61,104	101,144
43	68	19	42	61	89.7%	244	1.02	24,780	71,512	96,292
63	59	53	3	56	94.9%	224	0.93	83,160	4,636	87,796
16	96	59	13	72	75.0%	288	1.20	65,440	21,712	87,152
38	45	20	25	45	100.0%	180	0.75	27,224	51,688	78,912
37	56	21	26	47	83.9%	188	0.78	29,036	48,148	77,184
14	71	51	11	62	87.3%	248	1.03	56,896	18,332	75,228
8	60	48	5	53	88.3%	212	0.88	65,796	7,724	73,520
20	68	40	21	61	89.7%	244	1.02	35,384	32,724	68,108
19	42	25	14	39	92.9%	156	0.65	31,344	30,088	61,432
26	52	15	25	40	76.9%	160	0.67	18,560	41,408	59,968
60	28	27	1	28	100.0%	112	0.47	56,676	2,888	59,564
58	39	4	34	38	97.4%	152	0.63	6,460	52,512	58,972
53	43	20	15	35	81.4%	140	0.58	28,748	28,360	57,108
34	32	16	15	31	96.9%	124	0.52	20,128	33,736	53,864
23	41	23	13	36	87.8%	144	0.60	28,048	23,056	51,104
36	28	10	13	23	82.1%	92	0.38	20,804	28,544	49,348
50	38	9	22	31	81.6%	124	0.52	11,432	35,900	47,332
3	36	13	20	33	91.7%	132	0.55	13,060	31,180	44,240
4	30	16	2	18	60.0%	72	0.30	32,148	5,776	37,924
33	53	22	7	29	54.7%	116	0.48	26,380	11,100	37,480
22	28	22	3	25	89.3%	100	0.42	28,136	5,980	34,116
54	25	12	1	13	52.0%	52	0.22	30,312	2,888	33,200
62	19	18	1	19	100.0%	76	0.32	31,400	1,544	32,944
46	25	22	1	23	92.0%	92	0.38	27,564	1,544	29,108
41	18	11	5	16	88.9%	64	0.27	15,540	7,724	23,264
30	17	7	9	16	94.1%	64	0.27	9,148	13,900	23,048
51	11	5	6	11	100.0%	44	0.18	5,784	13,880	19,664
12	10	10	0	10	100.0%	40	0.17	18,592	0	18,592
1	16	6	7	13	81.3%	52	0.22	7,340	11,100	18,440

IdGDH	Quarterly size				%	Yearly size	Day size	Annual Amounts		
	nAdm	SMP	GS	Total				SMP	GS	Total
39	10	3	4	7	70.0%	28	0.12	3,036	6,468	9,504
Total	2,739	1,244	974	2,218		8,872		1,686,348	1,723,120	3,409,468
Mean	65	30	23	53	85.8%	211	0.88	40,151	41,027	81,178

IdGDH: GDHs anonymous identification number
Quarterly size:
nAdm: number of admissions in GDH
SMP: number of specific medical problem patients
GS: number of geriatric syndrome patients
Total: number of patients admitted in GDH for diagnosis
Yearly size: number of patients admitted in GDH for diagnosis per year (quarterly total * 4)
Day size: number of patients admitted in GDH for diagnosis per day (yearly size / 250 working days)
%: rate of patients admitted in GDH for diagnosis
Annual Amounts
SMP: Standard Specific Medical Problems component amount (€)
GS: Standard Geriatric Syndromes component amount (€)
Total: SMP + GS annual amount (€)

HOSPITAL-SPECIFIC MODEL

Table 71: Final hospital-specific financing model (n=42)

IdGDH	Quarterly size				%	Yearly size	Day size	Annual Amounts		
	nAdm	SMP	GS	Total				SMP	GS	Total
25	197	120	35	155	78.7%	620	2.58	283,752	105,932	389,684
18	205	6	180	186	90.7%	744	3.10	8,732	366,400	375,132
31	138	33	83	116	84.1%	464	1.93	40,004	138,528	178,532
7	98	27	69	96	98.0%	384	1.60	38,036	131,588	169,624
52	84	57	23	80	95.2%	320	1.33	117,436	50,608	168,044
29	91	15	63	78	85.7%	312	1.30	23,168	135,400	158,568
21	352	147	7	154	43.8%	616	2.57	142,784	12,112	154,896
49	60	9	46	55	91.7%	220	0.92	17,920	110,940	128,860
11	82	60	19	79	96.3%	316	1.32	80,328	30,980	111,308
42	94	40	36	76	80.9%	304	1.27	48,640	58,916	107,556
43	68	19	42	61	89.7%	244	1.02	25,028	73,068	98,096
47	101	72	10	82	81.2%	328	1.37	75,380	16,260	91,640
45	73	31	39	70	95.9%	280	1.17	33,264	51,248	84,512
38	45	20	25	45	100.0%	180	0.75	28,996	52,776	81,772
16	96	59	13	72	75.0%	288	1.20	59,624	19,552	79,176
37	56	21	26	47	83.9%	188	0.78	26,404	43,612	70,016
14	71	51	11	62	87.3%	248	1.03	53,052	16,236	69,288
26	52	15	25	40	76.9%	160	0.67	21,216	44,960	66,176
8	60	48	5	53	88.3%	212	0.88	56,796	6,740	63,536
62	19	18	1	19	100.0%	76	0.32	58,080	2,040	60,120
20	68	40	21	61	89.7%	244	1.02	29,944	28,964	58,908
34	32	16	15	31	96.9%	124	0.52	21,204	34,060	55,264
19	42	25	14	39	92.9%	156	0.65	27,040	26,172	53,212
36	28	10	13	23	82.1%	92	0.38	20,232	27,756	47,988
58	39	4	34	38	97.4%	152	0.63	2,776	45,152	47,928
53	43	20	15	35	81.4%	140	0.58	23,972	23,808	47,780
63	59	53	3	56	94.9%	224	0.93	41,860	4,324	46,184
50	38	9	22	31	81.6%	124	0.52	10,772	33,944	44,716
23	41	23	13	36	87.8%	144	0.60	24,408	20,248	44,656

IdGDH	Quarterly size				%	Yearly size	Day size	Annual Amounts		
	nAdm	SMP	GS	Total				SMP	GS	Total
60	28	27	1	28	100.0%	112	0.47	39,000	2,532	41,532
54	25	12	1	13	52.0%	52	0.22	37,236	3,420	40,656
3	36	13	20	33	91.7%	132	0.55	11,788	28,204	39,992
4	30	16	2	18	60.0%	72	0.30	28,780	5,180	33,960
33	53	22	7	29	54.7%	116	0.48	22,440	9,672	32,112
30	17	7	9	16	94.1%	64	0.27	10,796	16,520	27,316
22	28	22	3	25	89.3%	100	0.42	21,324	4,704	26,028
46	25	22	1	23	92.0%	92	0.38	22,852	1,276	24,128
41	18	11	5	16	88.9%	64	0.27	15,456	7,684	23,140
1	16	6	7	13	81.3%	52	0.22	6,952	10,372	17,324
12	10	10	0	10	100.0%	40	0.17	17,316	0	17,316
51	11	5	6	11	100.0%	44	0.18	4,652	10,724	15,376
39	10	3	4	7	70.0%	28	0.12	2,912	6,404	9,316
Total	2,739	1,244	974	2,218		8,872		1,682,352	1,819,016	3,501,368
Mean	65	30	23	53	85.8%	211	0.88	40,056	43,310	83,366

IdGDH: GDHs anonymous identification number
Quarterly size:
nAdm: number of admissions in GDH
SMP: number of specific medical problem patients
GS: number of geriatric syndrome patients
Total: number of patients admitted in GDH for diagnosis
Yearly size: number of patients admitted in GDH for diagnosis per year (quarterly total * 4)
Day size: number of patients admitted in GDH for diagnosis per day (yearly size / 250 working days)
%: rate of patients admitted in GDH for diagnosis
Annual Amounts:
SMP: Standard Specific Medical Problems component amount (€)
GS: Standard Geriatric Syndromes component amount (€)
Total: SMP + GS annual amount (€)

6.3.3 Sources of variations

The analysis of these final models shows important variations between the different hospitals (inter-hospital variations). The next paragraph studies the 3 main causes of variations. First, the use of a hospital-specific fee implies automatically an inter-hospital variation. Secondly, the hospital activity, i.e. the number of admissions of new patient per day, is of course the most important source of variation. To eliminate this effect, we standardized the activity among admission level met in the most active hospital. The final reason is the case mix of the hospital. Given that the day fee integrates the length of stay of the same case in classical hospitalization, it is obvious that a hospital handling a higher proportion of serious cases will receive more financing. Statistical analysis and graphical representation are intended for the explanation and the detection of outlier hospitals.

6.3.3.1 Hospital-specific fees

Table 72: Admission and per diem fees and gains from standard values

	N	Mean	S.D.	Min.	Max.	Range
Admission fee	42	148.22	40.83	96.66	347.43	250.77
Per diem fee	42	19.17	2.79	14.53	26.30	11.77
Gain in admission fee from standard value	42	2.02	40.83	-49.54	201.23	250.77
Gain in day fee from standard value	42	-0.43	2.79	-5.07	6.70	11.77

The overall effect of the use of the specific values of B2 instead of the national mean value has minor influence.

Indeed, for the fee by admission, we observe an average gain of 2.02 € and for the per diem fee, an average loss of 0.43 €. But, if we look by hospital, the individual differences can be important

So, the range of gains by admission goes from a loss of 49.54 €, until a gain of 201.2 €. Also, the per diem fee varies from a loss of 5.07 € until a gain of 11.77 €.

Figure 20: Gains in admission and per diem fees - box plots

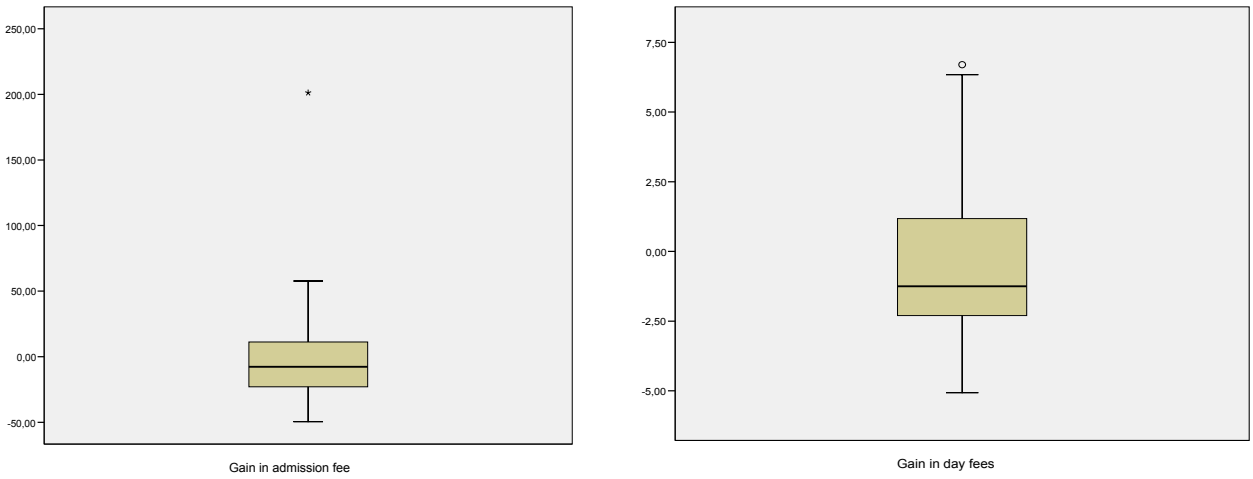


Figure 21: Gains in admission fees by GDH

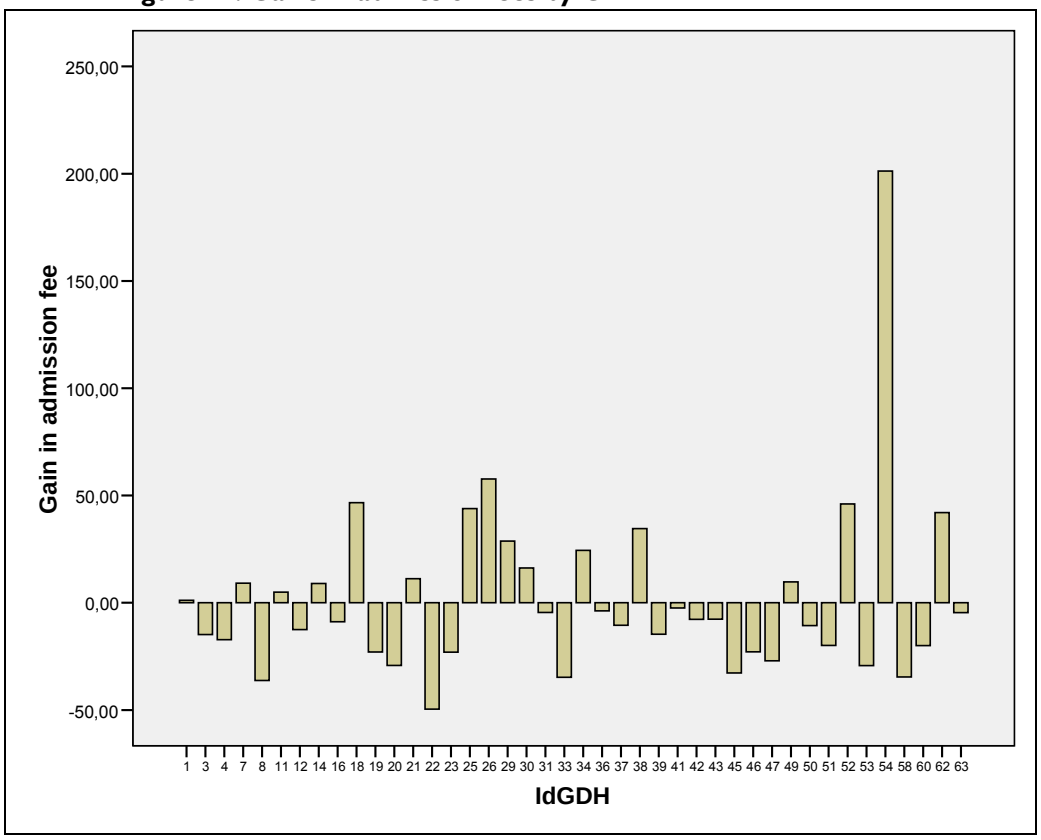
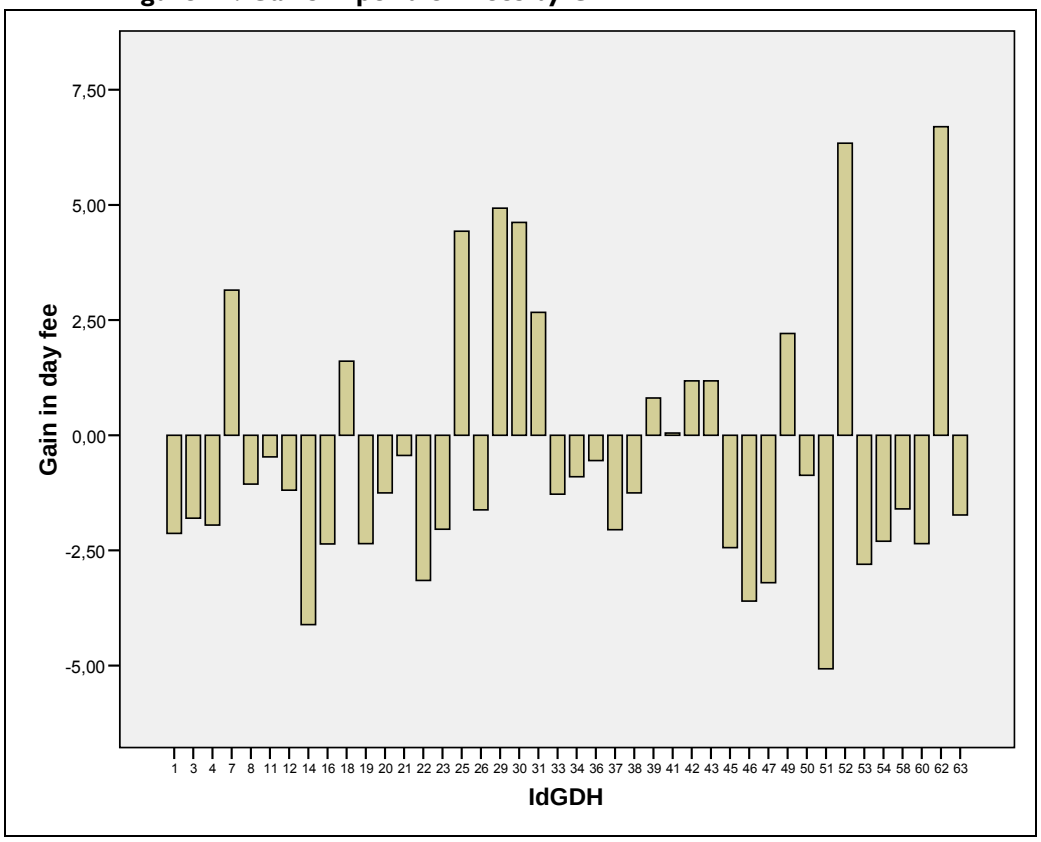


Figure 22: Gains in per diem fees by GDH



6.3.3.2 *Hospital activity*

In the hospital-specific final model (see Table 71), we notice that the sums allocated to the hospitals vary from 9,316 € to 389,684 €. The main explanation of these variations is the number of patients admitted in GDH. To eliminate this source of variation, we divided the total annual amounts by the yearly size to obtain a value of fee per patient. In the table below, we see that hospitals should receive, on average, 391 € per patient with a range from 206 € to 791 €. To explain this divergence, we will consider a third source of variation.

Table 73: Fee per patient

Number of GDH		42
Mean		391.69
Median		357.21
5% Trimmed Mean		379.43
Huber's M-Estimator		368.50
Tukey's Biweight		360.35
Std. Deviation		131.11
Minimum		206.18
Maximum		791.05
Percentiles	5	242.93
	10	260.87
	25	301.30
	50	357.21
	75	447.83
	90	567.55
	95	758.85

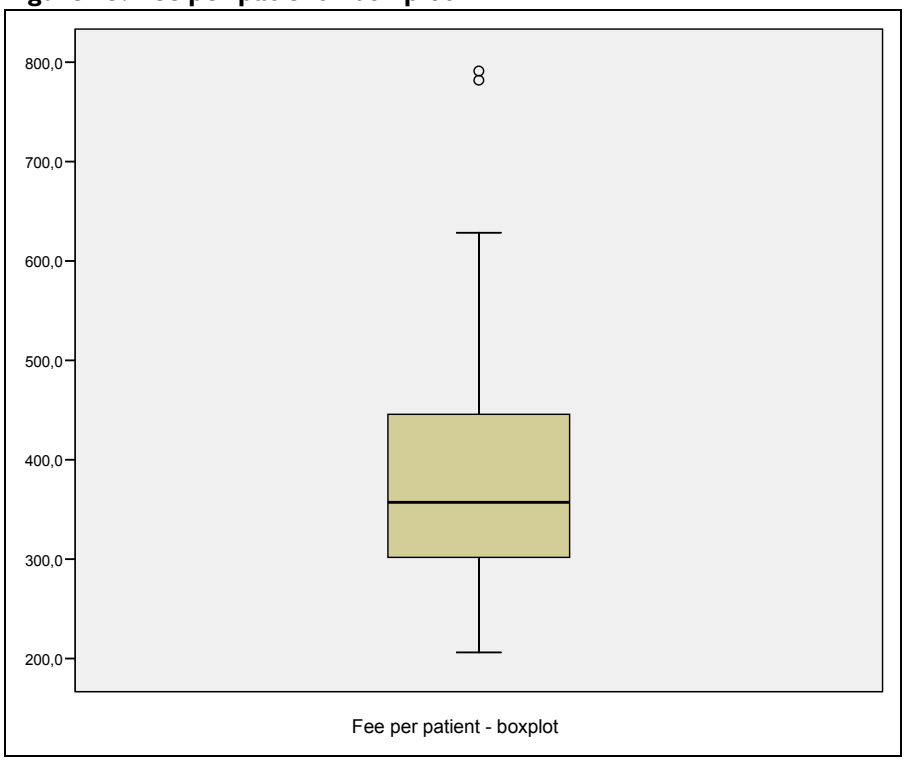
6.3.3.3 *Hospital case mix*

In the next table, the hospital case mix is presented by the number (N) and the percentage (%) of the three components of the model. The fee per patient is obtained by divided the total fee by the yearly total of admissions.

Table 74: Estimation of the fee per patient by GDH

IdGDH	Mono-pathology		Poly-pathology		Geriatric syndrome		Quarterly total admission	Yearly total admission	Total fees	Fee per patient
	N	%	N	%	N	%				
1	5	38.5	1	7.7	7	53.8	13	52	17,324	333.2
3	13	39.4	0	0.0	20	60.6	33	132	39,992	303.0
4	10	55.6	6	33.3	2	11.1	18	72	33,960	471.7
7	22	22.9	5	5.2	69	71.9	96	384	169,624	441.7
8	31	58.5	17	32.1	5	9.4	53	212	63,536	299.7
11	53	67.1	7	8.9	19	24.1	79	316	111,308	352.2
12	6	60.0	4	40.0	0	0.0	10	40	17,316	432.9
14	43	69.4	8	12.9	11	17.7	62	248	69,288	279.4
16	54	75.0	5	6.9	13	18.1	72	288	79,176	274.9
18	6	3.2	0	0.0	180	96.8	186	744	375,132	504.2
19	22	56.4	3	7.7	14	35.9	39	156	53,212	341.1
20	38	62.3	2	3.3	21	34.4	61	244	58,908	241.4
21	138	89.6	9	5.8	7	4.5	154	616	154,896	251.5
22	15	60.0	7	28.0	3	12.0	25	100	26,028	260.3
23	20	55.6	3	8.3	13	36.1	36	144	44,656	310.1
25	79	51.0	41	26.5	35	22.6	155	620	389,684	628.5
26	11	27.5	4	10.0	25	62.5	40	160	66,176	413.6
29	14	17.9	1	1.3	63	80.8	78	312	158,568	508.2
30	6	37.5	1	6.3	9	56.3	16	64	27,316	426.8
31	26	22.4	7	6.0	83	71.6	116	464	178,532	384.8
33	20	69.0	2	6.9	7	24.1	29	116	32,112	276.8
34	12	38.7	4	12.9	15	48.4	31	124	55,264	445.7
36	8	34.8	2	8.7	13	56.5	23	92	47,988	521.6
37	17	36.2	4	8.5	26	55.3	47	188	70,016	372.4
38	13	28.9	7	15.6	25	55.6	45	180	81,772	454.3
39	3	42.9	0	0.0	4	57.1	7	28	9,316	332.7
41	9	56.3	2	12.5	5	31.3	16	64	23,140	361.6
42	34	44.7	6	7.9	36	47.4	76	304	107,556	353.8
43	18	29.5	1	1.6	42	68.9	61	244	98,096	402.0
45	21	30.0	10	14.3	39	55.7	70	280	84,512	301.8
46	16	69.6	6	26.1	1	4.3	23	92	24,128	262.3
47	59	72.0	13	15.9	10	12.2	82	328	91,640	279.4
49	7	12.7	2	3.6	46	83.6	55	220	128,860	585.7
50	6	19.4	3	9.7	22	71.0	31	124	44,716	360.6
51	5	45.5	0	0.0	6	54.5	11	44	15,376	349.5
52	34	42.5	23	28.8	23	28.8	80	320	168,044	525.1
53	17	48.6	3	8.6	15	42.9	35	140	47,780	341.3
54	5	38.5	7	53.8	1	7.7	13	52	40,656	781.8
58	3	7.9	1	2.6	34	89.5	38	152	47,928	315.3
60	10	35.7	17	60.7	1	3.6	28	112	41,532	370.8
62	4	21.1	14	73.7	1	5.3	19	76	60,120	791.1
63	45	80.4	8	14.3	3	5.4	56	224	46,184	206.2
Total	978	44.1	266	12.0	974	43.9	2218	8872		

Figure 23: Fee per patient - box plot



In the next table, we verify if the components of case mix, i.e., the rates of: monopathology (Mono), polypathology (Poly) and geriatric syndromes (GS) are correlated with the fee per patient (Fee). We see that the components of SMP (specific medical problems) are very significantly correlated with fee, but GS is not. The results presented are "R": correlation coefficient of Pearson and "p": the p-value.

Table 75: Correlation matrix of the components of case mix and fee per patient

		Fee	Mono	Poly	GS
Fee	**R**	1			
	p	-			
Mono	**R**	-0.5303	1		
	p	**0.0003**	-		
Poly	**R**	0.4909	0.0578	1	
	p	**0.0010**	0.7164	-	
GS	**R**	0.0974	-0.7890	-0.6589	1
	p	0.5394	**0.0000**	**0.0000**	-

If we study the linear regression model with the fees as dependent variable and the rates of monopathologic (pMono) and polypathologic (pPoly) patients as predictors, we find a R^2 of 0.554, thus 55% of the variation are explained by this model. The analysis of the coefficients are given in the next table

Table 76: Regression analysis

	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	489.5	35.2		13.8853	0.0000
pMono	-3.5853	0.6850	-0.5605	-5.2339	0.0000
pPoly	4.0981	0.8387	0.5233	4.8865	0.0000

The three next figures give the scatter plots of the rate of the components versus the amounts of fee per patients (in €).

These graphs allow to a better understanding of the variations, sometimes apparently atypical, of certain hospitals.

So, we detect especially two outliers. The hospital number **62** receives a fee per patient of **791 €** and the hospital number **54** receives a fee per patient of **782 €**. For the first institution, the particularly high value of fee per patient is explained especially by a particular case mix with a very high rate of polypathologic patients (74%) and combined with a particularly high value of its per diem fee (26.3 € - see Table 74). As for the second hospital, it associates, in a lesser measure, a high rate of polypathologic patients with a particularly high admission fee (347.4 € - see Table 74). Obviously, before using a model of definitive financing, this kind of analysis must be conducted in depth

Figure 24: Fee per patient versus rate of monopathologic cases

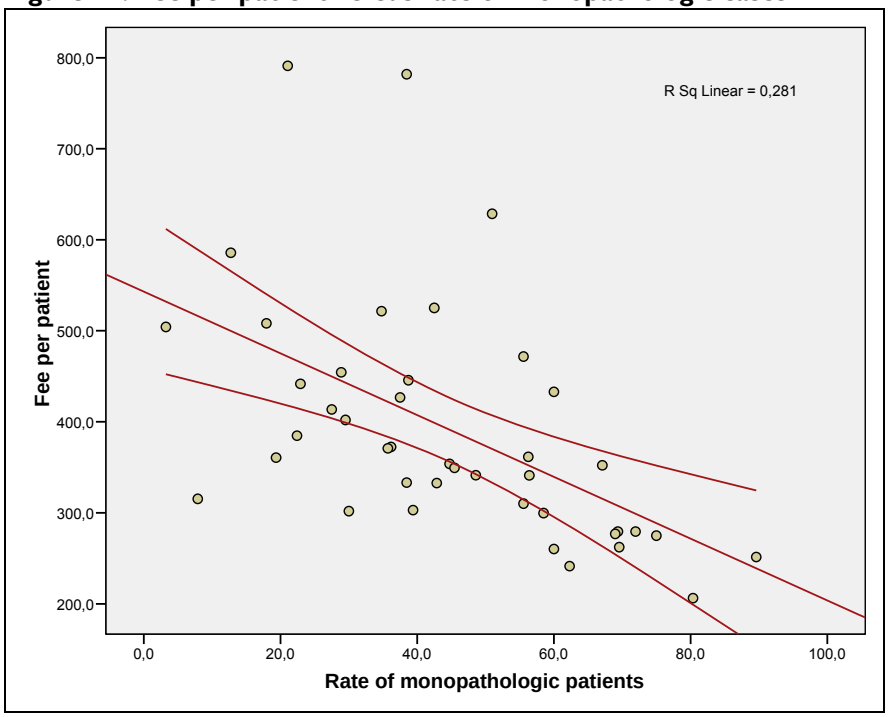


Figure 25: Fee per patient versus rate of polypathologic cases

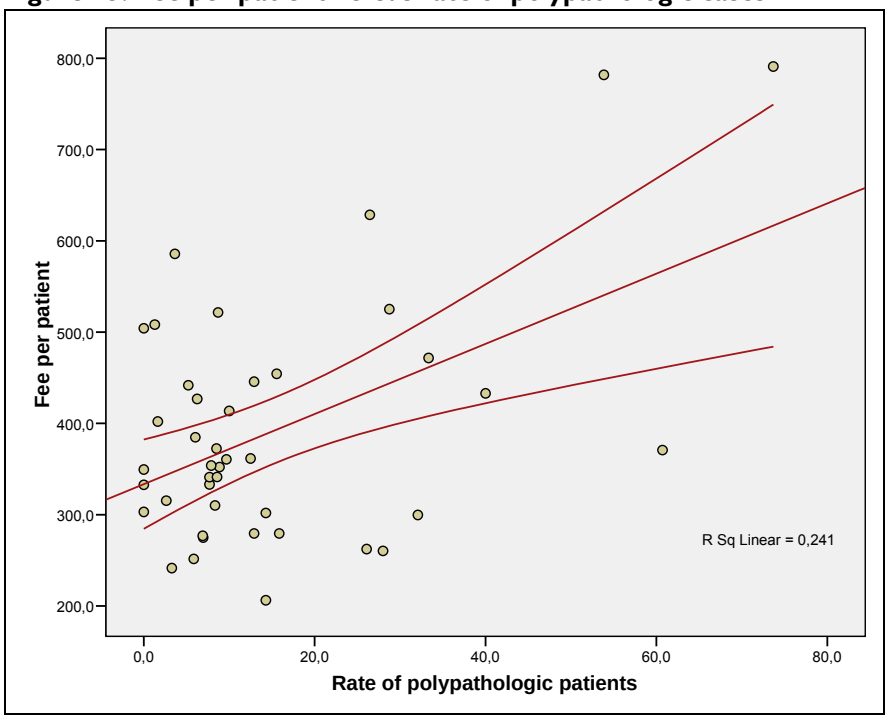
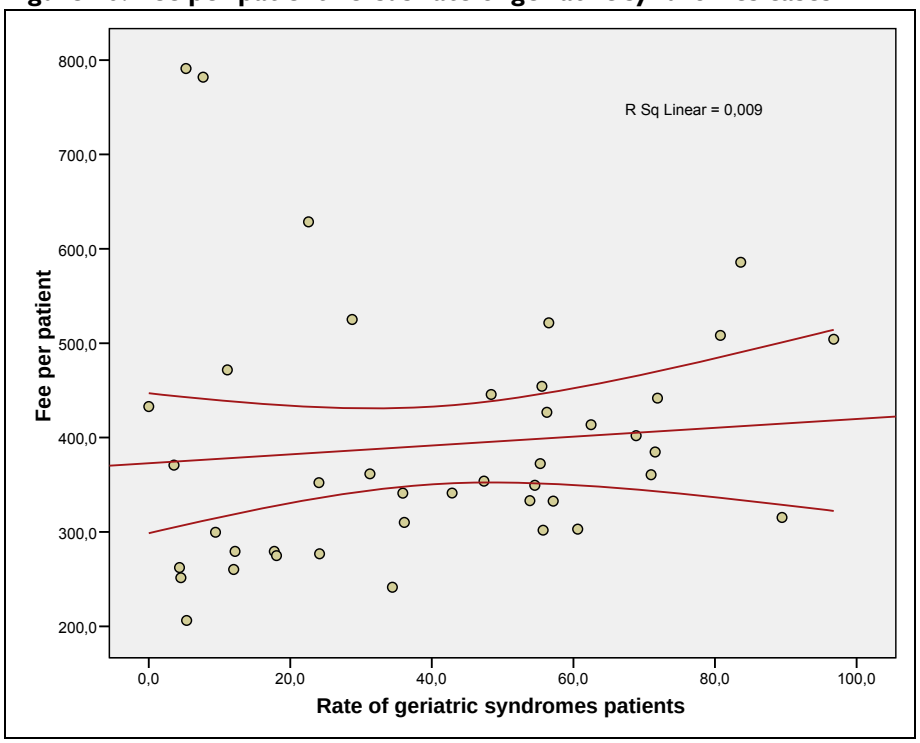


Figure 26: Fee per patient versus rate of geriatric syndromes cases



6.3.4 Budgetary impact on Social Security Body

The current budget can be estimated at the product of the actual allocation of the pilot project, 258,956 €, by the number of GDH, in this case 42. We obtain the value of 10,876,152 €. To estimate the budgetary impact of our model, we consider a realistic hospital activity of 3 new patients per day. This value is the number of hospital admission of the more active GDH from the SPF study. In the next table, we apply this factor to fee per patient to obtain the total fee per GDH and multiplying by 250 (working days) to get an annual value. The grand total obtained is 12,338,274 €, thus only a differential of 1,462,122 € (Table 77).

Table 77: Annual funding

IdGDH	Fee per patient	Yearly total fee for 3 admission/day
1	333.15	249,865
3	302.97	227,227
4	471.67	353,750
7	441.73	331,297
8	299.70	224,774
11	352.24	264,180
12	432.90	324,675
14	279.39	209,540
16	274.92	206,188
18	504.21	378,157
19	341.10	255,827
20	241.43	181,070
21	251.45	188,591
22	260.28	195,210
23	310.11	232,583
25	628.52	471,392
26	413.60	310,200
29	508.23	381,173
30	426.81	320,109
31	384.77	288,575
33	276.83	207,621
34	445.68	334,258
36	521.61	391,207
37	372.43	279,319
38	454.29	340,717
39	332.71	249,536
41	361.56	271,172
42	353.80	265,352
43	402.03	301,525
45	301.83	226,371
46	262.26	196,696
47	279.39	209,543
49	585.73	439,295
50	360.61	270,460
51	349.45	262,091
52	525.14	393,853
53	341.29	255,964
54	781.85	586,385
58	315.32	236,487
60	370.82	278,116
62	791.05	593,289
63	206.18	154,634
	Total	**12,338,274**

6.4 DISCUSSION

The objective of the present study, carried on request of the SPF, was to determine a structural system of financing the geriatric day hospitals as a replacement of the way they are financed today, i.e by a pilot project which ends in 2010.

6.4.1 Constraints and criteria for developing a financing model

6.4.1.1 The framework and the context

First of all, we would like to remind the constraints that are linked to the present research question:

- The short delay to give an answer.
- We have to propose a financial application that should be feasible i.e. it is reasonable, applicable and not too different of the way the financing is realised until now, in the other sections of the hospital.
- The model should also correlate well with the activity and type of patients. For example, for a geriatric patient due to their complex problems and presentation, a GDH should receive a higher payment than for an old patient presenting a clear cut medical problem.
- The financial model must encouraged hospital to develop that health care without non justified activity. Therefore, hospitals which have superior activity should be supported, but hospitals which have slight activity, due to the novelty of the setting, have not to be penalized during the first period. Indeed, these last ones risk to hesitate to continue the development of their geriatric day hospital activity. For reminder, today (2008) each GDH in the pilot's project receives two amounts: one is assigned to pay structure and functioning and the other pays two nurses and one paramedical agent. Until now, amounts are not in relation with level of activity.
- We have to think to mechanisms which will reduce the effects of various inappropriate behaviours: selection of patients, fall in the quality of care or else manipulation of coding data to find out pathology better financed, etc what could. Impair the efficiency on the control of hospitalisation costs

In addition, the system and the model must be in concordance with some fundamental criterions:

- be prospective in order with the patients characteristics, going to GDH
- have a good prediction power to predict costs as close as possible of real ones
- have sense for medical doctor, relating differences in costs to differences in medical problem
- be consensual between all the care givers
- be feasible for GDH: data easy obtainable and concerning a restricted number of parameters
- be transparent, proposing an analysis of the total amount which can explain the value and which can be compatible with actual registering system

We then, had to identify financing models inciting to an efficient activity, taking into account heterogeneity of the patients and the institutions

6.4.1.2 Implications and limitations due to the framework and the context

These constraints have reduced the methodological choices and therefore the type of results we can obtain from it. Indeed, **the time schedule** excludes, ipso facto, any prospective study that will be long and require a lot of energy to collect data in settings already much in demand because of the large amount of studies in the process.

Due to the **recentness of the GDH** for several hospitals and the fact that they are in an implementation phase, the quality of the data in terms of representatively of the activity of a GDH at a 'cruising speed' could be not optimal. Indeed, it is very difficult at the moment to determine if the studied population in GDH really has the profile of the expected population of a GDH. Probably better data collection to the financial questions would be obtained after more years of functioning. As shown in literature, this problem of changing activity and treatment is not specific to the Belgian system but also noted in the others countries. This could partly explain why articles are so confounding.

In addition to these constraints, the **specificities of the geriatric patient and the GDH** have also an impact that limits the possible useful financing models:

- Geriatric patients present large proportion of low income patients who present several co-morbidity factors.
- The holistic approach of the patient implies the intervention of several (heath) carers and a multidisciplinary approach.
- The activity of the GDH has not only financial purposes but is organised for the comfort of old person and to be preventive for further functional decline so that care at home will be longer preserved.

Consequently, the selected model and its implementation should be considered as an exercise which can be confronted with other models requiring, in addition, the evaluation of the population of the GDH. This constraint would require some years in hindsight of functioning of this new structure.

6.4.2 The Potential financing models

Two systems are currently used in Belgium: the fee-for-service and the payment per pathology.

6.4.2.1 The fee for service system

The 'classic' Day Hospitals are financed based on a system of fee-for-service (one act = an amount of money).

We could have opted for this system but it is difficultly applicable to the GDH because several reasons linked to the specificity of the patients (see here above) and also because:

- The activity in GDH is not well described yet, even if there is a geriatric assessment which is honoured for the geriatrician. For example, the composition of assessment varies greatly, like what is shown in the literature.
- There is no list of standardized procedures: which test is the most useful in each geriatric situation? Also, the time and the means necessary to realize it correctly are unknown. Even if geriatricians realize well that consensus should be done on standardisation of approach for the assessment and the type of intervention, this work would take time and ask for a lot of studies.
- Geriatric evaluation is a global approach to check functioning of the patient, geriatric care takes care of the person and not only of the illness.
- It is difficult to make association between money and INAMI codes; there are only 2 codes for the activity in GDH: Geriatrician is paid by amounts corresponding to the two INAMI codes dedicated to the ambulatory geriatric activity.

In consequence the system of fee-for-service, is quite difficult to integrate in the geriatric practice and embed to transfer the way of thinking the funding of an other type of 'day hospital'. It will require a long process to reach a consensus on the acts a patient has to receive, to define how the multidisciplinary approach has to be carried and to weight these in terms of time and thus money.

In addition, using this system could lead to damaging situation where a person coming for one problem will be looked at for the problem and not for his functioning, what goes straight against the geriatric approach. An additional pitfall could be that, if such system is used, as doing more acts will be better paid, physicians will came under pressure from their directions to augment their activities in term of payable acts.

This system, as it is currently realized by the RIZIV/INAMI, could not be used in the case of geriatric day hospital, at least for the moment.

6.4.2.2 The 'fee per pathology' system

The other system that is in use in hospitals today is the 'pay per pathology' system. Pricing according to pathology pays an amount calculated, prospectively for every illness. This system is also not transferable as such for the GDH. Therefore, in the proposed model, the concept of pathology has been replaced by three components to characterize patients: the monopathologic, polypathologic and geriatric syndromes components. Thus, these three groups involved in the model through various length of stay, observed in classical hospitalisation, as an indicator of heaviness of the patients.

6.4.3 The proposed model

6.4.3.1 The model

Considering all the remarks and conditions, we can propose the model as described in the previous chapter.

In the financing system proposed, we separated the financing of the geriatrician of the financing of the geriatric day hospital itself. The financing of the geriatrician is realized by a classic system of fee-for-services based essentially on the fees to the multidisciplinary geriatric assessment.

As for the financing of the geriatric day hospital itself, it is inspired by the funding system of hospitals through the sub-section B2, or rather 20% of this sub-part, which are paid to hospitals via patient invoice emitted by the hospital to mutual insurance on the basis of an amount per admission and an amount per day.

This system is actually applicable to classic hospitalization as well as for certain admissions in surgical one-day clinic. The package for admission is applied directly to each admission. As against, we applied to the day package, a multiplicating factor corresponding to the average length of stay that the patient would endure if he had been admitted to acute hospital. The average length of stay applied to each patient is estimated by disease, by age and degree of severity as applied in the current system of financing. The pathology is expressed, not in term of DRG but by a system of classification by pathology that we have developed according to the observations of the patients frequenting the geriatric day hospitals participating in the SPF study and for which we do not have RCM/MKG recording.

For the same reasons, it was impossible to estimate the severity of illness. We thus replaced it by a "geriatric" severity degree calculated according to the absence (degree 0) or of the presence of one or several geriatric syndromes.

The final model gives a package by admission and a package by pathology for every new patient admitted to the day hospital. The sum of these two packages represents a fee by patient who takes into account specificities of the hospital institution, pathologies of the patients, as well as their geriatric profiles.

The annual budget attributed to every geriatric day hospital being obviously related to its activity, we normalized by a critical number of 3 patients a day.

In the framework so defined, we notice that the budget, at present assigned for the implementation of these geriatric day hospitals (pilot project), is globally respected.

6.4.3.2 Limitations of the model

The main limitation of the model lies in its sustainability. We showed that the budgetary goal is reached. On the other hand, we need to verify if the reserve of patients, in classical hospitalisation, which could supply the geriatric day hospital is sufficient.

By limiting to the 42 hospitals of the model, the rate of transfer is organized as follows:

- In the monopathologic group, we have a shift rate of 984 patients in GDH matched with 5 363 inpatients;
- In the polypathologic group, we have a shift rate of 271 patients in GDH matched with 2 210 inpatients;
- In the geriatric syndromes group, we have a shift rate of 974 patients in GDH matched with 228 inpatients.

Thus, for a quarterly number of admissions in GDH of 984+271+974 = 2 229 patients, we matched 5 363+2 210+228 = 7 801 inpatients in the RCM/MKG-FY2003 database.

Under the hypothesis of 3 admissions per day, we obtain 3 * 250 working days = 750 admissions in each GDH. Thus, for the sample of 42 GDH, that gives: 750 * 42 = 31 500 patients who should be admitted in this setting.

From a reserve of shifting in classical hospitalisation of 7 801 patients, the amount of 31 500 patients can be reached only by patients coming from primary care. A future study could confirm the plausibility of that possibility.

7 CONCLUSIONS

The purpose of this study was to find an answer to the three questions:

- What is the situation of Geriatric Day Hospital (GDH) all over the world and how are they organised. Are there studies about the way to organize the financing of the structure and is it possible to transfer the experiments to Belgian health care system.
- What are the characteristics of patients coming in the GDH and what are the differences with geriatric patients treated in classic hospitalisation and with patients, in nursing homes or living at home?
- Which financing system can be developed and proposed taking into account the patients' profile and what is the impact on the budget of the health care system?

7.1 WHAT IS THE SITUATION OF THE GERIATRIC DAY HOSPITAL ALL OVER THE WORLD?

An attempt to answer to the first question was made by a systematic review of international literature corresponding to the background of this study.

A review of the organisation of GDH and existing financing system was also performed. There are few papers either describing the activity and effectiveness or studying the financial models. Data are also difficult to compare due to reasons discussed below.

All the studies comparing specific geriatric approaches to regular medicine, demonstrates efficiency of geriatric care, particularly the geriatric assessment. So, with a degree of evidence 1a, a better outcome for patients undergoing a geriatric assessment and intervention is found, compared to patients having no geriatric assessment at all. However, there is no evidence of benefit for the geriatric day hospital compared to patients treated in a conventional hospital or other settings of geriatric care.

Moreover, there is no clear consensus on the equipment and activities of a geriatric day hospital. Terms as day unit, day hospital, day care, are used interchangeable and are not always covering the same activity.

The same remark can be made on the exact composition of the geriatric multidisciplinary team and the role of the different members of the team. However members as nurses and paramedical workers are always mentioned as all performing geriatric assessment.

The diagnostic activities on the GDH are seldom described and studied. More information is available on rehabilitation activity. Rehabilitation is often developed in specific patient populations such as stroke patients, dementia patients, cardiac patients or patients with other chronic diseases. In this selected patient populations positive effects on outcome are shown in the GDH (level of evidence 1a).

Another problem in studying GDH effectiveness is the heterogeneity of the population. For scientific reason the GDH should focus on organising care for specific medical problems. Diseases as dementia, stroke, cardiac insufficiency, could be good models to investigate the efficiency of geriatric assessment and interventions within the setting of a GDH. However, in reality the geriatric patient does not have just one disease and presents himself with a mix of different pathologies creating research which is not transferable to the real geriatric patient population.

On top of that, there is no consensus on what the measure of effectiveness and efficiency should be for the geriatric day hospital. As this consensus is not present among experts, it is difficult to define the variables which should be measured to evaluate the effectiveness and cost-effectiveness of financial systems for the day hospital.

Due to a lot of confounding factors observed in the studies, no clear evidence is available on the benefit of geriatric day hospital over in hospital geriatric care.

Methodology, recruitment, and outcomes between different studies are often so different that the results can not be compared.

Financial studies principally are realized to try to show the cost-effectiveness of the geriatric day hospital and also the financing systems which can be proposed. However, results from these studies are very often inconclusive. This largely stems from the fact that the service offered by day hospitals, local circumstances and the range of elderly patients attending, can differ so greatly. Although sophisticated technology is not the subject of most geriatric interventions, teams composed by professionals from many disciplines are often costly.

The variety of outcome measures due to the fact that many studies, particularly those conducted with clinical trials, use clinical outcomes in the evaluation are making comparison and defining effectiveness and cost-effectiveness as discussed above more difficult.

7.2 WHAT ARE THE CHARACTERISTICS OF PATIENTS GOING TO THE GDH AND DO WE FIND SUCH PATIENTS IN THE CLASSICAL HOSPITAL?

Our study has only compared patients in GDH with inpatients older than 65 years in classical hospitalisation.

To answer to the question it is necessary to describe and compare the type of patients and activities in the GDH in Belgium with those in a classic hospitalised population of geriatric patients.

For the GDH study, data from a prospective, multicenter study on the evaluation of geriatric day hospitals in Belgium, sponsored by the Federal Public Service (FPS) of Public Health, were used. For the geriatric hospitalised patients, we used a coupled database of administrative data from the fiscal year 2003 – "Registration of Minimal Clinical data" (RCM/MKG) and "Registration of Minimal Financial Data" (RFM/MFG).

Cases of GDH studies were matched to inpatients following a complex methodology.

At the end of that methodology, a population of 12 387 patients in the RCM/MKG-FY 2003 database was matched with 2 229 patients in the GDH 2006 database.

The matching process is essentially based on a rigorous matching of patients based on their medical profile. After that, we have compared the two groups of patients for a lot of variables. The differences observed between the GDH patients and inpatients are mainly explained by a higher age of the patients admitted in day hospital with regard to inpatients. It is conceivable that this difference results from the legal definition of the geriatric care program. Indeed, this program, and by extension admission in GDH, is normally reserved for patients whose age is on average over 75-year-old. We find here the same criterion as for the definition of the G financed patient. Nevertheless, this difference cannot have any effect on the calculation of the financial model because the estimation of fee by pathology is standardized by age.

Despite their similarities in terms of pathologies, compared to inpatients, monopathologic GDH patients are in mean older and count more women. They are also more to have geriatric syndromes.

Polypathologica patients, or patients who have one or more geriatric syndromes, like monopathologic patients, are ore numerous to come from home (or residential home) and are more often referred by the general practitioner. In addition, patients with geriatric syndromes are more often send to residential home.

7.3 WHICH FINANCING SYSTEM CAN BE DEVELOPED AND PROPOSED?

The question to answer was: "which financing system can be developed and proposed taking into account the patients' profile and what is the impact on the budget of the health care system?"

One of the hypotheses of this study was that a fraction of geriatric patients, for whom an assessment is required, is treated by admission in the hospital. Those patients admitted to the hospital could now been avoided and a substitution rate between hospitalisation and GDH could be evaluated.

Therefore, a group of patients whose hospitalization could be avoided partially or totally was collected out the 2003 population comparing their profiles to the profiles of the GDH population in 2006. Here for not only the specific medical problem but also the geriatric profile was taking into account, making a translation from ICD codes necessary in function of the Geriatric Profile as described in chapter 5.

Considering all the remarks and conditions, we can propose the model as described in the previous chapter. It takes into account, performances and organisation of institution by the use of amount admissions fee, per diem fees and length of stay; seriousness and geriatric profile is checked in component mono, poly pathological patient and components related to geriatric syndromes.

This model seems equitable because it advantages the hospital which presents a justified activity (B2), whose geriatric day hospital presents a suitable volume (number of admissions per day), which presents a serious case mix. As a consequence the amounts paid vary from 154 634 euros to 593 289 euros. Under this model, we evaluated the budgetary impact at the level of Public Authorities. This exercise was conducted by assuming a rate of admission of three patients per day which is half the rate recommended by the College of geriatricians. However, this rate is the best activity among the sample of geriatric day hospitals participating in the SPF study.

Thus, we obtain, for the 42 GDH, a total budget of 12 338 274 €, which is only slightly higher than the current budget (pilot project) which presents a serious case mix. That amount is a upper limit because the used hypotheses are maximalist: they are based on a fully transfer of the geriatric patients from the classic hospital to the geriatric day hospital and on the existence of a reserve of patients living at home which should be dispatched by the general practitioner to the geriatric day hospital. These hypotheses plead for a progressive application of a new financing system.

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