# Soins maternels intensifs (Maternal Intensive Care) en Belgique

*KCE reports 94B*

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

Les soins maternels intensifs (Maternel Intensive Care – MIC) ont été organisés en Belgique dans le cadre d'un arrêté de 1996. Cet arrêté introduit le concept de fonction P (pour périnatale). Les hôpitaux agréés pour le la fonction P, disposent d'une maternité avec des lits MIC et d'un service de soins néo natals intensifs (NIC)

La fonction MIC consiste en une observation attentive des grossesses à haut risque et permet d'accueillir des patientes qui ont besoin de soins de post partum très spécialisés. Les soins néo natals intensifs (NIC) sont là pour assurer l'encadrement des nouveaux nés qui exigent des soins intensifs à la naissance.

L'Arrêté Royal ne précise pas de manière très claire le concept de MIC, ni les fonctions que ces lits doivent remplir et encore moins les indications qui doivent conduire à une admission dans ce type de lit. On observe dès lors sur le terrain une grande variabilité dans la politique d'admission et de référence vers des lits MIC, de même que dans les taux d'occupation. Cette variabilité pose la question de savoir si la fonction MIC remplit bien les objectifs que s'était fixés le législateur en termes de qualité, d'accessibilité et de bonne utilisation des moyens publics.

Nous espérons que ce rapport contribuera à éclairer ces questions relatives à la prise en charge des grossesses à haut risque et aideront les décideurs améliorer les soins périnatals en Belgique de manière à encore réduire la morbidité et la mortalité périnatales.

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# Sommaire

# INTRODUCTION

Le concept de soins maternels intensifs (Maternal Intensive Care) a été introduit en Belgique, dans le cadre d'un Arrêté Royal datant de 1996. Cet Arrêté Royal accorde un financement supplémentaire aux maternités qui assurent l'observation intensive des grossesses à haut risque, accueillent les patientes dont le fœtus pourrait nécessiter des soins néonatals intensifs ou les patientes qui nécessitent des soins hautement spécialisés du postpartum. Cet AR ne contient pas plus de précision concernant l'objectif des services ou les critères d'admission. Toutefois, les maternités disposant de lits MIC ont l'obligation de servir de centres de référence pour 5.000 naissances. Le financement supplémentaire accordé est destiné à couvrir les frais de renforcement du staff par des accoucheuses spécialisées en grossesses à haut risque.

Dix-sept maternités belges sur un total de 106 disposent d'une fonction P laquelle regroupe une maternité comprenant des lits MIC et un service de soins néonataux intensifs (NIC). Ces nombres n'ont pas changé depuis 2004. Il existe 172 lits MIC agréés sur un total de 3.200 lits de maternité et le nombre de lits MIC par maternité varie de 8 à 20, indépendamment de la taille de la maternité. Les maternités comprenant des lits MIC rassemblent 22 % du nombre total de lits de maternité. Dans la pratique, la section MIC d'une maternité est virtuelle, en ce sens que les lits MIC ne sont pas regroupés dans une entité séparée.

La dénomination « maternal intensive care » (soins intensifs) prête à confusion car la section MIC d'une maternité ne se substitue pas à un service de réanimation. Elle se positionne plutôt comme un service « intermédiaire » qui assure une surveillance rapprochée grâce au renforcement du staff. Ce rapport utilise donc la dénomination « intermediate care » (IC) afin d'éviter toute confusion avec les soins intensifs, lesquels ont des indications bien précises.

# OBJECTIFS DE L'ETUDE

Le dernier rapport national d'activité des maternités MIC a été publié en 2001. La présente étude a pour objectif de faire le point de la situation actuelle et en particulier d'évaluer dans quelle mesure :

- les services MIC remplissent leur rôle de centres de référence ;
- les moyens mis à leur disposition par les Pouvoirs Publics sont utilisés adéquatement ;
- l'accessibilité géographique aux soins IC est équitable.

Il est à noter que cette étude ne portera pas sur la qualité des soins en tant que telle; un autre design et des données complémentaires auraient été nécessaires pour tirer des conclusions à ce sujet.

# REVUE DE LITTERATURE

La revue de littérature avait pour objets la définition des soins maternels intermédiaires et les recommandations de bonne pratique internationales et nationales relatives à ces soins. Aucune publication internationale ne contient ni de définition précise des soins maternels intermédiaires, ni du niveau où ceux-ci doivent être pris en charge. En conséquence, l'étude de la littérature n'a pas permis de prouver l'efficacité des services MIC en termes d'Evidence Based Medicine. Les quelques recommandations internationales relatives à la prise en charge adéquate des grossesses à risque contiennent peu de données probantes. D'autre part, quoique la plupart des pays développés disposent de plusieurs niveaux de soins maternels, les lits MIC n'ont pas de véritables équivalents structurels dans d'autres systèmes de soins. Au niveau local ou national, il n'existe pas non plus de guideline décrivant les critères d'amission et de transfert ou les soins maternels intermédiaires.

# METHODOLOGIE

Au vu de cette absence de définition, les chercheurs et les experts ont, au cours de plusieurs séances de travail consécutives complétées par des commentaires écrits, construit ensemble une liste exhaustive de pathologies (liées à la grossesse ou non) et de problèmes fœtaux, susceptibles de requérir des soins supplémentaires par rapport aux soins classiquement requis par la grossesse. Cette liste a permis de constituer quatre catégories : la première regroupe les soins classiques (standard care), la deuxième, les pathologies pour lesquelles des soins intermédiaires sont recommandés (zone grise), la troisième les pathologies pour lesquelles des soins intermédiaires sont indispensables (intermediate care) et la quatrième, les pathologies pour lesquelles des soins intensifs sont requis (Near-Miss or intensive care). En parallèle, une base de données couplées contenant les Résumés Cliniques Minimums (RCM) et les données de remboursement de l'Agence Intermutaliste (AIM) de 97.648 femmes et de leurs nouveaux-nés ayant séjourné en maternité pour un accouchement ou une fausse-couche tardive entre le 1er octobre 2003 et le 30 septembre 2004, a été constituée. Les éléments cliniques constituant les catégories précitées ont été transformés en codes (prestations, médicaments, RCM). De cette manière, il a été possible de classer les parturientes dans les quatre catégories décrites ci-dessus.

Ce rapport se focalise sur les parturientes dont les données contenaient une ou plusieurs pathologies pour lesquelles des soins intermédiaires sont indispensables. Ces patientes sont dénommées ci-dessous patientes « intermediate care » (IC).

## LES LIMITES DE LA METHODOLOGIE UTILISEE SONT LES SUIVANTES

Il n'est pas possible de repérer avec précision les patientes admises dans les lits MIC. En effet, le codage spécifique pour les patientes MIC n'était pratiquement pas utilisé en 2004. Le classement des patientes a donc dû être établi sur base des quatre catégories décrites ci-dessus.

La liste des pathologies susceptibles de requérir des soins intermédiaires reste imprécise parce que (hormis en ce qui concerne l'éclampsie, le diabète, les hémorragies graves et la grande prématurité) une pondération des facteurs de risque et des pathologies en fonction de leurs conséquences pour la santé de la mère et de l'enfant n'a pu être réalisée. L'utilisation de la zone grise qui regroupe les soins intermédiaires recommandés a toutefois permis d'affiner cette dernière catégorie.

L'utilisation du codage ICD9 entraîne une imprécision qui est bien connue et était déjà décrite dans le rapport de Cannoodt et Vleugels en 1996. Notons que la répartition relativement aléatoire des problèmes de codage dans les bases de données permet un certain degré de comparaison entre les maternités disposant de lits MIC.

# RESULTATS

Une première analyse de la répartition des services montre d'emblée que les maternités disposant de lits MIC sont concentrées dans les grandes villes (voir carte n°1) et que les femmes accouchent le plus souvent près de leur domicile. Les patientes qualifiées IC représentent 9,6% des parturientes. Selon l'hypothèse de recherche, ces patientes devraient préférentiellement être admises dans des maternités MIC. Or, la concordance entre le lieu d'admission observé et le lieu d'admission attendu est faible. Quarante pour cent seulement des femmes dites IC sont admises dans une maternité possédant des lits MIC.

## LES SERVICES MIC REMPLISSENT-ILS LEUR ROLE DE CENTRE DE REFERENCE ?

Plusieurs variables telles que le taux de transfert in utero, le case-mix des patientes et le nombre de prématurés nés dans les maternités disposant de lits MIC permettent d'estimer dans quelle mesure ces maternités sont utilisées comme centre de référence pour les grossesses à haut risque.

Environ 1% du total des femmes enceintes est transféré vers un autre hôpital pendant la période périnatale. Soixante pour cent de ces transferts surviennent avant la naissance (transferts intra-utérins), parmi ceux-ci trois-quarts sont adressés à des maternités disposant de lits MIC.

Le nombre de transferts varie de 0,5 à 12,8 par lit MIC et par an. On constate que ce sont les maternités situées sur le site des universités qui enregistrent les taux de transfert les plus élevés (> 5%) à l'exception des maternités bruxelloises du réseau de l'ULB. Certaines maternités isolées qui ne possèdent pas de lits MIC reçoivent également des transferts (RMST[a] et CHR de Namur).

En moyenne, les maternités qui hébergent des lits MIC se distinguent des autres maternités par une concentration accrue de naissances prématurées, d'enfants mort-nés, de naissances multiples et de parturientes issues de groupe socio-économiquement défavorisés[b]. La concentration accrue de parturientes issues de groupes socio-économiquement défavorisés dans les maternités MIC n'est observée toutefois qu'à Bruxelles, dans le Brabant flamand et dans les deux Flandres.

Dans cette étude portant sur l'année 2004, le taux de grande prématurité (naissances avant 32 semaines) s'élève à 1,5% pour toutes les catégories de risques et à 8.8% pour les femmes identifiées comme IC. Pour l'ensemble du pays, 80% des grands prématurés dont les mères sont IC naissent dans les services MIC mais cette proportion est très variable. Certaines provinces enregistrent un taux beaucoup plus bas : Flandre Occidentale (63.5%), Hainaut (64.8%), Luxembourg (68.4%) et Namur (50%) (voir tableau 44, page 91). Les maternités MIC étant toujours associées à un service NIC au sein de la fonction Périnatale, les bébés qui naissent en MIC sont accueillis d'emblée dans un service NIC, ce qui correspond à une des recommandations du Collège Mères-Enfants[c].

## LES MOYENS SONT-ILS UTILISES DE MANIERE ADEQUATE ?

Différentes variables permettent d'approcher la mesure de la bonne utilisation des moyens : la durée de séjour, la comparaison du ratio femmes IC/total des femmes (F IC/total F) avec le ratio lits MIC/total des lits M (lits MIC/total des lits) et le taux d'occupation des lits MIC par des femmes dites IC.

En ce qui concerne la durée de séjour, on aurait pu s'attendre à ce que les patientes séjournant dans les maternités disposant de lits MIC aient une durée de séjour plus élevée. En fait, une différence de durée de séjour entre les maternités « classiques » et celles qui disposent de lits MIC, n'est constatée qu'à partir du percentile 90 (les 10% de femmes qui séjournent le plus longtemps à l'hôpital)

Le ratio : F IC/total F est régulièrement inférieur au ratio : lits MIC/total des lits, ce qui indique que la maternité admet systématiquement moins de femmes susceptibles de profiter des soins intermédiaires que ne le lui permettrait le nombre de lits MIC dont elle dispose.

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a Réseau de Médecine Sociale à Tournai

b Identifiées par leur statut BIM ou comme bénéficiant du MAF social

c NICaudit Synoptic Report 2000-2007; Federal Public Service, Health, Food chain safety and Environment

De même, le taux d'occupation moyen des lits MIC par des femmes IC est le plus souvent inférieur au taux moyen d'occupation des lits M dans la même maternité. Cette situation varie d'un centre à l'autre: de 10 femmes admises par lit MIC et par an (en moyenne) à 35 (en moyenne) pour les taux les plus élevés. Les lits MIC sont donc le plus souvent sous-utilisés quoique l'importance de cette sous-utilisation varie en fonction des centres, ce qui impose de réaliser une analyse détaillée.

## L'ACCESSIBILITE GEOGRAPHIQUE AUX SOINS INTERMEDIAIRES EST-ELLE ASSUREE ?

La possibilité pour toutes les femmes IC d'accoucher dans une maternité possédant des lits MIC ainsi que les barrières géographiques éventuelles pour y parvenir constituait une des questions de recherche.

La tendance générale observée est que les femmes accouchent près de leur domicile quelle que soit la catégorie de soins dont elles relèvent (standard care aussi bien qu'IC). En d'autres termes, plus il y a de maternités disposant de lits MIC aux alentours, plus une femme enceinte IC a de chances d'accoucher dans une telle maternité. Par exemple à Bruxelles, 6 maternités bruxelloises disposent d'un service MIC et réalisent 48% des accouchements ; les deux maternités liégeoises disposant d'un service MIC réalisent 52% de tous les accouchements de la province. Dans ces deux provinces, plus de 60% des femmes IC accouchent dans une maternité disposant de lits MIC. Par contre, dans certaines provinces ayant des communes situées à plus de 40 kms d'une maternité disposant de lits MIC, la proportion de femmes IC qui accouchent dans une maternité disposant de lits MIC est faible (15.5% dans la Province de Namur, 18.1% dans le Luxembourg et 17.1% en Flandre Occidentale). L'accessibilité géographique est élément de l'accessibilité globale qui ne peut être négligé vu que les problèmes périnataux sont la plupart du temps des situations urgentes. On constate toutefois, qu'un petit nombre de femmes IC parcourent des distances largement supérieures à 40 kms pour se rendre à la maternité. Il s'agit de femmes qui soit choisissent spontanément d'accoucher dans une maternité disposant de lits MIC, soit y sont référées en cours de grossesse ou en cours d'hospitalisation.

# CONCLUSION

L'organisation des soins périnataux est variable selon les pays ; le modèle des soins maternels intermédiaires est spécifique à la Belgique. Toutefois, tous les pays développés disposent de centres de référence destinés à accueillir les grossesses à risque. Ces centres sont organisés en fonction du système de soins en vigueur dans chaque pays. L'étude de la littérature n'a pas permis de prouver l'efficacité des lits MIC en termes d'Evidence Based Medicine, pas plus que l'existence de recommandations de bonne pratique appliquées au niveau local ou national.

Il est extrêmement complexe de définir avec précision qui sont les femmes enceintes nécessitant une surveillance et des soins supplémentaires. Ce rapport s'appuie sur une liste exhaustive définie par des experts du terrain. Toutefois, la notion de grossesse nécessitant des soins intermédiaires reste large et floue. Enfin, ni la littérature, ni les données locales ne permettent de conclure que toutes les grossesses cataloguées comme nécessitant des soins intermédiaires tireront bénéfice d'une prise en charge dans une maternité avec lits MIC.

Ce rapport fournit une photographie de la situation existante et permet de conclure que le facteur le plus déterminant dans le choix d'une maternité est la proximité. C'est vraisemblablement ce qui explique que 40% seulement des femmes dites IC sont admises dans une maternité disposant de lits MIC. A l'exception des maternités situées sur un site universitaire le nombre de transferts de maternités sans MIC vers des maternités avec MIC est relativement bas. La concentration accrue de grossesses à problèmes dans les maternités MIC se vérifie en moyenne mais n'est pas observée partout, et l'accueil des grands prématurés pose question dans certaines provinces.

Les performances des maternités MIC en fonction de leurs objectifs premiers sont faibles et variables. La plupart des maternités MIC admettent moins de femmes susceptibles de profiter des soins intermédiaires que ne le leur permettrait leur nombre de lits MIC. Le taux d'occupation moyen des lits MIC par des femmes IC est le plus souvent inférieur au taux moyen d'occupation des lits M dans la même maternité.

Enfin, la répartition géographique des maternités MIC n'est pas optimale et il n'existe pas de politique de référence suffisamment bien établie pour garantir un accès équitable à toutes les femmes concernées.

# RECOMMANDATIONS

## INSTAURER UNE POLITIQUE DE REFERENCE

- Les situations dans lesquelles il convient de référer une patiente vers un hôpital disposant d'une fonction P devraient être définies au sein du Collège Mères-Enfants et faire l'objet de recommandations et de critères précis ;
- Ces situations devraient être enregistrées en routine dans les registres des maternités de manière plus extensive que les situations simples et suivant un schéma adapté ;
- La structure du rapport transmis annuellement par les maternités MIC au SPF Santé Publique devrait être remaniée afin de contenir ces données et servir de base à des feedbacks personnalisés. Les résultats globaux issus de ce rapport devraient faire l'objet de publications régulières à l'instar des rapports d'audit des services NIC.
- Des mesures d'accompagnement devraient être mises au point pour assurer le transfert effectif des patientes à risque vers les centres de référence. Ces mesures devraient notamment prévoir des pénalités ou des incitants financiers, de façon à atteindre progressivement des taux de référence équivalents à ceux atteints par les services NIC.

## UTILISER LES MOYENS PUBLICS DE MANIERE OPTIMALE

- En fonction des recommandations dont question ci dessus, il faut enregistrer le nombre de patientes nécessitant d'être référées et ainsi évaluer les besoins en lits de référence (« MIC beds »);
- Le nombre de lits existants doit progressivement être ajusté aux besoins tels que déterminés ci-dessus.

## AMELIORER L'ACCESSIBILITE DES SERVICES

- La répartition géographique actuelle des hôpitaux disposant d'une fonction P devrait être revue de façon à tendre vers une égalisation des distances à parcourir par les parturientes à risque entre leur domicile et les centres de référence.

# Scientific summary

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| ACOG: | American College of Obstetrics and Gynaecology |
| AHRQ: | Agency for Healthcare Research and Quality. |
| AIM: | Agence InterMutualiste |
| ARDS: | Adult Respiratory Distress Syndrome |
| ATC : | Anatomical Therapeutic Classification |
| BIM : | Bénéficiaire de l'Intervention Majorée (Verhoogde tegemoetkoming) |
| BMI: | Body Mass Index |
| CMV: | CytoMegaloVirus |
| CNK : | Code National - Nationale Kode used by INAMI-RIZIV to identify the medicines |
| DRG: | Diagnostic Related Group |
| EBM: | Evidence Based Medecine |
| ELBW: | Extreme Low Birth Weight |
| EU: | European Union |
| FPS: | Federal Public Service |
| FPZ: | Financiering Perinatale Ziekenhuiszorg |
| FTE: | Full Time Equivalent |
| HDU: | High Dependency Unit |
| HELLP: | Haemolysis Elevated Liver enzymes-Low Platelet count syndrome |
| HSIL: | High-grade Squamous Intraepithelial Lesions |
| ICD-9-CM: | International Classification of Diseases, Ninth Revision, Clinical Modification |
| ICU: | Intensive Care Unit |
| ID : | Identification |
| IMA: | InterMutualistisch Agentschap |
| INAMI : | Institut National d'Assurance Maladie-Invalidité |
| INS : | Institut National de Statistique |
| ITU: | Intensive Therapy Unit |
| IUD: | Intra Uterine Device |
| IUGR: | Intra Uterine Growth Retardation |
| IUT: | Intra Uterine Transport |
| KB: | Koninklijk Besluit |
| KCE: | Kenniscentrum voor de gezondheidszorg – Centre fédéral d'expertise en soins de santé |
| LBW: | Low Birth Weight |
| LOS: | Length Of Stay |
| M: | Maternity |
| MAF : | Maximum Factuur – Maximum à facturer |

| | |
|---|---|
| MeSH: | Medical Subject Headings |
| MIC: | Maternal Intermediate Care |
| MIC: | Maternal Intensive Care |
| MKG: | Minimale Klinische Gegevens |
| MVG: | Minimale Verpleegkundige Gegevens |
| N: | Neonatology |
| NBW: | Normal Birth Weight |
| NIC: | Neonatal Intensive Care |
| NIS: | Nationaal Instituut voor Statistiek |
| OCDE = OECD: | Organisation for economic co operation and development |
| OR: | Odds ratio |
| P10: | Percentile 10 |
| PICO: | Patient, Intervention, Comparison, Outcome |
| PPROM: | Preterm Premature Rupture Of Membranes |
| RCM: | Résumé Clinique Minimum |
| RD: | Royal Decree |
| RHMS: | Réseau Hospitalier de Médecine Sociale |
| RIM: | Résumé Infirmier Minimum |
| RIZIV : | RijksInstituut voor Ziekte- en InvaliditeitsVerzekering |
| SAS: | Statistics Software |
| SD: | Standard Deviation |
| SPE | Studiecentrum voor Perinatale Epidemiologie |
| SW: | South West |
| UK: | United Kingdom |
| VLBW: | Very Low Birth Weight |
| WENZ: | Wetenschappelijke Evaluatie van Neonatale Ziekenhuisvoorzieningen |
| WHO: | World Health Organisation |

# 1 INTRODUCTION

## 1.1 SCOPE OF THIS REPORT

The goal of this report is:" To describe the current performance of the MIC-services in Belgium in order to formulate propositions of efficient utilization of these services".

It is important to point out that the concept 'Maternal Intensive Care' in Belgium is understood as **a level of intermediate care**. The MIC-services in Belgium are not Intensive Care Units (cf. following definition), specialized in peripartum complications. MIC-services provide a level of care between standard and intensive care. Therefore in this report we use the less confusing concept 'Maternal Intermediate Care (MIC)' to refer to intermediate care provided to peripartal women in Belgium.

## 1.2 BACKGROUND

In Belgium, the Maternal Intensive Care (MIC) concept was introduced by law in 1996. The Royal Decree (RD) of Augustus 20th 1996 defines Maternal Intensive Care as follows: "*The MIC-service*[1] *is recognized as a division of the maternity department (index M). This division is dedicated to the intensive observation of high-risk pregnancies. The division also admits in its P* function, patients with a pregnancy at high risk for neonatal observation at a Neonatal Intensive Care (NIC) service and patients who will need highly specialized postpartum care."* The P* function is mandatory constituted by a MIC-service and a NIC (Neonatal Intensive Care) service; the MIC-service will serve as a referral centre for a group of hospitals totalizing a minimum of 5000 deliveries per year; a convention must be signed between each hospital and the MIC-service".

However, the Royal Decree has not precisely defined the statute, nor the function and terms of reference of a MIC-service. Hence, the indications during pregnancy, delivery, or post-partum leading to an admission in a MIC-service are not specified. As a consequence of this opacity, the functioning of the MIC-service is unknown. Do the MIC-services actually act as reference centres? Do they treat women with more severe pathologies than other maternities? Do the MIC-centres improve the quality of obstetrical care? Is the resource allocation optimal?

During the last decade, the number of high-risk pregnancies has been rising and this trend is expected to continue mainly due to advanced maternal age and associated chronic medical conditions, and the increase of multiple gestations [1]. Therefore it is very important to monitor this evolution and develop appropriate strategies for referral of high- risk or complicated pregnancies to the tertiary levels of care.

More than ten years after the publication of the Royal Decree in relation of the MIC, an evaluation was considered essential. A proposal was submitted and accepted by KCE whereby a consortium of universities and experts, in collaboration with the Intermutualistisch Agentschap/Agence Intermutualiste (IMA/AIM) planned to carry out an assessment of the current situation in Belgium about the MIC-service in obstetrical care. The goal of this research project was to collect and analyze data allowing to advise the (health) authorities to optimize maternal and perinatal care in Belgium. The results of this evaluation will be crucial for further reduction of maternal and perinatal morbidity and mortality and to ensure proper use of available resources.

*The purpose of the MIC-service in Belgium described in the Royal Decree. (cf. infra) is: (1)intensive observation of high risk pregnancies, (2)admission of patients where the baby most probably will need intensive care after delivery (intra uterine transport, IUT) and (3)admission of patients who need highly specialised post partum care.*

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[1] Législation et réglementation relative aux hôpitaux – 20 août 1996 . – arrêté royal fixant les normes auxquelles une fonction de soins périnatals régionaux (fonction P*) doit satisfaire pour être agréée (M.B. du 01/10/1996, p.25275) Art 7 http://wallex.wallonie.be/wallexII?PAGEDYN=SIGNTEXT&CODE=168723&IDREV=1&MODE=STATIC

*Koninklijk Besluit (KB) van 01/10/1996, hoofdstuk IV, afdeling 1, Art. 7. :"De Maternal Intensive Care - afdeling is een afdeling van een erkende dienst kraaminrichting (kenletter M). Deze afdeling is gericht op* ***intensieve observatie van hoogrisico zwangerschappen****.*

*Ze staat eveneens open voor patiënten die, wegens het sterke vermoeden dat de foetus na de bevalling* ***intensieve neonatale zorgen*** *zal nodig hebben, bij voorkeur in een P* functie bevallen en voor patiënten die na de bevalling* ***hooggespecialiseerde postpartum*** *zorg vereisen."*

*"La section Maternal Intensive Care est une section d'un service de maternité (index M) agrée. Cette section est axée sur* ***l'observation intensive des grossesses à haut risque****. Elle peut également accueillir les patients qui en raison d'un risque présumé élevé que le fœtus nécessite, après l'accouchement, des* ***soins néonatals intensifs****, préfèrent accoucher dans une fonction P*, ainsi que les patientes qui nécessitent après l'accouchement des* ***soins postpartum hautement spécialisés.***

The functions and purposes of the MIC-services are imprecisely described in the R.D. What is intensive observation? Which are the indications wherefore a baby potentially needs neonatal intensive care? How are high-risk pregnancies defined? When does a patient need highly specialised post partum care?

This legal frame with regard to MIC is not sufficient to guide the daily obstetrical practise. The lack of clearly defined concepts in the R.D. required defining the peripartum continuum.

The concept 'Maternal Intensive Care' in Belgium is understood as **a level of intermediate care**. The MIC-services in Belgium are not Intensive Care Units (cf. definition), specialized in peripartum complications. MIC-services provide a level of care between standard and intensive care (cf. infra). Therefore in this report we use the less confusing concept 'Maternal Intermediate Care (MIC)' to refer to intermediate care provided to peripartal women in Belgium.

Confusions of meanings and differing interpretations are also found in the international literature. Each country has its own system of health care and use a different terminology to refer to MIC. Moreover these country-specific terminology and concepts are scarcely explained in the found studies.

## 1.3 HISTORY, FINANCING AND HEALTH ECONOMIC ASPECTS OF THE MIC

### 1.3.1 Maternal and Neonatal services in Belgium (1987)

By Royal Decree, the maternal and neonatal hospital units in Belgium were reorganised as of January 1, 1988 (R.D. August 15, 1987). The main focus was on the reorganisation of the neonatal care. It was decided, for instance, that newborns who cannot stay with the mother for medical reasons, should either be cared for in a neonatal service (called n–service), located within the maternity department (called M-service) and not in the paediatric department (called E-service) or should be transferred to a neonatal intensive care facility (called N-service). The same Royal Decree divides each maternity department in three units: the delivery unit, the neonatal unit and the ward were mothers and their healthy neonates are cared for.

Based on the new regulation rules, only 18 hospitals in Belgium (among which 8 university hospitals) were allowed to organise this new N-service.

At the same time the hospital financing system was changed to avoid that too many newborns are separated from their mother during the post-partum period in the hospital.

### 1.3.2 The "WENZ"-report (1993)

The reorganisation caused serious commotion within associations of paediatricians, as well as paediatric nurses and some hospital managers.

Following federal elections in 1988, the newly appointed Minister of Health ordered a scientific evaluation of this reorganisation.

This evaluation was given the name: WENZ-study (Wetenschappelijke Evaluatie van Neonatale Ziekenhuisvoorzieningen) and was conducted from 1990 – 1991 (Promotors: L. Cannoodt, A. Pardou and E. Eggermont).

Originally this study intended to evaluate only the neonatal services. The study was prolonged e.g. to also develop the concept of Maternal Intensive Care and to make further policy-recommendations in that connection. The study was published in April 1993, both in Dutch and French[2].

The most important recommendations of the researchers of this so-called WENZ-study were:

A. Each hospital with a maternity department needs to meet certain minimum standards of neonatal care as well.

B. Newborns don't belong in emergency services. There is a need for a neonatal service, located in the maternity department, but under the responsibility of a paediatrician for the medical aspects and a paediatric nurse or midwife (for the nursing aspects of neonatal care)

C. There is a need for an accreditation of an N*-function; separate from the accreditation of the M-service. If a hospital does not meet these accreditation rules, it looses automatically also its accreditation to run an M-service.

D. All newborns who need (even for one day) intensive care should be transferred to a hospital that is accredited for this neonatal intensive care (NIC-service) with at least 15 beds. A few of the existing N-services who fit perfectly in this new concept of NIC-service don't have a M-service on the same campus. It was not recommended that they should be shut down, but it was argued that the government should follow a policy that encourages having both a Maternal Intensive Care unit and an NIC-service at the same campus. Therefore, there is a need for an accreditation of both the MIC-service and the NIC-service simultaneously. Together they form the P*-function.

E. The limited number of MIC-cases does not justify the creation of separate MIC-services. Rather it was recommended to accredit MIC-services with at least 8 beds as part of a larger M-service that meets certain criteria.

F. The WENZ-study emphasised that it is better to transfer the mother before the delivery (called intra-uterine transfer), rather than to transfer the newborn after the delivery, when one can predict that the newborn will need neonatal intensive care. It would therefore be unwise to allow the accreditation of MIC-services in hospitals without a NIC-service.

G. These MIC-services are the best place to also observe some pregnant women with high risks for serious complications at least temporary during the pregnancy.

H. According to the international literature at that time, there is a need of one MIC–service for a region having an average of 10.000 births a year. As none of the Belgian maternities have more than 3.000 births a year, it is clear that each P*-function should be accessible to a larger number of patients than just those followed during pregnancy by the gynaecologists attached to that hospital. In other words, the MIC-service is a tertiary care facility, with a regional function. This means also that those responsible for a good organisation of any given M-service, the local N*-function and the regional P*-function should meet regularly to strive for optimal transfer-policies to and from MIC-services and NIC-services.

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2 Federale diensten voor wetenschappelijke, technische en culturele aangelegenheden. (1993). *Financiering van de perinatale ziekenhuiszorg in België.* Brussel, auteur.

To help them work together in this context a list of maternal pathologies was made for which procedures of consultation were considered necessary concerning conditions and circumstances for intra-uterine transfer.

I. Given the Belgian context it is recommended that any mother has the freedom to choose the accredited MIC-service she wants if she needs maternal intensive care as well as to choose the accredited NIC-service where she wants her child(ren) who need(s) neonatal intensive care, to be treated.

In other words, it is not allowed that any M, N* en P* makes exclusive contracts for transferring these patients among each other.

### 1.3.3 NIC-services in Belgium (1996)

A few years after the publication of the WENZ-report, a new Royal Decree changed the existing accreditation criteria of the n-service into the N*-function, while the N-service were replaced by the NIC-service. At the same time, the new P*-function (regional perinatology) was created. This new function combines the NIC-service and MIC-service which is both located at the same hospital campus.

The new Royal Decree implements almost all recommendations proposed by the WENZ-commission. The most important exception is that this R.D. does not specify the list of maternal pathologies for which written procedures concerning consultation between the chief-clinicians of M-service, the N*-function and the P*-function is deemed necessary.

The Royal Decree of August 1996 also specifies, as recommended, that the MIC-service should be staffed at all times with at least 2 FTE midwives, who are trained on a regular basis in the care of high-risk pregnancies.

Since then, the hospital budget is adjusted for the extra personnel costs in the M-services with an accredited MIC-service.

### 1.3.4 Perinatal Hospital Care (1996)

Hospitals with accredited MIC and NIC-services treat patients that need more intensive care than hospitals with accredited M and N*-services only. They need to be reimbursed separately for these intensive care treatments. This assumes that parameters are found that measure differences in workload and other cost-drivers. This assumes also that mothers and newborns can be classified between those who need intensive care and those who don't.

The Belgian Federal Science Policy Office (previously known as the Federal Office for Scientific, Technical and Cultural Affairs) has financed a research project to develop a more appropriate financing system for perinatal hospital care in Belgium that promotes efficiency and equity in this field. The study (promoters: L. Cannoodt and A. Vleugels) focussed primarily on the financing of neonatal services. In one chapter of this study efforts were made to classify patients that need maternal intensive care versus other maternal care. The list of high-risk pregnancies, developed by the WENZ-commission, (see above 1.2. H.) was translated into codes of ICD-9-CM. As it turned out, it was not possible to determine from the ICD-9-CM codes only whether the patient needed to be transferred to a MIC-service or could be treated in a regular M-service facility. The same analysis was attempted using the minimal nursing data-set ( M.V.G. – R.I.M.) and the physician reimbursement fee schedule (nomenclature). It was concluded that these two classification systems were also not useful to distinguish between MIC– and M-patients.

Therefore, the Obstetrical experts of the FPZ-commission recommended that the Chief Obstetrician of each M-Service should make written agreements with the Chief Obstetrician of at least one MIC-service about the conditions and circumstances where consultation and/or transfer of patients to a MIC-service is recommended, based on the following (translated) classification:

#### *1.3.4.1 Pathologies for which consultation is recommended:*

1. Pre-existing disorders which might influence pregnancy and/or delivery negatively or might be negatively influenced by pregnancy and/or childbirth:
- Diabetes and/or serious endocrinologic disorders like thyroid pathology etc.;
- Renal insufficiency;
- Cardiac disorders, with pulmonary hypertension or mitral suffering;
- Haematologic disorders (oncologic, thrombotic disorders, haemoglobinopathy);
- Respiratory disorders with respiratory limitations (insufficiency, blood gas ).
2. Based on obstetric anamneses:
- Recurrent preterm birth, PPROM (Preterm Premature Rupture Of Membranes);
- Trophoblastic disorders (Choriocarcinoma);
- Recurrent miscarriage;
- Genetic risks or risk for malformation.
3. Pathology developed or discovered during pregnancy:
- Suspicion of foetal malformation(s) and/or growth retardation whereby early treatment is recommended;
- PPROM between, 24 and 30 weeks;
- Iso-immunisation during pregnancy;
- Multiple pregnancies (> 2);
- Maternal malign disorders and serious infections (e.g. hepatitis).
4. During or shortly after childbirth: unexpected complications need to be treated in loco.

#### *1.3.4.2 Pathologies for which consultation and possible transfer is recommended*

1. All situations of increasing seriousness under 1+:
- Pregnancy-induced hypertension with serious impact on mother and child;
- Serious hypertensive disorders before 32 weeks or high risk for foetal distress before 32 weeks (PPROM, preterm labour, placenta praevia);
- Maternal pathology or trauma requiring intensive care or specific expertise (e.g. serious infections: hepatitis, ARDS, pancreatitis,…).

### 1.3.5 MIC-Financing

Each general hospital receives a budget for paying most of the operating costs (physician remuneration not included). In the year 1998 each hospital with an accredited MIC-service, received for the first time an extra amount to pay for the additional required FTE of midwives with experience in high-risk pregnancies who work in the MIC-service.

Since 1999 each general hospital is first assigned a number of points for part of the hospital budget (the so-called B2), based on a series of parameters expressing case-mix and hospital characteristics. Then the value of each point is calculated nationally, and finally the budget for each hospital is calculated.

Each hospital with an accredited MIC-service gets 3.75 points per accredited MIC-bed. For the other M-beds the hospitals get only 1.46 points per calculated appropriate bed [adjusted for average length of stay per DRG (Diagnostic Related Group)].

In other words the additional MIC-budget is worth 2.29 points per accredited MIC-bed. One point is now worth 20,239.10 € (situation July 2006).

## 1.4 OBJECTIVES

The goal of this report is:" To describe the current performance of the MIC-services in Belgium in order to formulate propositions of efficient utilization of these services". The objective of the research is then to carry out an evaluation of a health care service, namely the MIC-services in Belgium.

In order to realise the research objectives, the evaluation of the MIC-services in Belgium was translated into different research questions. The research questions contain four main themes:

1. used (inter)national definitions;
2. effectiveness ;
3. efficiency;
4. equity.

Efficiency (or cost-effectiveness) relates the cost of an intervention to the benefits obtained. Effectiveness describes the benefits of health services measured by improvements in health in a real population. Equity refers to the fair distribution of both the benefits and the burdens of health services.

Within the scope of this study, we will not be able to analyse thoroughly all the dimensions, as some parts of the assessment will require qualitative field surveys. We will also be limited in evaluating the effectiveness of the MIC-services. Actually, measuring outcomes such as maternal mortality is difficult because maternal mortality is a very rare outcome (in Europe between 2.8 and 11.4 per 100,000 live births)[3]. Due to the small number of cases within the so called 'developed world' it is unreasonable to use maternal mortality as a perinatal indicator. Therefore maternal morbidity is generally used as a good indicator to monitor maternal health and thus includes women who suffer from severe maternal complications (near miss) [2] [3] [4]

Also, the cause of death or morbidity of the neonate depends as much of quality of care as of underlying pathology. Hence, in this part of the project, mainly process indicators will be measured and outcome indicators will be taken into account where possible.

We will then concentrate on the following objectives:

- Measuring effectiveness through process outcomes;
- Measuring efficiency;
- Measuring equity of (geographical) access to care.

## 1.5 RESEARCH QUESTIONS

Research questions developed to reach the objectives:

1. Definitions used in Belgium and European countries
   - 1.1 What are the definitions of high-risk pregnancy, MIC-beds and MIC-services?
   - 1.2 What are the goals of the care given on MIC-services?
   - 1.3 What are the criteria for admission of women in a MIC-bed?
2. Effectiveness
   - 2.1 What are the obstetrical pathologies and risk factors that lead to admission in MIC-service?
   - 2.2 Do evidence-based guidelines to evaluate and treat patients in MIC-services exist?
   - 2.3 Do guidelines for admission and transfers of women in MIC-services exist?
   - 2.4 What are the systems used to register activity (including transfers)?

[3] Alexander et al. Maternal health outcomes in Europe, Eur J Obstet Gynecol Reprod Biol. 2003 Nov 28;111 Suppl 1:S78-87, table 1.

3. Efficiency
    - 3.1 How are MIC-services financed?
    - 3.2 How are they staffed?
    - 3.3 What are the costs of a MIC-bed compared to other maternity beds?
    - 3.4 What is the case-mix actually treated in MIC-beds?
    - 3.5 Do the MIC-services act as reference centre for other maternities?
    - 3.6 What is the length of stay?
    - 3.7 What is the beds occupation rate?
    - 3.8 What is the cost of these stays?
    - 3.9 Do we have indicators to measure cost-effectiveness of MIC-services?
4. Equity
    - 4.1 What is the epidemiology of obstetrical problems and risks in Belgium?
    - 4.2 What is the need of intensive maternity care?
    - 4.3 Does the offer of care address these needs?
    - 4.4 How many MIC-beds do exist in Belgium?
    - 4.5 How are they attributed to hospitals: coincidentally, according to geographical criteria, according to the pathology treated by the hospital or other criteria?
    - 4.6 What are the criteria of distribution to the country?
    - 4.7 Do all the women with high-risk pregnancy or obstetrical problem have equal access to high quality care in MIC-services? Is there any barrier of access to care?

# 2 METHODOLOGY

The strategy to address the research questions consists of: a literature review, descriptive analysis of available datasets, construction of a theoretical model for indications for MIC-admission, the application of this same theoretical model on the same datasets and analysis of this data.

## 2.1 LITERATURE REVIEW

First, an extensive search of all the relevant scientific and grey **literature** concerning the research topic was carried out. A review of the literature on obstetric pathology as related to intensive/intermediate care services, the study of the national and international literature was performed to find information about the obstetrical epidemiology and needs of intensive/intermediate obstetric care. The systematic literature review tried to answer the following research questions:

1. Definitions (national and international)
   - 1.1. What are the definitions of high-risk pregnancy, MIC-beds and MIC-services?
   - 1.2. What are the goals of the care given on MIC-services?
   - 1.3. What are the criteria for admission of women in a MIC-bed?
2. Effectiveness (epidemiology & guidelines)
   - 2.1. What are the obstetrical pathologies and risk factors that lead to admission in MIC-services?
   - 2.2. Do evidence-based guidelines to evaluate and treat patients in MIC-services exist?
   - 2.3. Do guidelines for admission and transfers of women in MIC-services exist?
3. Efficiency (grey literature)
   - 3.1. How are MIC-services financed?
   - 3.2. How are they staffed?

## 2.2 DESCRIPTION AND ANALYSIS AVAILABLE DATABASE

On the other hand a description and analysis of the available datasets was carried out. Therefore, the reports yearly collected by the FPS (Ministry of Health) were first analysed. A database containing information of the medical registration [MKG/RCM (Minimale Klinische Gegevens/Résumé Clinique Minimale)] and information from the 'sickness funds' (social security insurance companies) was then constructed. This part of the study tried to answer the following research questions:

- Effectiveness
  - What are the systems used to register activity (including transfers)?
- Efficiency:
  - What are the costs of a MIC-bed compared to other maternity beds?
  - What is the case-mix actually treated in MIC-beds?
  - Do the MIC-services act as reference centre for other maternities?
  - What is the length of stay?
  - What is the beds occupation rate?
  - What is the cost of these stays?
  - Do we have indicators to measure cost-effectiveness of M-services?

- Equity
    - What is the epidemiology of obstetrical problems and risks in Belgium?
    - What is the need of intensive maternity care?
    - Does the offer of care address these needs?
    - How many MIC-beds do exist in Belgium?
    - How are they attributed to hospitals: coincidentally, according to geographical criteria, according to the pathology treated by the hospital or other criteria?
    - What are the criteria of distribution to the country?
    - Do all the women with high-risk pregnancy or obstetrical problem have equal access to high quality care in MIC-services? Is there any barrier of access to care?

A descriptive statistics analysis was performed including:

- at the **maternity level**: number of maternities; types (With MIC-beds, with isolated NIC-beds and others); geographical situation; number of maternity beds, number of MIC-beds and proportion of MIC-beds per maternity.

- at the **mother level**: age, socioeconomic characteristics, place of residence, mode of delivery, length of stay (and number of in-patients stays), frequency of ICD-9-CM codes (primary and secondary) during hospitalization, transfers, mortality.

- at the **newborn level**: status (stillborn or alive), in-hospital mortality, birth weight, gestational age, Apgar score, stay in a NIC or N* department.

Secondly, the differences between maternities with MIC- and without MIC-services in terms of mother and newborn characteristics were analyzed. Student *t*-test and chi square test were used to assess differences in distributions of continuous and categorical variables, respectively. To assess the link between MIC-beds supply and utilization, the proportion of "intermediate care" women who delivered in maternities with MIC-services with the proportion of MIC-beds were compared and stratified by province and hospital.

## 2.3 CONSTRUCTION OF THE THEORETICAL MODEL OF INDICATIONS FOR MIC-ADMISSION

Whereas delineating obstetrical pathology is a challenging exercise by itself, it proved even more difficult to translate distinct pathologies into sufficiently specific ICD-9 codes. An extensive search for guidelines and evidence concerning obstetric intermediate care showed low accuracy of classifications of obstetrical pathology in relation to MIC. Therefore we decided to develop a theoretical frame of indication for maternal intermediate care admission based on a clinically designed list.

## 2.4 APPLYING THE THEORETICAL MODEL TO THE DATA

An algorithm based on the theoretical model was applied on the data and a bivariate analysis was conducted. Multivariate analysis was performed by logistic regression. The dependent variable was "admission in MIC-service" and the independent zones are: the categories of care (intermediate care, standard and grey zone), the mode of delivery, the age in 5 years category, the socioeconomic status and the median distance in kilometres to reach a maternity with MIC-service.

## 2.5 DISCUSSION AND CONCLUSION

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

# 3 LITERATURE REVIEW

## 3.1 MIC-DEFINITIONS

An exploring literature search was performed first. This preparatory phase gave a clear global view on the available literature concerning 'maternal intensive care' (MIC). Therefore keywords and meanings of what is understood under the concept 'maternal intensive care' were identified.
We started with this explorative limited review of the literature in Pubmed (used **keywords**: maternal intensive care unit, critically ill obstetric patient, severe maternal morbidity, near miss maternal mortality). Approximately 30 papers were retrieved and served as a basis for a more detailed search.

The search strategy for the second and more extensive search is showed underneath. The in depth literature search was based an extensive search in OVID Medline (access KCE and Central library UGent), Embase (access KCE) Cochrane (access Central library UGent) and CINHAL (access Central library UGent).

The searches were systematically updated during the research process. The last update took place when we completed the final revisions to the report.

### 3.1.1 Search strategy

We started our literature search with OVID MEDLINE and applied the same strategy on Embase, Cochrane and CINHAL. The MeSH terms/keywords used and the detailed flow chart of the literature searches are presented in the appendix. The different steps followed were: enter MeSH terms/keywords in selected databases, title and abstract evaluation (selection criteria underneath), full text evaluation, critical appraisal and selection of articles.

The Medline search retrieved 125 articles potentially relevant and 92 articles were included after resetting the limits of publication year from 1997 to 2007. The Embase search retrieved 46 articles potentially relevant and 44 articles were included after resetting the limits of publication year from 1997 to 2007. The Cochrane search resulted in 9 potential relevant articles, none was selected. The CINHAL search did not result in any potential relevant article.

The **selection criteria** used for the title and abstract evaluation were:

- Removing double articles;
- Limits: human, English Dutch and French, publication years 1995-2007;
- No comments and case reports;
- No specific 'intensive care' research [articles that describe research on mechanical ventilation, multiple organ support, invasive monitoring and artificial life support were excluded, see definition of intensive care];
- No specific 'neonatological' research [articles describing research on science in medically caring for the newborn were excluded (for example research about growth retardation and very low birth weight)];
- No 'infertility' research [article on specific research on infertility were excluded (for example ovarian hyperstimulation syndrome)].

During the full text evaluation of the selected articles, hand search retrieved one article of high relevance, written by Zeeman. [5] This systematic literature review evaluated 30 articles about obstetric intensive and intermediate care. Due to the high relevance of this literature review we retrieved all the Zeeman's selected studies by hand search.

During the writing process of this report we also found articles through the snowball-method. A detailed overview of all those selected articles is given in upper mentioned annex.

### 3.1.2 Critical appraisal

The critical appraisal of the selected articles (after full text evaluation) was based on the checklist for observational studies from the AHRQ (Agency for Healthcare Research and Quality). To evaluate the quality of the small number of selected guidelines (due to the lack of relevant guidelines) we used the AGREE-instrument. Two individual researchers[4] performed separately the assessment of the selected studies, the result of the final selection is presented in an evidence table (see annexes) with a summary of the selected articles.

The hierarchy of articles goes down from: Cochrane review, systematic review, review (based on the levels of evidence), randomized controlled trial, controlled clinical trial. Most of the articles are level 3 articles (no-experimental descriptive research with a good design: comparative research, correlation research and case-studies) or level 4 (report of expert groups, expert opinions, clinical experience of respected authorities).

After detailed evaluation, full text evaluation and critical appraisal, 12 articles were selected from Medline, 2 from Embase and not any from Cochrane library. The search in the CINHAL database did not result in any potential relevant article.

### 3.1.3 Methodology construction of definitions

Due to the lack of literature, unambiguous definitions and evidence, we needed an alternative approach to obtain a definition that could serve as a basis for our research.

The definitions were constructed by the means of the Delphi-method. A written proposition was made and sent to all the partners of the research group. They commented on the preliminary version and all of these comments were gathered and discussed in a meeting. After the meeting a reworked written proposal was made and the whole procedure was repeated. To obtain consensus, we had 4 rounds and consequently the definitions were mainly expert-based.

In the underneath results-section we present the most important findings from our literature search.

### 3.1.4 Results

We like to point out that the concept Maternal Intensive Care is in Belgium understood as **a level of intermediate care**. The MIC-services in Belgium are not Intensive Care Units (cf. definition), specialized in peripartum complications. MIC-services provide a level of care between standard and intensive care (cf. infra). Therefore in this report we use the less confusing concept 'Maternal Intermediate Care (MIC)' to refer to intermediate care provided to peripartal women in Belgium.

This confusion of meanings and different interpretations is also found in the international literature. Every country has its own system of health care and terminology to refer to what we understand in Belgium as MIC. Moreover these country-specific terminology and concepts are scarcely explained in the found studies. This is probably due to the obviousness of these different health care contexts to the authors.

The concept 'maternal intermediate/intensive care' was not found elsewhere. We did found concepts referring in a certain sense to what ranges under MIC namely: high-dependency care, maternity high-dependency care, obstetrical intermediate care, emergency obstetric care, and obstetric critical care, intensive care in obstetrics, maternity recovery ward, obstetric services, and operative obstetric services.

Terms that refer to the MIC-service are: intensive care unit, intensive therapy unit, high dependency unit, maternal high dependency unit, post anaesthesia care unit, critical care obstetric unit, maternity recovery ward, obstetrical intermediate care unit, high-risk antepartum unit, maternal-foetal ICU's, consultant obstetric units, recovery area for obstetric patients, obstetrical ICU's, obstetric hospital [1, 5-8].

4 dr. Hans Verstraelen and Ms. Van Parys.

The concepts referring to certain aspects of obstetrical intermediate care and intensive are used mixed, depending on the country-specific health care organisation.

For example in some countries mechanical ventilation is a part of obstetrical high dependency care and in others it is only located within the intensive care unit.

This report focuses on the 'intermediate care' concept, but the variety of meanings and the limited amount of intermediate care research, obliged to also study several forms of intensive care. Hence, an outline of the broad scope of levels of care for maternal morbidity was not found.

As an answer to all the etymologic confusion, we will try to give a clear picture of all the concepts within the 'peripartum continuum'.

### *A. Peripartum Continuum*

As an answer to all the etymologic confusion, a clear picture of the concepts within the 'peripartum continuum' is given.

Intensive observation of obstetrical patients (MIC) can be required by different situations and pathologies. These form a continuum of severity ranging from low-risk physiologic pregnancy[5] > morbidity [6]> severe morbidity[7] > near miss[8] > death[9]. The extremes of this continuum are reasonably easy to demarcate, but identifying the concepts in-between is less obvious. Clear thresholds at which a woman can be categorised as having a severe morbidity or as a near miss are difficult to define. The reason why a woman progresses from one category to another is even harder to demarcate [3].

The last 15 years several reports from centres all over the world described the characteristics and treatment of critically ill pregnant or puerperal women.

Studies report significant variations in patient populations, definitions of major morbidity, ICU (Intensive Care Unit) admission criteria, utilisation rates, treatment and outcomes, hospital settings, nursing policies, and management protocols [5]. It is then not straightforward to compare the Belgian MIC-situation to the international obstetrical high-risk population and management.

Most of the published international literature about pregnancy complications and (severe) maternal morbidity deals with intensive care for peripartal women. Systems of care applicable to the general (non-obstetrical) critical care have been extrapolated to pregnant patients [9, 10]. Models or detailed guidelines from any specialty organisation describing the plan of care of critically ill obstetric patients do not exist [5].

It results clearly from our systematic literature search that reliable evidence based definitions and guidelines for obstetrical intensive/intermediate care are lacking.

### *B. Standard Care*

Van Zelm et al (1995) describe standard care as care that is no medium or intensive care and can be delivered by nurses/midwives with a basis nursing/midwifery degree. A midwife is trained and capable to care for women with a normal, physiological and low-risk pregnancy and childbirth[10].

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5 Low-risk is understood as a pregnancy without any risk before and after pregnancy (Lodewyckx et al, 2004).

6 Morbidity: A diseased condition or state, the incidence of a disease or of all diseases in a population (University of Newcastle, 1997).

7 Severe acute maternal morbidity: "a very ill pregnant or recently delivered woman who would have died had it not been that luck en good care was on here side" (Say, L., Pattison, R.C. & Gülmezoglu, M.A., 2004)

8 Near miss: "acute organ system dysfunction which if not treated appropriately could result in death (Wagaarachchi, P.T. & Fernando, L., 2001) Near miss: "… a narrow category of morbidity encompassing potentially life-threatening episodes" (Geller et al., 2002)

10 A normal childbirth is according to the WHO (2003): "…spontaneous in onset, low-risk at the start of labour and remaining so throughout labour and delivery. The infant is born spontaneously in the vertex position between 37 and 42 completed weeks of pregnancy. After birth mother and infant are in good condition".

Low-risk is understood as a pregnancy **without any risk** before and after pregnancy (see table). Collaboration with a specialist obstetrician is required when any of the risk factors is found[11]. The absence of the underneath risk factors during the perinatal period demarcate a woman as low-risk. In other words the risk factors in the underneath table give a limited indication of factors that require more than standard care.

**Table 1: List of risk factors that require additional care, not limitative (translation of list in KCE report 6A)**

**General risk factors**

Age under 16 or above 40 years, BMI under 18 or above 35, suboptimal socio-economic conditions, risk-behaviour: smoking, alcohol and drug use, use of medication, risks at work, other risk factors of personal, family or genetic nature

**Clinical examination and history**

- **Medical**: cardio-vascular disorders, hypertension, thrombosis, lung embolism, kidney disorders, metabolic disorders, thromboembolic disorders, neurologic disorders, lung disorders, haematologic disorders, auto-immune disorders, malign disorders, serious infections, psychiatric disorders and any other pre-existing disorder that is relevant during pregnancy
- **Gynaecologic:** disorders of the uterus anatomy, operations, deviant cytology, disorders of the pelvis, abnormalities of the pelvic diaphragm , IUD, history of mutilation/circumcision
- **Obstetric:** complicated obstetric history, rhesus/iso immunisation, blood group antagonism, repeated miscarriage, cervix insufficiency, cerclage, pre-eclampsia, HELLP (Haemolysis Elevated Liver enzymes-Low Platelet count syndrome), prenatal blood loss, preterm birth, problematic growth of the foetus, Caesarean section, big multiparae, serious perinatal morbidity, difficult delivery, postpartum psychosis or –depression

**Risks current pregnancy**

- **General: l**ate entry prenatal care, psychiatric disorder, adoptive child
- **Medical:** hyperemesis gravidarum, gestational diabetes, gestational hypertension, thrombo-embotic disorder, coagulation disorder, malign disorders, infectious disorders
- **Obstetric:** amniocentesis, chorion villi sampling, multiple pregnancy, intra-uterine death, threatening preterm birth, cervix insufficiency, blood loss, abruptio placentae, loss of amniotic fluid, negative or positive discongruence, symphysiolysis, obstetric relevant uterus myomatosus, rhesus/iso immunisation, blood group antagonism, abnormal cervixcytology (HSIL), serotinity

The ACOG (American College of Obstetrics and Gynaecology) guidelines of perinatal care (2002) mention three levels of in-hospital perinatal care. (cf. supra.): basic care (level I), specialty care (level II) and subspecialty care (level III). Basic care is more or less comparable with standard Belgian in-hospital obstetrical care; the two other levels will be discussed in the 'intermediate care' section.

- Surveillance and care of all patients admitted to the obstetric service, with an established triage system for identifying high-risk patients who should be transferred to a facility that provide specialty or subspecialty care;
- Proper detection and initial care of unanticipated maternal-foetal problems that occur during labour and delivery;
- Capability to begin an emergency caesarean delivery within 30 minutes of the decision;
- Availability of appropriate anaesthesia, radiology, ultrasound, laboratory, and blood bank services on a 24 hours basis;

11 Lodewyckx K, Peeters G, Spitz B, et al. KCE reports 6A: Nationale richtlijn prenatale zorg. Een basis voor een klinisch pad voor de opvolging van zwangerschappen. Brussel: KCE, 24.12.2004

- Care of postpartum conditions;
- Resuscitation and stabilisation of all neonates born in the hospital;
- Evaluation and continuing care of healthy neonates in a nursery or with their mothers until discharge;
- Adequate nursery facilities and support for stabilisation of small or ill neonates before transfer to a specialty of subspecialty facility;
- Consultation and transfer arrangements;
- Parent-sibling-neonate visitation;
- Data collection and retrieval.

Some basic care facilities may provide continuing care for neonates who have minor problems. Many basic care facilities provide care for convalescing neonates who have been transferred from specialty and subspecialty facilities.

### *C. Intermediate Care*

#### INTRODUCTION

Health care organisations around the globe need to cope with a rising demand for care, scientific evolutions (evidence based), the increasing costs and limited budgets, limited beds, insufficient medical and paramedical personnel. These restrictions stimulate health care managers and policymakers to reorganise their healthcare services more efficiently. An example of a 'new' health care structure is the 'graded care' structure [11, 12] . Beside the already existing general ward and ICU, another structure was introduced: the intermediate care service. These intermediate care units (also termed high-dependency or step-up/step-down units) have generally a higher nurse/patient ratio and more facilities for intensive monitoring than a general ward, but fewer staff and less invasive equipment than on an ICU. This facility is required for patients too sick for care on a general ward, to step up to care intermediate between that on a general ward and the ICU, and for others appropriate to step down from ICU to a general ward. Such areas cater for patients who do not require full ICU care but are thought to need more care than could be offered on the general ward.

Intermediate care services have been adopted by some hospitals, for specific patient groups e.g. paediatrics, obstetrics. The use of these services is promoted to enable earlier discharge of some ICU patients and to provide an alternative to intensive care and thus freeing ICU-beds. There are few, if any prospective studies on the benefits of intensive versus intermediate care which provide objective and hence comparable admission and discharge criteria [13].

Our systematic literature review did not result in a consensus definition of obstetric intermediate care (~MIC). Variation within the definitions used is due to large differences between the organisational structures of the individual perinatal care settings. Therefore, we decided to integrate several definitions into a self-constructed definition applicable to the Belgian MIC-context (see conclusion of this chapter). The underneath paragraphs give an overview of the most relevant definitions that served as a basis for our own definition. The American guidelines of perinatal care and the article from Lee and colleagues [7] are mentioned separately as they acted as a point of reference.

#### GENERAL INTERMEDIATE CARE DEFINITIONS

Nasraway [14] identified in their 'Guidelines on admission and discharge for adult intermediate care services' a patient population that does not require intensive care but needs more care than that provided on a general ward. These patients may require frequent monitoring of vital signs and/or nursing interventions, but usually do not require invasive monitoring.

In a study from Zimmerman[15] 6,180 patients of 17,440 ICU admissions, were admitted strictly for intensive monitoring, although they had a <10% risk for requiring active treatment based on this monitoring. As a consequence, intermediate care has been proposed as a more appropriate means of resource utilization for these patients.

Nasraway [14] stated that intermediate care areas can be represented as multipurpose "progressive care units" or as single-organ subspecialty floors such as cardiac telemetry, surgical (thoracic, vascular, etc), neurosurgical/neurological monitoring areas, or chronic ventilator respiratory care units.

The intermediate care service serves as a place for the monitoring and care of patients with moderate or potentially severe physiologic instability, requiring technical support but not necessarily artificial life support. The intermediate care service is reserved for those patients requiring less care than standard intensive care, but more than that which is available from ward care [14]

High dependency care was defined by [16] as appropriate for patients requiring only basic respiratory support or the support of only one other organ system.

We would like to remark that most definitions of intermediate care (cf. infra) state that respiratory support does not belong on an intermediate care level. Only a few authors, mainly from within the UK, state that basic respiratory support can take place on an intermediate care level.

"High-dependence care is a level of care intermediate between care on a general ward and that on an ICU. Such care involves the monitoring and support of patients with (or likely to develop) acute on acute-on-chronic single organ failure and 'step-up' or 'step-down' support between levels of care, although not those requiring multiple organ support or mechanical ventilation. Postoperative care exceeding a few hours is highlighted as an appropriate indication for (or definition of) high-dependency care. An average ratio of one to two is specified, together with 'continuous availability' of trainee medical staff (Department of Health/NHS London, 1996). "

**OBSTETRIC INTERMEDIATE CARE DEFINITIONS**

Owing to their specific problems, combined with the frequent shortage of costly ICU-beds, some have suggested that obstetric patients should be referred to specialized obstetric ITU's (Intensive Therapy Units). Two large descriptive reports [16], [17] support this suggestion showing that about half of all women were thought to necessitate ICU admission, whereas the remaining half were thought to be suitable for intermediate or high dependency care [5, 18].

In other words, half of the women in the upper research population were admitted to the ICU but did not really needed intensive care as given on an ICU, with all due financial and psychosocial consequences.

"Patients who did not need advanced respiratory support, two or more organ system support and those with chronic system insufficiency and requiring support for acute reversible failure of another organ system were deemed suitable for high dependency unit care (HDU) intermediate care." [17]

"The intermediate or high dependency care unit may be appropriate for patients who are conscious and who have a single-organ dysfunction." [5]

"HDU's have not been assessed formally for obstetric patients; however, several referral centers have actually incorporated these concepts. In this environment, care is provided by one nurse to two patients and usually supervised by maternal-foetal medicine specialists and obstetric anaesthesiologists rather than by intensive care specialists."[5, 18]

"An HDU facility may be appropriate for patients who are conscious and who have a single organ dysfunction. In a HDU environment care is provided by one nurse to two patients and usually supervised by obstetricians rather than by intensive care specialists.

Patients who might have been admitted to an HDU include those with haemorrhage who did not require blood products or invasive monitoring and those with hypertension that were admitted for observation and nursing care." [18]

### ACOG GUIDELINES

In this chapter we point out the American guidelines of perinatal care. These guidelines are written by the American College of Obstetrics and Gynaecology and published in 2002.

We would like to remark that the American healthcare organisation, training and management differ considerably from the European. Therefore it is not possible to adopt these guidelines.

It are quite general guidelines and lack of specificity. Nevertheless, these are important guidelines and can be interesting a point of reference.

As mentioned above the ACOG guidelines of perinatal care (2002) mention three levels of in-hospital perinatal care: basic care (level I), specialty care (level II) and subspecialty care (level III). Subspecialty care is more or less comparable with intermediate (MIC) care. The guidelines for specialty care (level II) apply only for the Neonatal Intensive Care (NIC). The subspecialty guidelines (level III) cover the concept perinatal care and deal with maternal as well as neonatal levels care (more or less comparable to our Belgian P* function).

Subspecialty care (level III):

- Provision of comprehensive perinatal care services for both admitted and transferred women and neonates of all risk categories including basic and specialty care services as described previously;
- Evaluation of new technologies and therapies;
- Data collection and retrieval.

The services provided by a subspecialty care facility vary markedly from those at a specialty facility. Subspecialty care services include expertise in neonatal and maternal-foetal medicine. Both are usually required for management of pregnancies with threatened maternal complications at less than 32 weeks of gestation. Foetuses that may require immediate complex care should be delivered at a subspecialty care centre.
In circumstances where subspecialty level of maternal care is needed, the level of care subsequently needed by the neonate may prove to be at the basic or specialty level. It is difficult to predict accurately all neonatal risk and outcomes before birth. Appropriate assessment and consultation should be used, considering the potential risks of the woman as well.

### FORUM ON MATERNITY AND THE NEWBORN OF THE ROYAL SOCIETY OF MEDICINE

We want to focus an article published in The Midwives Journal of the Royal College of Midwives [7]. This article was the result of the challenges of setting up a designated high dependency/recovery unit (HDU) within a maternity service. Interesting in this article is that the authors (HDU working party consisting of obstetricians, physicians, midwives, anaesthetists and neonatologists) extensively describe their definition of intermediate care, the organisational aspects (staffing & training, …) and admission criteria. This situation is somewhat similar to the Belgian MIC-structure.

The authors agreed (as many others did, cf. supra) that the HDU would exist for patients requiring more observation and/or nursing care than on a general ward. It would not normally include patients requiring ventilation or invasive monitoring.

The service would exist for patients too sick to be cared for on a general ward to step up in care intermediate to that on a the ICU, and for others where appropriate to step down from ICU to HDU.

The aim of their maternity recovery/HDU is to offer women and their families a consistently high level of individual, medical, and psychological care delivered by staff who understands the physiology and pathology unique to obstetric patients. The levels of care are defined as follows:

- Care level one (recovery): patients at risk of deterioration in their conditions, or those recently relocated from higher levels of care, whose needs can be met on an acute ward with advice and support from the critical care team;

- Care level two (HDU): patients requiring more detailed observation or intervention, including post-operative care or support for a single organ system, and those stepping down from a higher level of care.

### *D. Intensive Care*

In contrast with the lack of consensus concerning the definition of intermediate care, there seems to be a broad consensus about the definition of intensive care. Below we cite the most relevant definitions of general and obstetric intensive care:

"Intensive care is appropriate for patients requiring or likely to require advanced respiratory support, patients requiring support of two or more organ systems, and patients with chronic impairment of one or more organ systems who also require support for an acute reversible failure of another organ [16]."

Intensive care is advanced and highly specialized care provided to medical or surgical patients whose conditions are life-threatening and require comprehensive care and constant monitoring. It is usually administered in specially equipped units of a health care facility (Medical Subject Headings (MeSH), consulted on 22/03/07, www.pubmed.gov ; online medical dictionary, consulted on 26/03/2007, http://cancerweb.ncl.ac.uk/omd/)

#### INTENSIVE CARE UNIT

Intensive Care unit:" A service for patients with potentially recoverable conditions who can benefit from more detailed observation and intensive treatment than can safely be provided in general wards or high-dependency areas.

A minimal nurse-patient ratio of one to one is specified, together with 24-hours dedicated cover by resident trainee medical staff (Department of Health/NHS London, 1996).

Intensive Care Unit: "A hospital facility for provision of intensive nursing and medical care of critically ill patients, characterised by high quality and quantity of continuous nursing and medical supervision and by use of sophisticated monitoring and resuscitative equipment; may be organised for the care of specific patient groups, e.g., neonatal or newborn ICU, neurological ICU, pulmonary ICU." (MeSH, consulted on 22/03/07, www.pubmed.gov; online medical dictionary, consulted on 26/03/2007, http://cancerweb.ncl.ac.uk/omd/).

#### OBSTETRIC INTENSIVE CARE DEFINITIONS

As mentioned above, there are no specific definitions for obstetrical intensive care. Systems, guidelines and definitions applicable to general critical care population have been extrapolated to obstetric population. This is also what the authors of the following definition did.

Mirghani et al [17] audited the obstetric admissions to the ICU in tertiary referral teaching hospital in the United Arab Emirates between 1997 and 2002. The patients were divided into two groups, based on the severity of their illness and need for organ support.

"Patients requiring advanced respiratory support, two or more organ system support and those with chronic system insufficiency and requiring support for acute reversible failure of another organ system where considered genuinely to need ICU admission."

The criteria for admission on a (obstetric or general) ICU are very clear, there is a large consensus among clinicians and researchers. The admission criteria and definition of intensive care is care-based. In other words patients require intensive care when they need mechanical ventilation and/or multiple organ support and/or invasive monitoring and/or artificial life support.

## 3.2 EPIDEMIOLOGY OF SEVERE MATERNAL MORBIDITY

The main objective will be to present the most important types of morbidity, both in terms of burden of the disease and in terms of their prevalence.

The following four step conceptual path has been followed.

1. Which are the conditions most associated with maternal death and what is their incidence?
2. What are the conceptual approaches to severe morbidity?
3. What are the data regarding these conditions in patients which did not die (disease based approach to severe morbidity)?
4. What are the data available regarding conditions in women admitted to intensive care (ICU) and high dependency (HDU) units?

### 3.2.1 Search strategy

The following search strategy has been utilised.

**For maternal death**, the three most recent **confidential enquiries** for the UK have been used. These give more detailed data than any other publication (see chapter 1 literature review). Confidential enquiries from France and the Netherlands were also accessed but not used for the final data.

**For severe maternal morbidity and for ICU/HDU** the following **electronic databases** were searched to identify relevant publications:

Ovid MEDLINE(R) 1996 to June Week 2 2007

Ovid EBM Reviews-Cochrane Central Register of Controlled Trials 1st Quarter 2007

Ovid EBM Reviews-Cochrane Database of Systematic Reviews 4th Quarter 2007

Ovid EBM Review-Database of Abstracts of Reviews of Effects 4th Quarter 2007

The search strategy was used for MEDLINE and adapted to suit the other databases. Unless otherwise stated, search terms are MeSH terms (Medical Subject Heading). The exp. prefix indicates exploded MeSH terms. MeSH terms are combined with free text terms (.tw) searched in all of the fields in the databases which contain text words and which are appropriate for the subject. Text word index in Ovid MEDLINE (R) includes titles and abstracts. The dollar sign ($) stands for any character(s).

The P.I.C.O.(Patient, Intervention, Comparison, Outcome) model for clinical questions was used to isolate the two concepts to be searched separately 1) High-risk pregnancies, near-miss conditions, severe morbidity; 2) Intensive and high dependency care.

### 3.2.2 Critical appraisal

After removal of duplicates, 524 references were retained from the different MEDLINE searches (1996-2007) and scanned for relevance. Articles were rejected on initial screen when neither titles, abstracts nor MeSH terms met the inclusion criteria. The remaining 212 articles were thus evaluated for inclusion in the current review.

The EBM Reviews databases did not contain any relevant publication.

From these extracted list and draft analysis, we finally integrated the data of 22 population based studies with a total birth base of more than 10000 births.

Contact was made with the EU Peristat group working on the same topic, who shared a recent review of the literature with us (see annex).

### 3.2.3 Results

#### *A. Main causes of maternal death*

These can be divided into obstetrical and non obstetrical (cf. supra). Only the 1st category will be considered, as the other conditions are less likely to be admitted to intensive care or high dependency units.

The following are the leading causes and prevalence (per million) of maternal death over the last published nine years.

- Direct causes
    - Thrombosis and thromboembolism 16.0
    - Hypertensive disease of pregnancy 7.5
    - Haemorrhage 7.5
    - Amniotic fluid embolism 3.8
    - Early Pregnancy 7.2
    - Sepsis 6.6
    - Uterine trauma 3.7
    - Anaesthesia 2.6
- Indirect causes
    - Cardiac indirect 15.0
    - Psychiatric indirect 20.0
    - Cancer indirect 4.2
    - Other indirect 36.0

In effect many of these conditions are very dramatic, and it would be unusual for the patient to be admitted for a long duration stay prior to the development of the condition in most cases. The most notable exceptions to this assumption are probably the indirect cardiac and psychiatric deaths, but it can be hypothesised that such cases would mostly not be admitted to a MIC.

We consequently conclude that the examination of maternal deaths gives good information about the causes of deaths, but does not contribute much to decisions regarding the needs for maternal intensive and high dependency care.

We therefore proceeded to analyse published reports of maternal morbidity, attempting to restrict the review to severe morbidity. This was done in three steps:1) analysis of the wording in use to distinguish severe from non severe morbidity and conceptualisation of indicators; 2) review of published data in relation to hospitalisation or to population based reporting, and 3) finally, for certain conditions specific papers on the topic have been included.

#### *B. Conceptualisation of severe morbidity and wording in use*

This section is largely inspired by the work which has been done within the PERISTAT European Union group working group on maternal morbidity. Much of the primary work related to disease, management or organ classification was due to Geller and associates, [3] [2] and is in effect an extension to maternal and child health of concepts already used in adult intensive care. Four concepts will be addressed: disease based definitions, management based definitions, organ failure based definitions and combined approach definitions.

#### *C. Disease-based definitions of maternal morbidity*

A common approach among studies is to use definitions based on disease-specific morbidities.

Examples of these can be found in the MOMS-B EU study, which used common definitions for given conditions (severe preeclampsia, sepsis and haemorrhage which were then prospectively collected during a 12 month in 11 regions of Europe [19].

#### ADVANTAGES AND DISADVANTAGES

The criteria are easy to interpret, and the quality of care for a particular disease can be assessed. Also, data can be collected retrospectively from case notes or registers, providing population-based estimates for maternal morbidity. On the negative side, this approach yields the highest number of non-severe morbidities, as well as hospitalizations that are not related to the health of the mother. Accordingly, estimates of maternal morbidity using disease-based criteria are higher than among studies using other definition types. A systematic review of studies of maternal morbidity by the World Health Organization observed that rates were higher in studies using disease-based criteria as compared to those using organ system-based definitions, suggesting less specificity in identifying near-miss cases [20]. Another disadvantage is that trends over time may reflect trends in organization of care and hospitalization for particular conditions.

An example of this might be insulin requiring gestational diabetes, a condition which has increased in prevalence while decreasing in occupancy of hospital beds over the last decades.

The reason of this apparent paradox is that it used to be recommended to admit these patients, but now the accent is put on domiciliary management, eventually with home visits.

Another issue related with disease as the underlying concept is that there may occur diagnostic bias when more advanced technology is available, as with pulmonary embolism, the prevalence of which will directly reflect the use of ventilation perfusion scan.

The prevalence will therefore be directly related to the quality and acceptability of the definitions used, and will require on-going audit in routine systems, or good monitoring in ad hoc surveys.

### *D. Management-based definitions of maternal morbidity*

Admission to an intensive care unit or the requirement of critical care has been used in most developed countries to identify near-miss morbidity. However, other interventions such as peri-partum laparotomy, embolisation, ventilation, or massive blood transfusion and others have also been used to define near-miss cases.

#### ADVANTAGES AND DISADVANTAGES

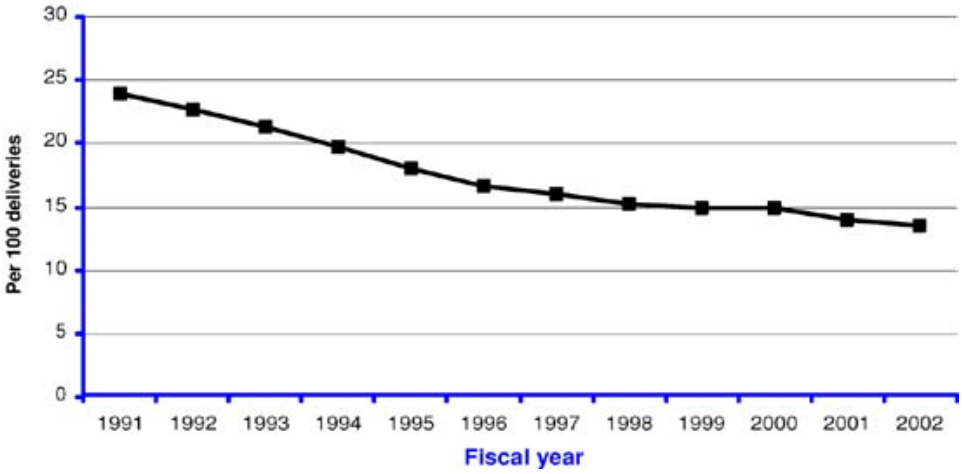
This category of definition is apparently simple to apply and presents an adequate proxy for severe conditions which are life threatening for mothers and related to maternal death. A relatively large number of non population based studies have used this definition to collect data from ICU admission. However in Belgium, an attempt to do this in the late 1990s revealed that ICU units (e.g. surveillance at week-ends after general anaesthesia) were being used for non ICU needs.

Conversely, some cases of life-threatening morbidity are managed either inside the highly equipped obstetrical service, while others are managed in hospitals that do not have intensive care units.

To illustrate this, in the UK, for example, only 31% of maternal deaths were recorded as having intensive care (NHS, 2000), while Bouvier-Colle et al reported that in France most maternal deaths had been seen in intensive care [21 22].

Problems of change in management standards over time, which have already been discussed in relation to gestational diabetes, will be even more obvious for management based criteria as can be observed in the following figure [23].

**Figure 1: Ratio of antenatal hospitalization per 100 deliveries, Canada excluding Nova Scotia, Quebec and Manitoba, 1991/92 to 2002/03**




In conclusion, management based definitions require once more clear definitions and good monitoring of their application.

### *E. Organ failure-based definitions of maternal morbidity*

As Pattinson describes [24], "this type of definition is based on the concept that there is a sequence of events leading from good health to death. The sequence is clinical insult, followed by a systematic inflammatory response syndrome, organ dysfunction, organ failure, and death. Near-misses include women with organ dysfunction and organ failure who survive."

#### ADVANTAGES AND DISADVANTAGES

According to Geller [3] who evaluated this as one of their five factors in a scoring system, "organ failure" as an indicator definition identified the vast majority of near misses and excluded the vast majority of other severe morbidities from the near-miss group, with a sensitivity of 95% and a specificity of 87.8%.

This approach is the most labour-intensive for identifying cases.

Retrospective identification of cases is difficult because of the inability to identify cases from registers.

### *F. Combination approaches*

A small number of studies use a combined approach, mixing more than one definition type. The EU group has suggested this type of approach. The European group has suggested for EU data to collect systematically the following combination:

- Eclampsia (a disease and an organ failure condition),
- Markers of management of severe haemorrhage,
- Ventilation,
- ICU admission.

## *3.2.3.1 Prevalence of maternal morbidity in large studies*

These studies are not very numerous and have often used different approaches. However, it is of interest to note that the baseline order of magnitude of events is similar in all studies. Major studies are summarised below.

### *A. Canadian study*

The Canadian study [23] pertains to all hospitalised woman. It does have the advantage of giving a good distribution of causes of admission, as well as of length of stay.

**Table 2: Antenatal hospitalization by primary diagnosis and length of in-hospital stay (mean ± standard deviation [SD]), Canada excluding Quebec and Manitoba, 2001/02 and 2002/03** [23]

| Primary diagnosis | Number | Proportion | Length of stay (mean±SD) |
|---|---|---|---|
| 1. Threatened preterm labour | 17,372 | 23.6 | 2.1 ± 3.2 |
| 2. Antenatal haemorrhage | 7,417 | 10.1 | 2.7 ± 3.8 |
| 3. Hypertensive disorders | 5,914 | 8.1 | 2.5 ± 2.4 |
| 4. Vomiting | 5,148 | 7.0 | 3.4 ± 3.5 |
| 5. Diabetes | 4,288 | 5.8 | 2.4 ± 2.7 |
| 6. Genitourinary complications | 3,944 | 5.4 | 2.4 ± 1.9 |
| 7. Rupture of membranes | 2,820 | 3.8 | 2.8 ± 4.2 |
| 8. Abdominal pain | 1,558 | 2.1 | 1.8 ± 1.6 |
| 9. Cervical incompetence | 1,542 | 2.1 | 4.7 ± 7.4 |
| 10. Known and suspected foetal problems | 1,379 | 1.9 | 2.5 ± 3.8 |
| 11. Intestine, liver and gallbladder disorders | 1,220 | 1.7 | 2.5 ± 2.7 |
| 12. Mental disorder | 929 | 1.3 | 6.7 ± 8.0 |
| 13. Other causes | 19,949 | 25.6 | 2.5 ± 3.5 |
| Total | 73,480 | 100.0 | 2.6 (2.5–6) |

Another Canadian study [25] by using a provincial database for 15 years identified with one or more of markers of severe maternal morbidity: blood transfusion > 5 units, emergency hysterectomy, uterine rupture, eclampsia and intensive care (ICU). The main contributing obstetric complication was haemorrhage (64.7%) and followed by hypertensive disorders (16 %). The relationship between morbidity markers and the associated obstetric complication is showed in the following Table 3.

**Table 3: Relationship between morbidity markers and obstetric complications [25]**

| | Associated obstetric complications | | | | | |
|---|---|---|---|---|---|---|
| Morbidity Marker | APH | PPH | Hypertension/ HELLP | Sepsis | Other | Total |
| Blood transfusion (BT) (70) | 20 | 57 | 26 | 13 | 2 | 118 |
| Hysterectomy (Hyst) (47) | 10 | 37 | 6 | 3 | 6 | 62 |
| Uterine Rupture (UR) (41) | 1 | 34 | 3 | 2 | 7 | 47 |
| Eclampsia (E)(40) | 2 | 25 | 13 | 0 | 12 | 52 |
| Intensive Care (ICU) (59) | 6 | 26 | 22 | 10 | 20 | 84 |
| Hyst + BT (25) | 12 | 25 | 2 | 2 | 0 | 41 |
| Hyst + UR (2) | 0 | 2 | 0 | 0 | 0 | 2 |
| ICU+BT (8) | 4 | 7 | 1 | 1 | 0 | 13 |
| ICU+E (4) | 2 | 2 | 1 | 1 | 2 | 8 |
| BT+UR (2) | 0 | 1 | 0 | 0 | 1 | 2 |
| ICU+Hyst (1) | 0 | 1 | 0 | 0 | 0 | 1 |
| Hyst+BT+UR (2) | 1 | 2 | 1 | 0 | 0 | 4 |
| ICU+Hyst+BT (9) | 3 | 9 | 0 | 1 | 0 | 13 |
| ICU+BT+E (1) | 0 | 1 | 0 | 0 | 0 | 1 |
| Hyst+BT+UR +E (1) | 1 | 1 | 1 | 1 | 0 | 4 |
| ICU+Hyst+BT+ UR (1) | 0 | 1 | 0 | 0 | 0 | 1 |
| Total (313) | 62 (13.7%) | 231 (51.0%) | 76 (16.8%) | 34 (7.5%) | 49 (11%) | 452 |

APH = Antepartum haemorrhage.
PPH = Postpartum haemorrhage.

### *B. MOMS-B European multicentric study*

The MOMS study took place in 11 EU regions in 1996. A summary of results can be found in the table underneath. The study identified 1734 women with at least one of three selected conditions [pre-eclampsia (in table underneath PET), haemorrhage and sepsis]. With 847 women (4.6/1000) experiencing severe haemorrhage, 793 (4.3/1000) experiencing severe pre-eclampsia and 142 (0.8/1000) experiencing severe sepsis. There were wide variations in incidence of three conditions combined, ranging from 14.7 per thousand in deliveries in Brussels, Belgium to 6.0 per thousand deliveries.

**Table 4: incidence of haemorrhage, sepsis and pre-eclampsia [19]**

| Country | All | PET | Haemorrhage | Sepsis |
|---|---|---|---|---|
| Austria | 36(6.0) | 32(5.3) | 4(0.7) | 0 |
| Belgium | 250(14.7) | 115(6.4) | 103(6.0) | 54(3.1) |
| Finland | 246(14.3) | 86(5.0) | 152(8.8) | 18(1.0) |
| France | 459(6.4) | 214(3.0) | 221(3.1) | 36(0.5) |
| Hungary | 107(7.8) | 81(6.4) | 22(1.6) | 6(0.4) |
| Ireland | 11(6.1) | 9(5.0) | 2(1.1) | 0 |
| Italy | 22(6.9) | 19(6.0) | 4(1.3) | 1(0.3) |
| Norway | 26(8.6) | 6(2.0) | 8(2.7) | 12(4.0) |
| UK | 577(11.8) | 231(4.7) | 331(6.8) | 15(0.3) |
| Total | 1,734(9.5) | 793(4.3) | 847(4.6) | 142(0.8) |

### C. Netherlands study

This study took place over 12 years in Leiden region [26]. The criteria for inclusion were any admission to ICU. The main original finding was that certain populations are at increased risk in relation to poor social circumstances (meaning, 19.0% of the women were of non-Caucasian origin). This in effect would mean, for a city like Brussels, that major differences in utilisation of services might be expected when comparing hospitals like "Saint-Pierre" or "Cavell". The most common reasons for ICU admission were (pre) eclampsia (62.0%) and obstetric haemorrhage (18.3%). The following table shows the severe morbidity by primary diagnosis.

**Table 5: Severe morbidity and interventions [26]**

Severe morbidity and interventions, shown by primary diagnosis

| | (Pre)eclampsia (*n* = 88) | Obstetric haemorrhage (*n* = 26) | Other diagnoses (*n* = 28) |
|---|---|---|---|
| Coma | 2 | 1 | 1 |
| Hyperreflexia | 28 | – | 3 |
| Convulsion | 16 | 1 | 2 |
| Renal dialysis | 5 | – | 3 |
| Coagulation disorder | 11 | 11 | 9 |
| Blindness | – | – | 1 |
| Caesarean section | 54 (61.4%) | 6 (23.1%) | 12 (42.9%) |
| Hysterectomy | – | 9 (34.6%) | 1 (3.6%) |
| Embolisation | – | 9 (34.6%) | 4 (14.3%) |

### D. Scotland Study

Severe morbidity was reported in 196 women, out of 51,165 deliveries in Scotland (rate 3.8 per 1000 deliveries). Thirty percent of cases fell into more than one defined category. Major obstetric haemorrhage accounted for 50% of events. Only a third of identified patients were admitted to intensive care units. Four relevant maternal deaths occurred [27].

**Table 6: Near-miss cases reported. Percentages do not add up to 100% as some patients have more than one diagnosis. [27]**

| Category | No. of events (*N*= 270) | % of near-miss patients (*N*= 196) | Rate/1000 deliveries |
|---|---|---|---|
| Haemorrhage | 98 | 50 | 1.9 |
| Eclampsia | 25 | 13 | 0.5 |
| Renal dysfunction | 19 | 10 | 0.4 |
| Cardiac arrest | 1 | 0.5 | 0.02 |
| Pulmonary oedema | 15 | 8 | 0.3 |
| Respiratory dysfunction | 18 | 9 | 0.3 |
| Coma | 0 | 0 | 0 |
| Cerebrovascular event | 7 | 4 | 0.14 |
| Status epilepticus | 5 | 3 | 0.1 |
| Anaphylaxis | 0 | 0 | 0 |
| Septicaemic shock | 5 | 3 | 0.1 |
| Anaesthetic problem | 13 | 7 | 0.3 |
| Intensive therapy unit or coronary care unit | 64 | 33 | 1.3 |

In an answer to this paper, the French group from the Centre region presented similar data and prevalence: among 15,281 deliveries in 14 maternity services, there was one maternal death, due to thromboembolism. Fifty events involved severe maternal morbidity, a rate of 3.3 per thousand [28].

### *E. ICU studies*

There are a large amount of these studies, often not population based. A systematic review has been made in 2006 by [5], reporting on 29 such studies. The interesting conclusions are that more than 50% of all such admissions are related either to pre-eclampsia or to haemorrhage. The other interesting information is that the median length of stay is short, ranging from 1 to 6 days.

Another important ICU study originates from the SW Thames area [16], reports on 122 850 deliveries, leading to 210 ICU admissions. The interesting aspect is that the prevalence is about 10 times lower than other studies, presumably reflecting the fact that less severe cases were admitted to HDU rather than ICU. The other interesting aspect is that the APACHE score was systematically tested, and found inappropriate for obstetrical patients.

### *F. Other conditions*

A limited number of potentially life-threatening conditions will be addressed separately. This will be the case for trauma and domestic violence. These are being addressed separately either because of their burden, or because they are apt to not be addressed with the filters which have been used for identification of severe conditions.

#### TRAUMA

Trauma registry data reveal that the incidence of pregnancy complicating trauma ranges from 4.6% to 8.3%; conversely, trauma complicated one in 12 pregnancies [29, 30, 29]. Trauma is one of the leading causes of death in women of child-bearing age. The previous studies showed that the aetiology of maternal trauma is most often motor vehicle accidents (55%), followed by falls (22%), assaults (22%), and burns (1%) [31]. Foetal deaths have a different aetiology: motor vehicle accidents (82%), gun shot wounds (6%), and falls (3%), with maternal death accounting for 11% of the foetal deaths [32].

#### DOMESTIC VIOLENCE

A comprehensive literature search was carried out by Boy and Salihu [33], including 30 peer reviewed publications. They conclusions are as follows. Overall, adverse pregnancy outcomes, including low birth weight, maternal mortality and infant mortality are significantly more likely among abused than non-abused mothers.

The risk for maternal mortality is three times as high for abused mothers. Intimate partner violence is also responsible for increased foetal deaths in affected pregnancies (about 16.0 per 1000).

## 3.2.4 Conclusion

A somewhat crude approach is to consider the following. A near miss is a case where without care (in most cases advanced life support technology) it can be hypothesised that the patient would have died.

A severe condition is one which potentially might have become a near miss, but did not present the severe organ failure which qualifies near miss. A medical condition concerns all pregnant women who presented with a "disease" concomitant to pregnancy, regardless of whether this disease was pregnancy related or not, and of whether the patient was admitted to hospital or not.

It is simplistic, but easy to remember that, in the more affluent OCDE countries, orders of magnitudes are as follow for 100.000 deliveries.

**Table 7: overview maternal mortality and morbidity (based on the above literature review)**

| | |
|---|---|
| Maternal death | 0.5-2.5 |
| Maternal morbidity (near miss or life threatening) | 17-50 |
| Maternal severe condition | 100-200 |
| Maternal morbidity (all) | 1,500-3,500 |

Another way of putting this is to say that mortality will be expressed in units or less, and that there is a ten fold increase at each of the following steps.

Two additional aspects need to be stressed. The use of ICU beds will be less in countries where HDU is available. This presumably would be an important aspect. Unfortunately we could not find published evidence on obstetrical HDU units.

Another important point is that these women are in general young and in good health and that acute situations are rapidly resolved.

Finally, this review of the literature is only marginally relevant for planning of MIC-services in Belgium. This is because two major questions have not been answered. The first is the magnitude of the caseload of women admitted essentially for foetal conditions, and also the length of their stay.

This is addressed by the Canadian study, but presumably, direct extrapolation to the Belgian situation would not be appropriate. The other problem is related to obstetrical admissions to non-MIC services. This will always be difficult to clearly regulate, among other reasons because the size of the hospital, the presence of an ICU, the presence of an anaesthesiologist and a paediatrician around the clock are all factors which need to be taken into account.

The last point is that at present it seems that there are only two levels of neonatal care in Belgium. It might be worth considering the entire issues of intermediate care. The same question is possibly appropriate for intensive care, where possibly there should be a place for differentiation between ICU and HDU.

## 3.3 CONCLUSIONS OF THE LITERATURE REVIEW

It is important to point out that the concept Maternal Intensive Care is in Belgium understood as **a level of intermediate care**. The MIC-services in Belgium are not Intensive Care Units (cf. definition above), specialized in peripartum complications. MIC-services provide a level of care in between standard and intensive care. Therefore in this report we use the less confusing concept 'Maternal Intermediate Care (MIC)' to refer to intermediate care provided to peripartal women in Belgium.

Due to the lack of literature, unambiguous definitions and evidence, we needed an alternative approach to obtain a definition that could serve as the basis for our research. The following efinitions are based on the Belgian Royal Decree of 1996 and on specific publications [14, 16, 18, 34].

Definitions were constructed by the means of expert consensus. A written proposition was made and sent to all the partners of the research group. They commented on those version and all of these comments were combined and discussed during meeting. After each meeting a reworked written proposal was made and the whole procedure was repeated. To obtain consensus, we had 4 rounds and therefore the definitions are mainly expert-based.

### 3.3.1 Definitions (national and international)

- What are the definitions of high-risk pregnancy, MIC-beds and MIC-services?

An all-encompassing evidence-based definition of high-risk pregnancy, 'maternal intermediate care' or a 'maternal intermediate care service' was not found. Therefore experts propose the underneath definitions based on the Belgian Royal Decree of 1996 and following publications: [14, 16, 18, 34]

**Maternal Intermediate Care** is a level of peripartum care between the care given on a general ward and that on an ICU. The patient population admitted to the service does not require invasive care but needs more care than that provided on a standard maternity ward (see standard care). Such intermediate care involves extensive observation and monitoring of high risk pregnancies, admission of patients where the baby most probably will need intensive care after delivery (intra uterine transport) and admission of patients that need highly specialised post partum care. Maternal intermediate care is appropriate for women who are conscious and have no multi-organ dysfunction. These women need frequent monitoring of the vital signs and/or nursing interventions, but do not require multiple organ support, mechanical ventilation, invasive monitoring and/or artificial life support.

**Maternal Intermediate Care service is** a service within an accredited maternity ward established for women during peripartum whom can benefit from maternal intermediate care (cf. supra).
In this environment, 24 hours care is provided by one midwife (with experience in treating high-risk pregnancies) to two patients and supervised by gynaecology-obstetrical specialists, with experience in treating high-risk pregnancies. A neonatal specialist and an obstetric anaesthesiologist must be available at any time.

**A MIC-patient** can be defined as a woman who needs extensive levels of care, observation and permanent medical supervision during pregnancy and/or birth and/or postpartum (up to 42 days/6 weeks) due to severe risks and/or complications and/or underlying diseases, in the mother and/or in the foetus.

### 3.3.2 Criteria for admission of women in a MIC-bed?

The literature review did not result in any specific or uniform criteria for the admission of women into a MIC-bed. In alternative approach, an exhaustive model of pregnancy- and non-pregnancy-related maternal and foetal morbidity was compiled, which allowed us, through repeated expert rounds, to define four distinct sets of admission criteria (morbidity- or indication based). More details can be found in the findings-chapter under the heading construction of the 'theoretical model' (also see annex).

### 3.3.3 Effectiveness (epidemiology & guidelines)

- What are the obstetrical pathologies and risk factors that lead to admission in MIC-services?

This research question is addressed in section 3.3

Do evidence-based guidelines to evaluate and treat patients in MIC-services exist?

Very few evidence-based guidelines for evaluation and treatment were identified that entailed recommendations as to which level of care is indicated for various pregnancy-associated disorders. The guidelines that were identified were included in the 'theoretical model'.

- Do guidelines for admission and transfers of women in MIC-service exist?

No evidence-based guidelines for admission and transfer were identified that entailed recommendations as to which level of care is indicated for various pregnancy-associated disorders.

### 3.3.4 Efficiency (grey literature)

- How are MIC-services financed?

No international literature on MIC-financing was found. On a national level, since 1998, every hospital with accredited MIC-beds receives an extra amount of money to pay for the FTE of midwives with experience in high-risk pregnancies. The additional MIC-budget is worth 2.29 points (or 46.347,54€) per accredited MIC-bed. More details are found in the background-chapter.

- How are they staffed?

The international staffing-norm on services similar to the Belgian MIC-services is one midwife to two patients, supervised by obstetric/gynaecologist specialist(s). The only published national data on staffing was found in a report of the Federal Belgian Government from 2001. This report contains unfortunately only data on the paramedical staff on the Belgian Maternity-services: 81% are midwives, 7% graduated nurses, 7% qualified child care workers, 4% other health care staff and 1% vocational trained nurses. The distinction between staff working in the MIC-services and in the Maternity-services is not made, they are included in the aforementioned percentages. No data on the medical personnel was found.

### *Key Messages*

- **The literature review alone did not result in a clear definition of maternal intermediate care, nor MIC-patient, nor MIC-service**
- **The literature review resulted in very few evidence-based guidelines for evaluation and treatment that entailed recommendations as to which level of care is indicated for various pregnancy-associated disorders**
- **The working-definitions of MIC-patients, Maternal Intermediate Care and the MIC-service were constructed by expert consensus based on the Belgian Royal Decree of 1996 and following publications [14, 16, 18, 34]**

# 4 CONSTRUCTION OF THE DATABASE AND DATASET ANALYSIS

## 4.1 METHODOLOGY AND DATA

### 4.1.1 Available federal and regional data

The R.D. of 1996 (legal basis of the MIC-services) chapter IV art. 16 states: "The MIC-services have to record principal diagnosis that causes the admission in the MIC-service. [….]The MIC-services have to provide annual statistics related to the medical conditions (principal diagnosis) that cause the admission in the MIC-service, following the instructions of the Minister who has the agreement of the hospitals in his attributions…." However, no report was published since 2001.

Some data on the MIC-activity in Belgium can however more indirectly be obtained from the following sources:

- **IMA/AIM**: centralizes information on all health care reimbursed by the 7 social security insurance companies (sickness funds);
- **MKG/RCM**: all hospitals register their activity by the means of ICD-9-CM codification. This data is sent to the ministry of health and is used to calculate the hospital financing;

Reports were also published by regions :

- **SPE**: edits an annual report. This publication is based on the data of all 70 maternity clinics within the Flemish region (and the University Hospital Brussels). Registered parameters are: parity, caesarean section in previous deliveries, hypertension in pregnancy, diabetes, HIV, multiple pregnancies, gestational age, position of the baby, induction of labour, epidural analgesia, group B *Streptococcus* infection (+ prophylaxis), date and time of birth, mode of delivery, episiotomy, indication for caesarean section, birth weight, sex, Apgar (at 1 & 5 minutes), ventilation of the baby, congenital malformation, transfer to N* or NIC-service, stillbirth, early neonatal death (+ cause), maternal morbidity and maternal mortality. Unfortunately the information on maternal morbidity is not specific and detailed enough to meet our research goals;
- **Observatoire Bruxellois de la Santé et du Social/ Observatorium voor gezondheid en welzijn Brussel**: published a report in 2007 on perinatal health indicators for the region of Brussels between 1998 and 2004. However, the information provided is not detailed.

Hence, as there is no systematic uniform reporting of obstetrical data available for the entire country, we aimed to develop a new database that compiles all available data on MIC-activities in Belgium as registered by the Social Health Insurance companies and by the FPS (through MKG/RCM).

## 4.2 CONSTRUCTION OF THE DATABASE

### 4.2.1 Ethics and privacy

The ethical approval was given by the Gent university hospital ethic commitee on April 3rd, 2007 (Belgian registration number: B670200719 69). The authorisation to use private patient information was also obtained from the "Commission Vie Privée de la Banque Carrefour de la Sécurité Sociale" on March 6th, 2007.

### 4.2.2 Information sources

The data are derived from two separate sources: 1) the IMA/AIM reimbursement bills of women and their newborns admitted to maternity wards between January 2003 and December 2004; 2) hospital stay records (MKG/RCM) sent by the hospitals to the Ministry of Health (FPS) during the same period.

#### *IMA/AIM Data*

The IMA/AIM gathers this detailed information on all health care reimbursed by the 7 social security insurance companies (sickness funds). Within this database, health services provided to one specific patient can be followed longitudinally over the years. The patient identification is irreversibly masked before data analysis.[12] [13]

All reimbursed health services are coded with nomenclature codes[14] for the type of care received; the care provider, date and place of care delivery are also specified. The information on hospital stays is inferred on the basis of the health care consumption data (reimbursement claims). Each registered stay contains many details about the admission e.g. date of admission, date of discharge, etc..., which are particularly useful for the linkage between the two databases. The IMA/AIM dataset also includes personal information such as sex, age, NIS/INS code[15] and benefiting from a specific health insurance scheme.

IMA/AIM data contains also all the consumption in medicines. This information will be used in a second phase of this analysis.[16]

#### *MKG/RCM data*

The MKG/RCM data provide medical information consisting of APR-DRG, diagnostic information in ICD-9-CM codes, degree of severity, risk of mortality etc., attributed to each hospital stay for all patients.

The ICD-9-CM classification is the ninth version of the clinical modification of International Classification of Diseases and related health problems. This classification was published by the WHO and is adapted in Belgium as the official system of assigning codes to diagnoses and procedures associated with hospital utilization. The ICD-9-CM consists of: a tabular list containing a numerical list of the disease code numbers in tabular form, an alphabetical index to the disease entries; and a classification system for surgical, diagnostic, and therapeutic procedures (alphabetic index and tabular list). An ICD-code can be a diagnostic code (e.g. 664.11= second degree perineal laceration), a status code (e.g. V 270= single life born) or a procedure code.

In each hospital, experts in medical registration search medical information in medical records, and translate the clinical principle diagnosis, secondary diagnosis and the performed procedures into ICD-9-CM codes. Hospital stays are then grouped into APR-DRG[17] (All patient refined diagnostic related groups) and further grouped into MDC (Major Disease Category)[18].
When the patient changes from specialty during the in-patient stay, several diagnoses may be registered for example the patient is admitted through the emergency room.
The main diagnostic for specialty 1 is the administrative information "UUUU" and the secondary diagnosis is "DDDD" and there will be a second speciality where an ICD-9-CM code will be attributed.

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12 These exhaustive data refer to the health care expenses of the social security scheme, prescription drugs included except for the persons insured only for "petits risques" (8% of the women). For more information see appendixes.

13 http://www.cin-aim.be/fr/home/

14 This codification is explained at the following address http://www.inami.fgov.be/care/fr/nomenclature/index.htm accessed on 26/02/2008

15 these codes are attributed by the National Institute of Statistics to each municipality

16 see next chapter

17 Homogeneous groups of patients with a similar case-mix regarding clinical presentation and use of hospital resources.

18 All definitions can be find at https://tct.fgov.be/etct/site_fr/info.html

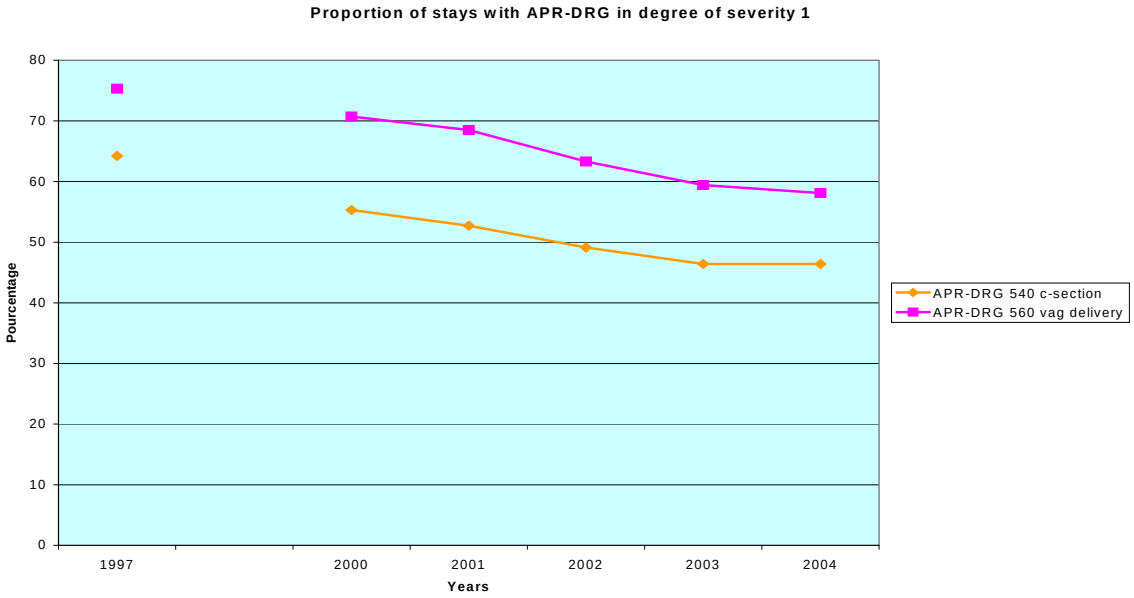
The level of severity of illness - classification within the APR-DRG is a complex matrix, which was designed to calculate the hospital workload and the therefore required finance. These levels of severity are based mainly on secondary diagnoses.
The relation between the level of severity and the seriousness of the pathology is not straightforward. Each woman has only one main diagnosis, but women can have more than one second diagnosis

The MKG/RCM database unfortunately provides no longitudinal follow-up. Moreover, for privacy reasons, exact dates are unknown. Only number of week, month and year are available.

The MKG/RCM database contains a wide array of variables pertaining to the diagnostic and therapeutic aspects of the admission as well as a number of patient characteristics; information on the successive bed types and services during the stay. There is a specific database for newborns.[19]

It is important to note that this MKG/RCM database is used primarily to measure hospital case-mix for financing, not epidemiological purposes. Thus reporting bias can not be ruled out.The level of severity is determined by the coded secondary diagnoses. It is highly unlikely that from 1997 to 2004, the actual morbidity has increased. The increase of the coded level of severity is a well-described and well-known phenomenon, it implies that patients are placed in higher level of severity yielding a higher standard price than justified by their actual health status (Bjørnenak et al., 2000)(Hsia et al., 1988)(Colin Preyra, 2004)[20]. In this context, it is very interesting to see the Belgian evolution of the severity in the APR-DRG along the years.

**Figure 2: Evolution of the degree of severity 1**




Source: Feedback Cellule technique - https://tct.fgov.be/etct/anonymous?lang=fr

Figure 3 shows the evolution of the APR-DRG 560: 'Vaginal delivery'. In 1997, 75.3 % of the in-patient stays were attributed a degree of severity I. In 2004, the proportion of stays in degree of severity I was only 58.1%. The same evolution is noticed for 'APR-DRG 540: 'Caesarean delivery'. The proportion of in-patient stays with a degree of severity I was 62.4% in 1997 and only 46.4% in 2004. It is rather unlikely that from 1997 to 2004 morbidity has actually increased to such an extent. Rather, it may be suspected that increasing proportions of women with a higher degree of severity of morbidity are an artefact related to the financial rewarding of higher levels of severity.

19 see appendix

These two databases (IMA & MKG/RCM) were merged to obtain one database that combines all available information for each patient. More information about the merging procedure is described in the next chapter and in the annexes.

### 4.2.3 Database construction

Selection criteria and coding rules have been devised in order to maximize the merge rate of the two original databases. Data selection was performed in four steps:

- **Step 1: Selection of the maternity stays**

First, we selected in both databases all patients who were admitted to a maternity ward between 01/01/2003 and 31/12/2004 on the basis of the code of the hospital department (codes 260 and 26 for maternity ward).

In the MKG/RCM data, only in-patient stays are selected; day care is excluded from the merger for technical reasons.

We structured the received MKG/RCM stays in three separate datasets based on the age of the patient: one containing the data of the mothers, one with the neonates (age=0) and one with the double records[21].

- **Step 2: Selection of the deliveries or other pregnancy outcomes**

In order to study the care given to pregnant women, we selected from the IMA/AIM data only patients who were billed for a vaginal delivery, a Caesarean section or a miscarriage (admitted to hospital or in ambulatory care). The above-mentioned care was identified in the bills through detailed nomenclature codes[22].

- **Step 3 : Selection of the newborns**

The third step is the addition of the IMA/AIM data on all newborns. Neonates admitted to maternity wards are automatically included in the database. We additionally selected neonates who were admitted to a neonatal department N* or neonatal intensive care department (NIC) – codes of departments 190 or 19 and 270 or 27.

- **Step 4: Selection of all members of the social security scheme**

The fourth step is the selection of all social security beneficiaries, as this subpopulation can be followed up longitudinally in the IMA/AIM data. This selection is made during the merging procedure between MKG/RCM data (all patients) and IMA/AIM data (all social security beneficiaries).

### 4.2.4 Linkage of the IMA/AIM data with the MKG/RCM data

In order to study the care of these patients and their trajectories in a longitudinal way, the MKG/RCM data are linked with the IMA/AIM data.

Before starting, an anonymous identity (ID)-number has been added to the MKG/RCM data in order to create a link with the IMA/AIM data. This ID-number is based on the so-called national register number, a unique identification number assigned to each Belgian citizen.

From the IMA/AIM population data, numerous variables were used as quality checks for the merging procedure: identification of the beneficiary, sex, and INS code.

After data selection and data cleansing[23], 195.110 stays in 2003 and 202.500 stays in 2004 were ready to be merged in the MKG/RCM data.

The merging procedure is based primarily on the mother's identity number, the hospital number and the admission and discharge date. Only the stays containing all four elements are taken into account for the merger.

The merging procedure was applied to the three created datasets: mothers, babies and double records[24].

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21 see appendix
22 see appendix
23 see appendix
24 see below : 1.2.2.3. step1

When the merge procedure[25] was carried out, 91.2% of all stays in 2003 and 92.4 % of all stays in 2004 were eventually merged with the IMA/AIM data.

The stays that could not be merged are subjected to a separate analysis (see annex).

Table 8 summarizes the results of the merging procedure.

**Table 8: Result of the merge between both databases**

| | 2003 | 2004 |
|---|---|---|
| **RCM stays to link** | **195,110** | **202,500** |
| **Linked RCM stays with IMA stays** | **178,514** | **186,265** |
| *% linked stays* | ***91.2%*** | ***92.4%*** |
| Unlinked RCM stays | 16,742 | 16,421 |
| *Difference with source data* | | |
| *Delta > 0 because of the linking of dubbles* | *146* | 186 |

### 4.2.5 Study population

After the merging procedure, all possible inconsistencies were excluded or adequately corrected. Data of some neonates were left aside because of a missing baby ID number[26] in the IMA dataset (the linkage was done on the ID of the mothers). Eventually, 130.584 newborn stays have been merged this way. Among the unmerged babies, 68% do not have the MKG/RCM number of the mother.

Finally, the databases available for analysis contained:

- 198.502 patients with at least one maternity stay in 2003 or 2004, totalling 243.947 merged stays;
- 197.419 neonates born in 2003 or 2004, accounting for 240.711 hospital stays.

In addition, 11.035 stays of 'mother' and 21.752 stays of 'newborns' remained unmerged because there was no IMA/AIM identification or the date of the in-patient stay did not correspond in the two databases. These stays are analyzed separately (see annex).

**Table 9: Overview of denominators used in the report**

| | | | | Total | Mat. With MIC - services | Mat. without MIC-services |
|---|---|---|---|---|---|---|
| **Pregnant women** | | | | **97,648** | | |
| **In-patient stays** | | | | **113,845** | 32,099 | 81,746 |
| | Ante-partum stays | | | **14,889** | 4,201 | 10,688 |
| | **Stay of Delivery** | | *= nb of pregnancies* | **97,718** | 27,318 | 70,400 |
| | | Mode of delivery: Vaginal deliveries | | 78,694 | 21,380 | 57,314 |
| | | Mode of delivery: C-sections | | 18,164 | 5,598 | 12,566 |
| | | | *Total* | 96,858 | 26,978 | 69,880 |
| | | Mode of delivery: Embryotomies | | 4 | 0 | 4 |
| | | Mode of delivery: Miscarriages | | 856 | 340 | 516 |
| | Postpartum stays | | | **1,238** | 580 | 658 |
| **Transfers** | | | | **1,073** | 862 | 211 |
| | Intra-uterin transfers | | | **660** | 510 | 150 |
| | Postpartum transfers | | | **413** | 352 | 61 |

25 see appendix
26 see appendix

Table 9 shows all different denominators used in the report. From October 1st 2003 to September 30th 2004, 97.648 women gave birth, less than 1% (n=70) of the women gave birth more than one time in the selected period (exclusive multiple births). The database contains information about 113.845 in-patients stays (97.718 in-patient delivery stays, 14.889 stays during pregnancy and 1.238 stays after the delivery). Among the 97.718 in-patient stays for delivery , 78.694 woman delivered vaginally, 18.164 had a caesarean section, 4 had an embryotomy and 856 pregnancies ended in a miscarriage.

Data allows to study the transfers from hospitals to hospitals, 1.073 women were transferred, 660 were before the delivery and 413 were after the delivery.

**Table 10: Summary of available data for analysis (all data from 2003-2004)**

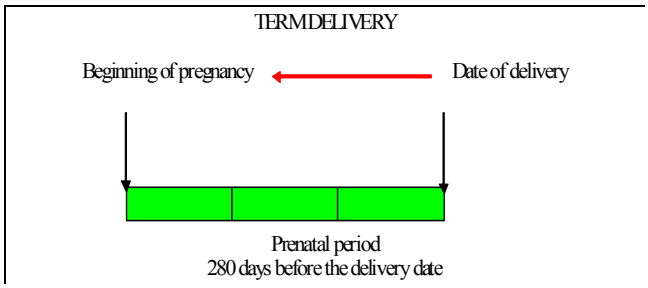
| | *MOTHERS* | *BABIES* |
|---|---|---|
| **Number of patients with merged data** | **198,502** | **197,419** |
| **Number of merged stays (2 years)** | **243,947** | **240,711** |
| Number of unmerged stays | 11,035 | 21,752 |
| **Total number of stays (merged + unmerged stays)** | **254,982** | **262,463** |

The unmerged stays can't be aggregated by patient, nor can a longitudinal approach be made. The results of the analysis of the unmerged data are added to the annexes.

### 4.2.6 Study period

As the goal of the data analysis is to study the care for pregnant women, the studied period for each one is her pregnancy including a post-partum follow-up of 6 weeks.

Therefore, the IMA/AIM date of delivery was taken as reference for each woman and the pregnancy period was defined as the period of 9 months before this delivery.




According to that and to the fact that the data is available for a period from 01/01/2003 to 31/12/2004, all the **deliveries between 01/10/2003 and 30/09/2004** were selected. Additionally, **all related in-patients stays during the pregnancy and the postpartum follow-up were selected**. In total, **113,845 in-patients stays** were studied.

In-patients stays are defined in the IMA/AIM database as a continuous period of admission in the same hospital (short interruptions like week-ends and one-day holidays are not taken into account).

### 4.2.7 Statistical analysis

Data processing and statistical analysis were performed by use of the statistical software package SAS version 9.

The descriptive statistics are presented for the following levels:

- the maternity level:

  number of maternities; types (With MIC-services, with isolated NIC-services and others); geographical situation; number of maternity beds, number of MIC-beds and proportion of MIC-beds per maternity;

- the mother level:

  age, socioeconomic characteristics, place of residence, mode of delivery, length of stay (and number of in-patients stays), frequency of ICD-9-CM codes (primary and secondary) during hospitalization, transfers, mortality;

- the newborn level:

  status (stillborn or alive), in-hospital mortality, birth weight, gestational age, Apgar score, stay in a NIC or N* department.

Subsequently, associations were explored in a bivariate analysis. Finally, a binary logistic regression model was constructed to identify the parameters associated with admission to a MIC-service. Goodness-of-fit of the model was assessed through the Hosmer and Lemeshow test for goodness-of-fit.

### 4.2.8 Definition of studied indicators

***A. Indicators related to patients:***

- Age of the women,
- Place of residence identified by INS code[27]: these codes are attributed by the National Institute of Statistics to each municipality,
- Socioeconomic status established on the basis of IMA/AIM population information:
- People who have very low earnings[28] benefit from a higher reimbursement of their medical expenses; they are labelled as "BIM" in our data. People with low social status and low revenue do not have any co-payment for their health expenses when they reach some threshold of health care expenses. These people are called Maf29 in our data;
- Single people are adult people who live alone or alone with children.

***B. Indicators related to health care***

- Ambulatory care received is identified by nomenclature codes attributed to each reimbursed medical services; prescribed drugs are identified by CNK codes30. The drugs are grouped by ATC codes (Anatomical Therapeutic Classification)31 classification system devised by WHO;
- In-patient care is identified through nomenclature codes, ATC codes and MKG/RCM data. For each in-patient stay, the hospital attributes an APR-DRG 32 and a degree of severity, on the basis of clinical diagnoses. Diagnostics attributed to the in-patient stay are coded by means of ICM-9-CM codes33. Each woman has only one main diagnosis, but women can have more than one secondary diagnosis. Several diagnoses may be registered for one patient in the case of 'sequential stays' in various hospital departments, e.g. if admitted through the emergency room, the main diagnosis for department 1 is "UUUU" and the secondary diagnosis is "DDDD" and there will be a 'second stay' where an ICD-9-CM code will be attributed;

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27 http://www.statbel.fgov.be/figures/d12_fr.asp

28 Conditions to be respected to benefit from a higher reimbursement are detailed at the following address http://www.inami.fgov.be/secure/fr/medical_cost/general/ceiling/index.htm

29 Conditions to be respected to be in this category are detailed at this address http://www.inami.fgov.be/secure/fr/medical_cost/general/maf/index.htm

30 http://www.inami.fgov.be/drug/fr/index.htm

31 http://www.whocc.no/atcddd/

32 The procedure of registration is thoroughly described at the following address https://portal.health.fgov.be/pls/portal/docs/PAGE/INTERNET_PG/HOMEPAGE_MENU/GEZONDHEIDZORG1_MENU/ZORGINSTELLINGEN1_MENU/REGISTRATIESYSTEMEN1_MENU/MKGMINIMALEKLINISCHEGEGEVENS1_MENU/RICHTLIJNEN1_HIDE/RICHTLIJNEN1_DOCS/DIRECTIVES%20RCM%20LAY-OUT%201999%20FR%20OCTOBRE%202003.PDF

33 Definition and more information can be found at the following address http://www.cdc.gov/nchs/about/otheract/icd9/abticd9.htm

- Destination of the patient after the in-patient stay specified as: discharged, death, other hospital;
- Transfers from hospital to hospital can be identified by both MKG/RCM database and IMA/AIM database. The MKG/RCM database contains two variables that specify the type of discharge and the destination of the patient. Several types of transfers are recognized in this way. In the IMA/AIM database, the date of discharge from hospital 1 and the date of admission in hospital 2 are used to identify transfers. If the delay between dates is smaller or equal to 1 the case is considered to be a transfer.

#### *C. Indicators related to newborns*

Most of the newborns stay only a few days in the maternity and remain in the room of their mother. For these neonates, there is no separate bill issued. The only available information comes from the MKG/RCM systematically filled in for every newborn.

Parameters available are:

- vital status (live born alive or stillbirth);
- birth weight in grams;
- term in weeks;
- Apgar score at 1 and 5 minutes;
- place of birth (NIS/INS code).

Unfortunately, when the baby is transferred, the link between the two stays can not be done because the patient identification number is specific to each hospital and the absence of bill for the first stay does not allow the use of the IMA/AIM identification number.

Transfers of neonates towards NIC services were quantified in the NIC-Audit. According to data covering the period 2004-2006, 38% (CI : 26 to 55%) of all neonates admitted in NIC were transferred. For this period, they were +/- 6.000 admissions/year in NIC services. Among these admissions, transfers concern about 2.000 neonates per year.

No information on neonatal mortality after discharge is available.

### 4.2.9 Results of the descriptive analysis

#### *4.2.9.1 General description*

#### *A. Maternities*

Hospitals are identified through their 'agreement number', number attributed by the FPS to each health institution authorized to deliver care.
Information about type of health institution and number of beds was retrieved on the website of the FPS.[34]. With the fusion of hospitals, the number of financed MIC-beds was not straitforward. Therefore, additional information about the number of MIC-beds was obtained by phone calls to the maternities. . The Brugmann Hospital declared 9 accredited MIC-beds but has 8 financed MIC-beds according to the FPS.
To compute distances and draw maps, the distance in kilometres between the INS code of the hospital where the women delivered and the one of the mother residence was computed.

Currently, Belgium counts 106 maternity departments that are sited in 125 maternity sites (due to merged hospitals). These 106 maternities totalise 3,200 beds[35] (for 112,149 births in 2003 and 115,618 births in 2004[36]).

34 https://portal.health.fgov.be/portal/page?_pageid=56,512866&_dad=portal&_schema=PORTAL
35 Total number of maternity beds retrieved on February 18th, 2008 from https://portal.health.fgov.be/portal/page?_pageid=56,512866&_dad=portal&_schema=PORTAL
36 FOD Economie - Algemene Directie Statistiek en Economische Informatie. Statistieken Geboorte. Retrieved on February 18th, 2008 from: http://www.statbel.fgov.be/figures/d22_nl.asp#2

Among these maternities, 17 have a proportion of their beds registered as MIC-beds. Table 11 shows that as well the number of M -beds as the proportion of MIC-beds among the total number of beds varies widely between maternity services.

The total amount of maternity beds per MIC-service varies between 20 and 65 and the proportion of MIC-beds within these maternities varies between 13.3% and 44.4% of all M -beds.

Among the MIC-services, 7 are imbedded in a university setting.

All the 17 maternities with MIC-beds have also NIC-beds and are considered as P* function. Only 2 hospitals are isolated NIC centres (marked in blue) without a maternity with MIC-beds.

**Table 11: Hospitals with MIC- and NIC-services**[37]

| Agreement number | Maternity | Town | M beds | Nic beds | Mic beds | Proportion MIC beds on M beds | Academic status |
|---|---|---|---|---|---|---|---|
| 710403 | UCL | Brussel | 36 | 15 | 16 | 44.4 | yes |
| 710300 | U.I.A. | Edegem | 20 | 19 | 8 | 40.0 | yes |
| 710076 | C.H.U. St. Pierre | Brussel | 40 | 15 | 15 | 37.5 | no |
| 710322 | K.U.L. | Leuven | 65 | 35 | 20 | 30.8 | yes |
| 710077 | CHU Brugmann + hôpital des enfants | Brussel | 30 | 0 | 9 | 30.0 | no |
| 710406 | Erasme | Brussel | 27 | 15 | 8 | 29.6 | yes |
| 710096 | C.H.U. Tivoli | La Louvière | 28 | 15 | 8 | 28.6 | no |
| 710158 | C.H. St. Vincent & Ste Elisabeth | Rocourt | 61 | 35 | 16 | 26.2 | no |
| 710670 | UZGent | Gent | 31 | 32 | 8 | 25.8 | yes |
| 710009 | AZ Middelheim | Antwerpen | 36 | 15 | 8 | 22.2 | no |
| 710049 | AZ St. Jan | Brugge | 38 | 15 | 8 | 21.1 | no |
| 710143 | VUB | Brussel | 40 | 16 | 8 | 20.0 | yes |
| 710027 | C.H. Notre Dame/Reine Fabiola | Charleroi | 45 | 18 | 8 | 17.8 | no |
| 710099 | AZ St. Augustinus | Wilrijk | 49 | 15 | 8 | 16.3 | no |
| 710412 | C.H.Régional La Citadelle | Liège | 53 | 25 | 8 | 15.1 | yes |
| 710332 | C.H. Edith Cavell | Brussel | 54 | 15 | 8 | 14.8 | no |
| 710371 | Z.O.L. | Genk | 60 | 17 | 8 | 13.3 | no |
| 710006 | C H R NAMUR | Namur | 40 | 15 | **0** | 0.0 | no |
| 710718 | C H U CHARLEROI | Charleroi | 38 | 15 | **0** | 0.0 | no |
| | **Total number of beds** | | **713** | | **172** | **24.1** | |

Source: Ministry of Public Health and phone calls with hospital workers (prof. Dr. Spitz)

The 106 maternities totalize 3.200 beds and the maternities with MIC-services have 713 beds. In other words, 22.3 % of all maternity beds are situated within maternities with MIC-services.

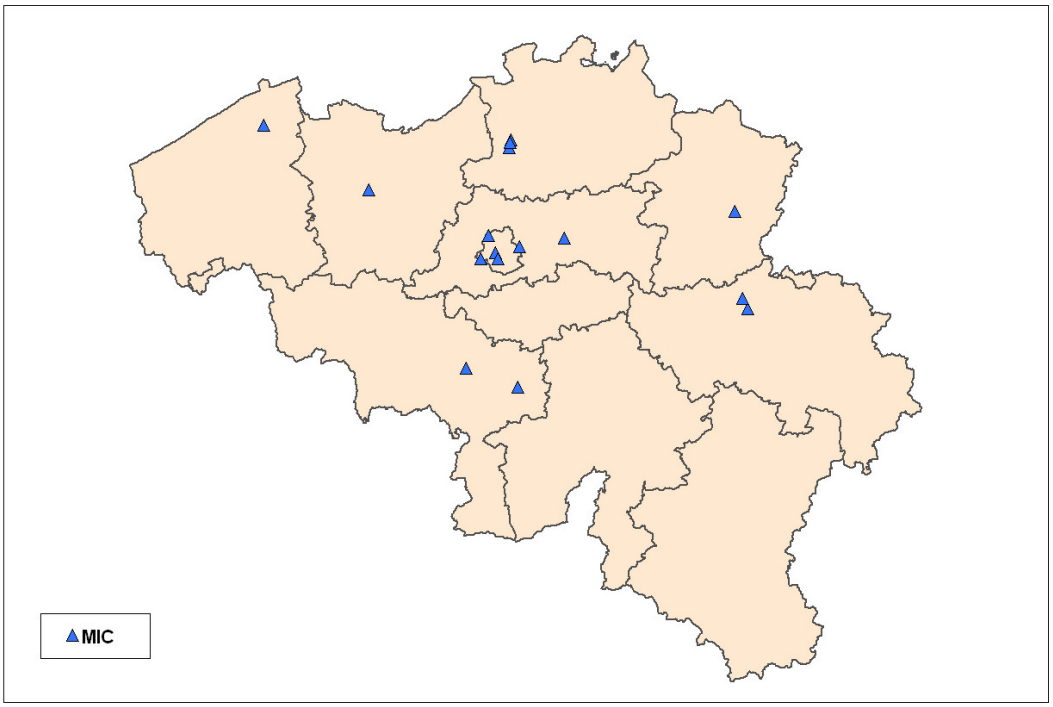
In Belgium, 27.8 % of all deliveries occur in MIC-services. However, among the total number of beds owned by maternities with MIC-services, only 172 are MIC-beds, accounting for **5.4% of the total amount of maternity beds.**

It is therefore important to keep in mind that the majority of women admitted to MIC-services do not occupy MIC-beds. Unfortunately, data registration is done for the maternities as a whole, not separately for the MIC- and maternity beds.

The following figure shows the geographical distribution of the hospitals with MIC-services on the Belgian territory. The map shows clearly that the MIC-services are located in big cities.

37 The abbreviations of the hospitals in our tables and figures come from our database of 2003-2004. Some of the names of the hospitals have changed as this report is written 4 years later , e.g. VUB= UZ Brussel.

**Figure 3: Situation of the MIC- services**




Source: Ministry of Public Health and phone calls with hospital workers,

They are two maternities with NIC service and without MIC-service : CHR Namur and CHU Charleroi.

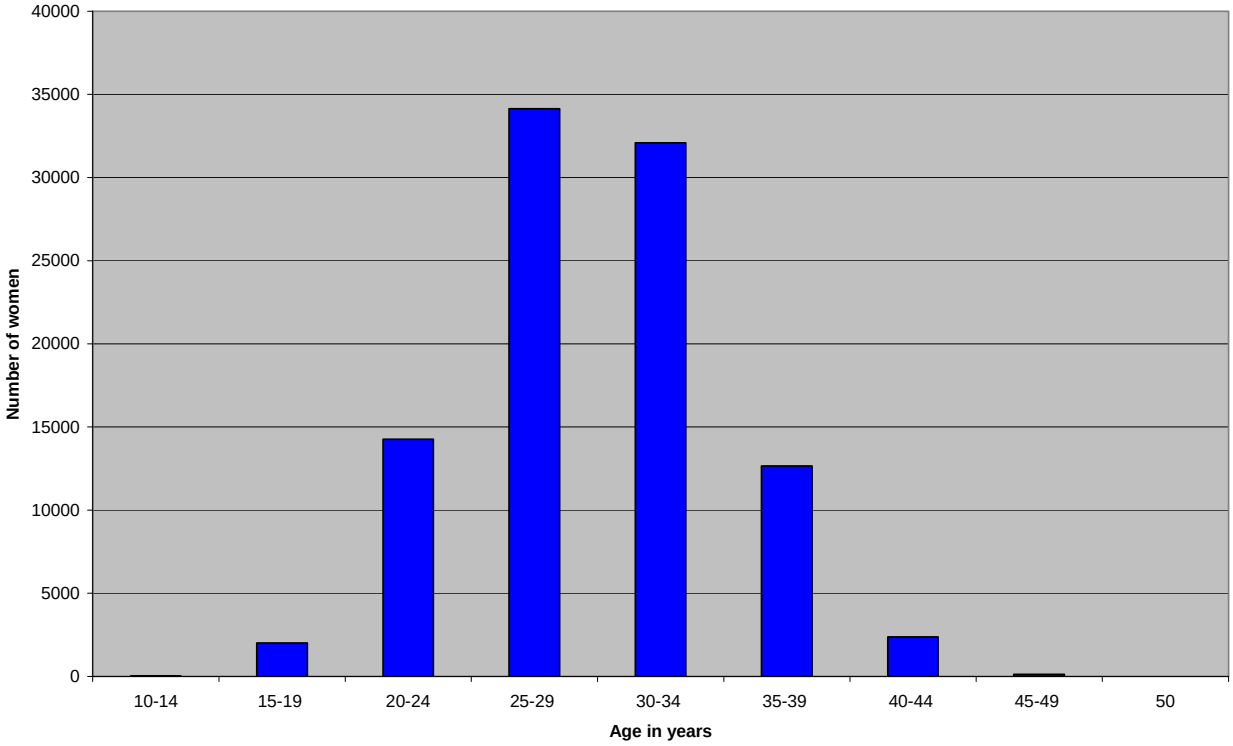
### *B. Pregnant women*

#### MATERNAL AGE

Mean age (for 97.648 women) is 29.4 years (median = 29 and mode= 30). The age distribution is shown in figure 5. There are 9 women between 10-14 years and 1 woman is 50 years old.

Figure 4 shows that 35. 0% of the women are between 25-29 years and 32.9 % is between 30-34 years old.

**Figure 4: Age distribution of all admitted women**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### SOCIO - ECONOMIC CHARACTERISTICS

The distribution of the socio - economic indicators is as follows:

- Indicators of socio - economic frailty: 8,036 (8.2 %) women are included in the category social Maf and/or BIM and 5,435 (5.7 %) are included in the category Maf income. The distribution of this indicator of low socio-economic status by region and arrondissement according to INS code of residence is shown in table underneath.
- There are 6,446 (6.6%) single women without a depending child and 5,717 (5.9%) are single with a depending child before delivery.

**Table 12: Geographic distribution of women with weak socioeconomic status (N= 97.648)**

| Region | Province | BIM et/ou MAF social | |
|---|---|---|---|
| | | Number | *Proportion* |
| **Région Bruxelles-Capitale** | | **2,063** | ***16.6%*** |
| **Vlaams gewest** | Antwerpen | 1,178 | *7.7%* |
| | Vlaams Brabant | 328 | *3.6%* |
| | West Vlaanderen | 401 | *4.1%* |
| | Oost Vlaanderen | 748 | *6.1%* |
| | Limburg | 391 | *5.6%* |
| | ***Total*** | **3,046** | ***5.7%*** |
| **Région Wallonne** | Brabant Wallon | 92 | *3.7%* |
| | Hainaut | 1,245 | *9.7%* |
| | Liège | 1,139 | *11.7%* |
| | Luxembourg | 119 | *5.6%* |
| | Namur | 285 | *6.6%* |
| | ***Total*** | **2,880** | ***9.1%*** |
| Unknown | | 47 | *12.2%* |
| **Belgium** | | **8,036** | ***8.2%*** |

**PLACE OF RESIDENCE AND PLACE OF DELIVERY**

Among the 97,718 pregnant women, 12.7% lived in Brussels, 54.6% in Flanders and 32.3% in Wallonia.

Pregnant women delivered most frequently in the region where they were living. However, table 13 shows that in Brussels there were 32% more deliveries than pregnant women. In Flanders and Wallonia there were respectively 64,9% and 73,3% of the pregnant women living there who deliver in the region of residence. Then, we can extrapolate that the additional number of women delivering in Brussels live mainly in the adjacent Vlaams or Wallon Brabant provinces which are very close to Brussels.

**Table 13: Geographic distribution of pregnancy women by INS code of residence (N= 97.718) and place of delivery**

| Region | Province | INS Place of residence | INS Place of delivery | *Proportion* |
|---|---|---|---|---|
| **Région Bruxelles-Capitale Brussels Hoofdstedelijk gewest** | | **12,412** | **16,393** | *132.1%* |
| **Vlaams gewest** | Antwerpen | 15,370 | 16,671 | *108.5%* |
| | Vlaams Brabant | 9,066 | 5,886 | *64.9%* |
| | West Vlaanderen | 9,712 | 10,027 | *103.2%* |
| | Oost Vlaanderen | 12,235 | 11,950 | *97.7%* |
| | Limburg | 7,002 | 6,750 | *96.4%* |
| | **Total** | **53,385** | **51,284** | *96.1%* |
| **Région Wallonne** | Brabant Wallon | 2,512 | 1,842 | *73.3%* |
| | Hainaut | 12,845 | 12,721 | *99.0%* |
| | Liège | 9,699 | 9,835 | *101.4%* |
| | Luxembourg | 2,129 | 2,122 | *99.7%* |
| | Namur | 4,352 | 3,512 | *80.7%* |
| | **Total** | **31,537** | **30,032** | *95.2%* |
| Unknown | | 384 | 9 | *2.3%* |
| **Belgium** | | **97,718** | **97,718** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *C. In-patient stays*

#### MODE OF DELIVERIES

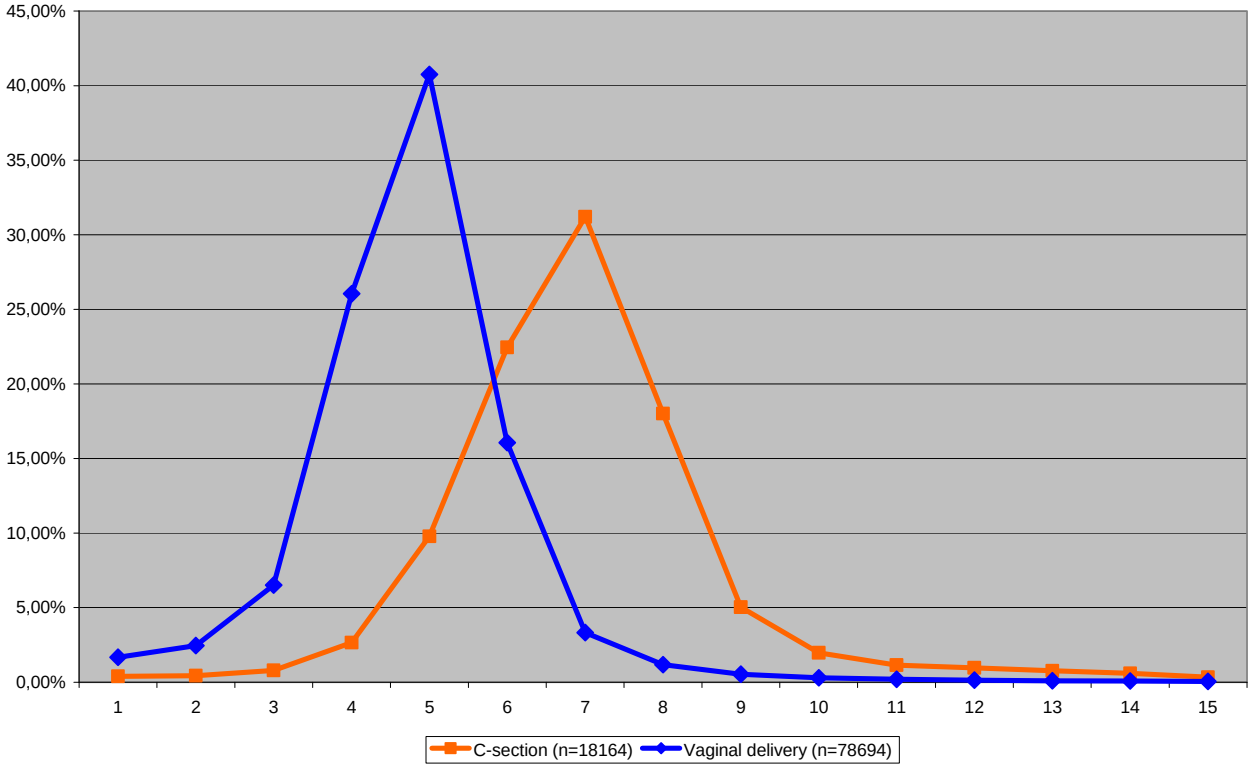
Based on the nomenclature-codes from the in-patient stays (N = 97,718 stays), 78,694 pregnancies ended in a vaginal delivery, 18,164 (18.6 %) in a caesarean section, 856 in a miscarriage (<22 weeks) and 4 pregnancies ended in an embryotomy.

#### LENGTH OF STAY

The mean length of stay for a vaginal delivery is 4.9 days (P10= 3 days; P50=5 days; P90= 6 days). The mean length of stay for a caesarean delivery is 7.7 days (P10= 5 days; P50= 7 days; P90=9 days).

The distribution of the length of stay is presented in the figure 5.

**Figure 5: Length of stay by mode of delivery (N= 97.718)**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The 97,648 women who delivered had 113,845 hospitalizations. During **pregnancy**[38] 12,019 (12.3%) women were admitted to a hospital. 9,810 (10.0%) women were admitted once, 1.729 (1.8 %) were admitted twice and 480 (0.5%) three times and more. (Day care is not included, as stated in the methodology, these stays cannot be merged)

The mean length of stay for the women admitted during pregnancy is 7.2 days (P10=2; P50 = 4; P90 = 16).

During the **postpartum** 1,188 (1.2%) women were admitted to a hospital of which 1,141 (1.2%) women were admitted once, 45 (0.05%) were admitted twice and 2 (0, 0%) women were admitted three times.

For the postpartum period, the mean length of stay is 4.7 days (P10 = 3; P50 = 5; P90 =7).

38 These in-patients stays do not include the stays in which the delivery occurs.

### *D. Ten most frequent ICD-9-CM codes by mode of delivery*

As mentioned in the methodology section, each woman has only one main diagnosis, but can have more than one secondary diagnosis. For the 97,718 pregnant women in the database, we have 225,404 diagnostic codes as secondary diagnosis[39], The detailed frequencies of these codes are presented in the tables underneath (V-codes excluded).

**Table 14: 10 most frequent[40] ICD-9-CM codes Vaginal delivery (N=78,694) - Main diagnosis - Specialty 1[41]**

| Naming of icd9 | icd9 | Number | Proportion |
|---|---|---|---|
| Delivery in a completely normal case | 650 | 17,959 | 22.8% |
| First-degree perineal laceration during delivery | 66401 | 4,882 | 6.2% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 4,060 | 5.2% |
| Early onset of delivery | 64421 | 2,002 | 2.5% |
| Other & unspecified cord entanglement, without mention of compression, complicating labor & delivery | 66331 | 1,970 | 2.5% |
| Second-degree perineal laceration during delivery | 66411 | 1,769 | 2.2% |
| Forceps or vacuum extractor delivery without mention of indication | 66951 | 1,720 | 2.2% |
| Cord around neck, with compression, complicating labor & delivery | 66311 | 1,631 | 2.1% |
| Fetal distress | 65631 | 1,576 | 2.0% |
| Premature rupture of membranes | 65811 | 1,553 | 2.0% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Table 15: 10 most frequent[42] ICD-9-CM codes Vaginal delivery (N=78,694) - Secondary diagnoses – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion |
|---|---|---|---|
| First-degree perineal laceration during delivery | 66401 | 3,287 | 4.2% |
| Streptococcus B infection | 04102 | 3,186 | 4.0% |
| Other & unspecified cord entanglement, without mention of compression, complicating labor & delivery | 66331 | 2,313 | 2.9% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 2,169 | 2.8% |
| Anemia | 64822 | 2,086 | 2.7% |
| Tobacco use disorder | 3051 | 1,992 | 2.5% |
| Anemia, unspecified | 2859 | 1,909 | 2.4% |
| Anemia complicating pregnancy, childbirth, or the puerperium | 64821 | 1,635 | 2.1% |
| Other current conditions classifiable elsewhere | 64891 | 1,530 | 1.9% |
| Cord around neck, with compression, complicating labor & delivery | 66311 | 1,511 | 1.9% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

39 from which 51.06 % are V-codes and D-codes.
40 The 10 most frequent ICD-9 codes total 39,112 out of 78,694
41 Information from the doctor who manages the medical file (specialist nr 1)
42 The 10 most frequent ICD-9 codes total 21,618 out of 78,694

**Table 16: 10 most frequent[43] ICD-9-CM codes C-section (N=18,164) - Main diagnosis – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion |
|---|---|---|---|
| Uterine scar from previous surgery complicating pregnancy, childbirth, or the puerperium | 65421 | 1,978 | 10.9% |
| Breech presentation without mention of version | 65221 | 1,838 | 10.1% |
| Obstruction caused by malposition of fetus at onset of labor | 66001 | 1,190 | 6.6% |
| Obstruction by bony pelvis | 66011 | 1,074 | 5.9% |
| Fetopelvic disproportion | 65341 | 1,032 | 5.7% |
| Fetal distress | 65631 | 913 | 5.0% |
| Cesarean delivery, without mention of indication | 66971 | 896 | 4.9% |
| Obstruction by abnormal pelvic soft tissues | 66021 | 505 | 2.8% |
| Generally contracted pelvis | 65311 | 496 | 2.7% |
| Early onset of delivery | 64421 | 418 | 2.3% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Table 17: 10 most frequent[44] ICD-9-CM codes C-section (N=18,164) - Secondary diagnosis – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion |
|---|---|---|---|
| Uterine scar from previous surgery complicating pregnancy, childbirth, or the puerperium | 65421 | 2,227 | 12.3% |
| Breech presentation without mention of version | 65221 | 1,577 | 8.7% |
| Early onset of delivery | 64421 | 1,302 | 7.2% |
| Fetopelvic disproportion | 65341 | 1,026 | 5.6% |
| Anemia | 64822 | 976 | 5.4% |
| Fetal distress | 65631 | 957 | 5.3% |
| Anemia | 64821 | 746 | 4.1% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 707 | 3.9% |
| Generally contracted pelvis | 65311 | 698 | 3.8% |
| Infections of genitourinary tract in pregnancy | 64661 | 644 | 3.5% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *E. Transfers*

Among the 97,718 pregnant women in our database, 992(1.02%) were transferred from one hospital to another. These women account for 1,073 transfers, 68 women were transferred more than twice.

Among these 1,073 transfers, 660 (61.5%) occur before the delivery and 413 (38.5%) after the delivery.

These figures are similar to those provided by the FPS yearly statistics (most recent report published in 2001). The 2001 file provided totalize 1,050 transferred women on 118,247 deliveries (0.9% of women transferred).

43 The 10 most frequent ICD-9 codes total 10,340 out of 18,164
44 The 10 most frequent ICD-9 codes total 10,086 out of 18,164

The data in the report (2007) from the College of Physicians for Mother and Newborn estimates the IUT rate in Belgium 0.9% and the neonatal transfers at 0.28% (total 1.18%).

### *F. Maternal mortality*

Fortunately, maternal mortality[45] is a very rare phenomenon in our regions. As we have two years of deliveries available for analysis, we used both years to analyze maternal mortality.

Among the 198,502 women available for analysis in the database, 26 women died during the period 2003 and 2004. From these 26 deaths, 12 deaths were *maternal deaths* (deaths within 42 days post-partum) and 14 *late maternal deaths* (deaths from direct or indirect causes that occur more than 42 days but less than a year following delivery) according to ICD-10 definitions of maternal deaths. One woman died during pregnancy, 7 women during the in-patient stay of the delivery, 1 died within 1 month of delivery and 3 within 2 months of delivery (no data on exact date due to privacy-reasons). The cause of mortality is not known for women that died outside the hospital, we only know the diagnostic attributed to the in-patient stays.

The incidence is measured on the 198.502 women from the cohort. Theoretically, the women who delivered in the last six weeks of the study period may have died after the study period and are, thus, not included in the numbers. This could have lead to a slight underestimation of the incidence. Although unlikely to be of clinical significance (incidence is very low), it must be mentioned.

In total we thus registered 9 to 12 maternal deaths over the two years, accounting for a maternal death rate of 4.5 to 6.0 /100,000.

### *G. Neonates*

Between 01/10/2003 and 30/09/2004, a total of 98,240 neonates were born from the mothers with merged data.
The specific information about the location of the birth indicates that 2% (N= 1,976) of the neonates were transferred from another hospital and 94 were transferred from ambulatory care. It is important to note that most of the newborn babies transferred to NIC units in another hospitals figure in the database of unmerged stays. (Figures can be find in annex).

A total of 4,174 (4.3%) neonates were admitted to a NIC-service and 17,068 (17.4%) to an N*-service. In total more than 20% of the neonates were admitted to either a NIC-unit or N*-service. It is interesting to note that in the FPS questionnaire, 81 (65%) hospital declare that the phototherapy is realized in the N*-service. This could partially explain the high neonatal admission rate.

45 A maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 2000).

**Table 18: General data newborns**

| Status | N | Proportion |
|---|---|---|
| born alive | 97,617 | 99.4 |
| Still born | 433 | 0.4 |
| Died during hospital stay | 181 | 0.2 |
| Type of pregnancy | N | Proportion |
| single | 94,490 | 96.2 |
| twins | 3,220 | 3.3 |
| multiple (more than 2) | 76 | 0.1 |
| missing data | 21 | 0.0 |
| Birth weight | N | Proportion |
| 500 - 999 : Extreme low birth weight ELBW | 444 | 0.5 |
| 1000 - 1499 : Very low birth weight VLBW | 630 | 0.6 |
| 1500 - 2499 : Low birth weight LBW | 6,104 | 6.2 |
| 2500 - 3999 : Normal birth weight NBW | 83,748 | 85.3 |
| >=4000 : High birth weight HBW | 7,235 | 7.4 |
| Missing information | 79 | 0.1 |
| Gestational age | N | Proportion |
| 22-28 : Extreme prematurity | 563 | 0.6 |
| 29-32 : Very preterm | 995 | 1.0 |
| 33-36 : Preterm delivery | 6,558 | 6.7 |
| 37-42 : Term delivery | 90,099 | 91.7 |
| >=42 : Prolonged pregnancy | 9 | 0.0 |
| missing information | 16 | 0.0 |
| **Apgar score at 1 min** | N | Proportion |
| 0-3 | 2,156 | 2.2 |
| 4-6 | 5,538 | 5.6 |
| 7-10 | 90,535 | 92.2 |
| **Apgar score at 5 min** | N | Proportion |
| 0-3 | 741 | 0.8 |
| 4-6 | 1,194 | 1.2 |
| 7-10 | 96,291 | 98.0 |
| **Stay in a NIC department** | N | Proportion |
| No | 94,066 | 95.8 |
| Yes | 4,174 | 4.3 |
| **Stay in a N* department** | N | Proportion |
| No | 81,172 | 82.6 |
| Yes | 17,068 | 17.4 |
| **All** | 98,240 | 100.0 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### 4.2.10 Analysis of maternities with and without MIC-services

The MIC-service serves as a referral centre for a group of hospitals caring for a minimum of 5000 deliveries. A (non-exclusive) convention must be signed between each hospital and the hospital with a MIC-service. The goal of this organisation is to stimulate women with high-risk pregnancies to deliver in specialized centres, in order to maximize quality of care. Women with severe complications in pregnancy should be transferred as soon as possible to a MIC-service, as intra-uterine transfer improves the outcome for mother and child (Tency et al, 2007).

Hence, the Belgian inpatient perinatal care of pregnant women is divided into three levels, namely: 1) standard maternity care, 2) maternal intermediate care, and 3) intensive care. All calculations are made on 97,718 deliveries.

#### *4.2.10.1 Characteristics of patient population by type of maternities*

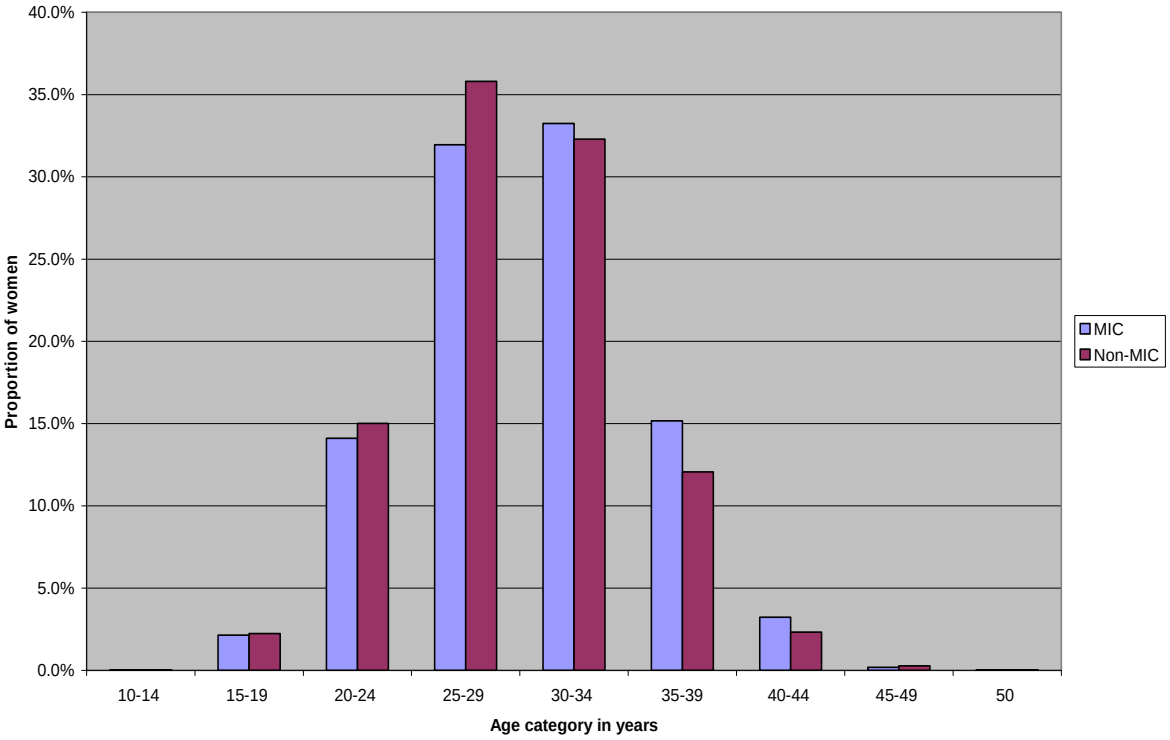
***Maternal Age***

The mean age of the women who deliver in MIC-services is 29.82 (P10=23; P50=30; P90=37).

The mean age of the women who deliver in non-MIC services is 29.21 (P10=23; P50=29; P90=36).

The difference of proportion of women in each age category according to type of maternity is shown in figure 7.

**Figure 6: Proportion of women in age categories according to type of maternity (Non MIC N= 70,400; MIC N = 27,318)**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The figure shows clearly that MIC-services receive a higher proportion of women from 30 to 44 years old. The proportion of women between 20 and 29 years is higher within the non-MIC services. These differences are statistically significant ($p < 0.05$).

The extreme groups contain few women; there are 9 women aged 10-14 years old, 121 women aged 45-49 years old and only 1 woman between 50 and 54 years old.

In the age group 45-49, 81 women are admitted to a hospital without a MIC-service and 40 in a with a MIC-service, the difference is not statistically significant ($\chi^2$ test, p=or<0.2106).

***Socio-economic characteristics***

**Table 19: Comparison of the proportion of women with low social status between maternity types for Belgium**

| | *Maternities with MIC-services* | | *Maternities without MIC-services* | | *Total* |
|---|---|---|---|---|---|
| **Social Status** | *Nb* | *%* | *Nb* | *%* | *Nb* |
| no MAF social and/or BIM | 25,222 | *92,3%* | 66,915 | *95.0%* | 78,705 |
| MAF social and/or BIM | 2,039 | *7.5%* | 3,391 | *4.8%* | 18,167 |
| *Unknown* | *57* | | *94* | | *151* |
| **Total** | **27,318** | *100%* | **70,400** | *100.0%* | **97,718** |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

In maternities with MIC-services, 7.5% of women have an indicator of low socio-economic status. In the non-MIC services this percentage is only 4.8 %. (p < 0.0001)

**Table 19 (bis) : Comparison of the proportion of women with low social status between maternity types per Province (N= 97.718)**

| | | **Proportion of pregnant women with low social status (BIM and/or social MAF)** n=8,051 (on N=97,718 deliveries) | | | **Relative risk** | | |
|---|---|---|---|---|---|---|---|
| **Region** | **Province** | Delivery in maternities **with** MIC services | Delivery in maternities **without** MIC-services | $\chi^2$-*test p value* | Value | 95% confidence limits | |
| **Région Bruxelles-Capitale Brussels Hoofdstedelijk gewest** | | **18,6%** | **14,8%** | *<0,0001* | **1,15** | 1,10 | 1,20 |
| **Vlaams gewest** | Antwerpen | 8,1% | 7,5% | *0,2486* | 1,06 | 0,96 | 1,16 |
| | Vlaams Brabant | 4,5% | 3,1% | *0,0004* | 1,26 | 1,12 | 1,42 |
| | West Vlaanderen | 6,6% | 3,9% | *<0,0001* | 1,62 | 1,30 | 2,03 |
| | Oost Vlaanderen | 7,4% | 6,0% | *0,0449* | 1,23 | 1,01 | 1,50 |
| | Limburg | 6,6% | 5,2% | *0,0315* | 1,19 | 1,02 | 1,38 |
| | ***Total*** | **6,6%** | **5,5%** | *<0,0001* | **1,17** | 1,09 | 1,24 |
| **Région Wallonne** | Brabant Wallon | 2,9% | 4,3% | *0,0538* | 0,78 | 0,59 | 1,03 |
| | Hainaut | 10,5% | 9,5% | *0,1011* | 1,09 | 0,98 | 1,21 |
| | Liège | 12,0% | 11,5% | *0,4679* | 1,02 | 0,96 | 1,08 |
| | Luxembourg | 2,2% | 5,8% | *0,0073* | 0,38 | 0,12 | 1,17 |
| | Namur | 4,2% | 6,8% | *0,0523* | 0,63 | 0,38 | 1,02 |
| | ***Total*** | **10,0%** | **8,8%** | *0,0005* | **1,10** | 1,05 | 1,17 |
| **Belgium** | | **10,5%** | **7,4%** | *<0,0001* | **1,30** | 1,26 | 1,34 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

For the whole Belgium, we see that hospitals with MIC-services admit a higher proportion of women with a low socio-economical status Table 19 (bis) shows that this shift is only seen in Brussels, Vlaams Brabant, Limburg, West and Oost Vlaanderen.

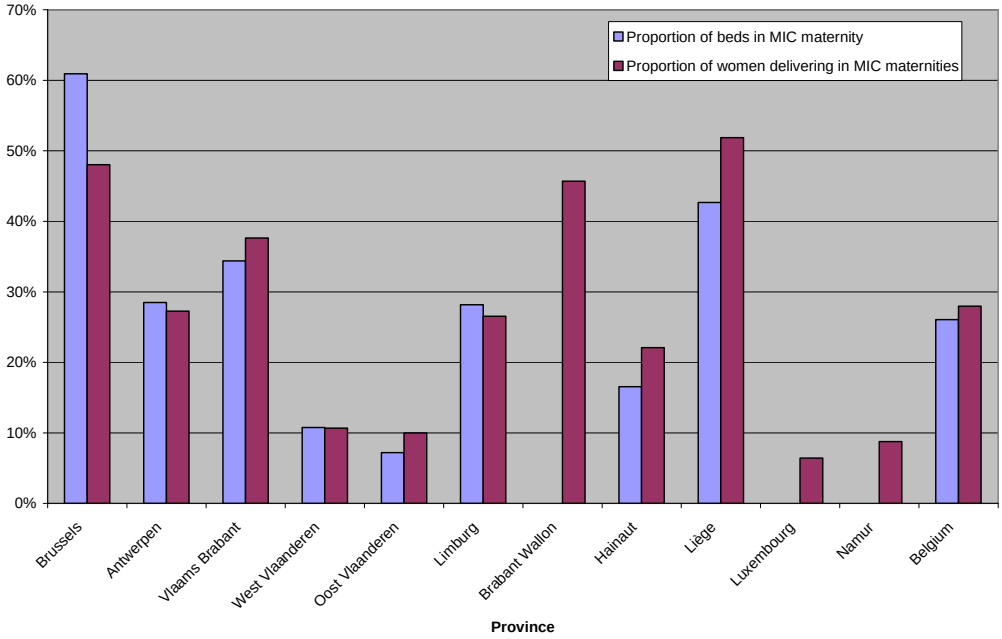
### *4.2.10.2 Capacity of maternities with MIC-services*

**Table 20: Number of deliveries in maternities with MIC-services**

| Region | Province | Number of Maternities with MIC-services | N of MIC-beds | **Total deliveries** | Number of deliveries per maternity with MIC-services |
|---|---|---|---|---|---|
| **Région Bruxelles-Capitale Brussels Hoofdstedelijk gewest** | | 6 | 64 | 16,351 | 2,725 |
| **Vlaams gewest** | Antwerpen | 3 | 24 | 16,648 | 5,549 |
| | Vlaams Brabant | 1 | 20 | 5,882 | 5,882 |
| | West Vlaanderen | 1 | 8 | 10,014 | 10,014 |
| | Oost Vlaanderen | 1 | 8 | 11,935 | 11,935 |
| | Limburg | 1 | 8 | 6,742 | 6,742 |
| | ***Total Vlaams gewest*** | 7 | 68 | 51,221 | 7,303 |
| **Région Wallonne** | Brabant Wallon | 0 | 0 | 1,840 | No MIC |
| | Hainaut | 2 | 16 | 12,704 | 6.352 |
| | Liège | 2 | 24 | 9,824 | 4.912 |
| | Luxembourg | 0 | 0 | 2,118 | No MIC |
| | Namur | 0 | 0 | 3,505 | No MIC |
| | ***Total Wallonie*** | 4 | 40 | 29,991 | 7,497 |
| Unknown | | | | | |
| **Belgium** | | 17 | 172 | 97,563 | 5,739 |

According to the Royal Decree (RD) of Augustus 20th 1996: « the MIC-service will serve as referral centre for a group of hospitals totalizing a minimum of 5 000 deliveries". Globally, the conditions of the RD seems to be respected since 17 MIC services were created for 85 000 deliveries. However, as seen in table 20 above, the situation varies widely between regions. The situation is quite similar in Vlaanderen en in Wallonie but in Brussels, there are not enough births to justify the high number of MIC-services (6). Of course, MIC services in Brussels can establish reference agreements with maternity services outside Brussels: this assertion is tested in section 6.3.1. These agreements do not correspond to the primary objective of the Royal Decree, even if the text of this RD does not prevent maternity services to sign agreements with several MIC services, including agreements which are practically never carried out.

**Figure 7: Proportion of women who deliver in a maternity that has some MIC-beds per province and proportion of beds in MIC-services in each province**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of women who deliver in maternities with MIC-beds differs according to their place of residence and varies from 6.4% in province Luxembourg, 37.7% in Vlaams Brabant, 48.0% in Brussels, and 51.9% in Liège.

This proportion of women delivering in MIC-services is related to the proportion of beds in MIC-services in the province except for Brabant Wallon. In this province, there are no MIC-beds and the proportion of women delivering in MIC-services is equal to the proportion observed in Brussels. It is explained by the fact that most of the women living in this province deliver in Brussels or in the maternity of Braine-L'Alleud. The maternity of Braine-L'Alleud now belongs to the Chirec group. This whole group of hospitals, including one hospital in Brussels having a MIC-service, is considered administratively as a maternity with MIC service. However, there are no MIC bed in Braine-l'Alleud. Therefore, the 1.021 women who delivered in this hospital in 2004 contribute to overestimating the global proportion of pregnant women who really deliver in a maternity with MIC-service in Brabant Wallon.

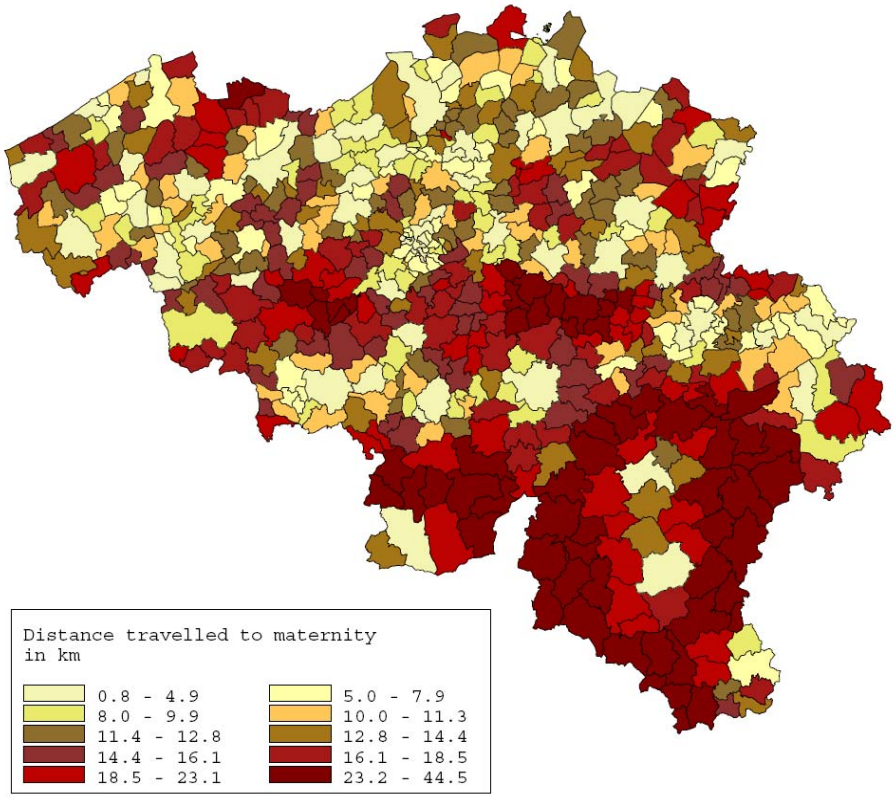
### *4.2.10.3 Accessibility of maternities with MIC-services*

For Belgium in total, the mean distance travelled by women to reach a Maternity without MIC-services is 9.1 km (P10=0; P50= 7.3; P90= 20.2) and the mean distance to reach a maternity with a MIC-service is 10.6 km (P10=0; P50= 7.0; P90= 25.4).

According to the place of residence, the distance to reach a hospital with or without a MIC-service differs.

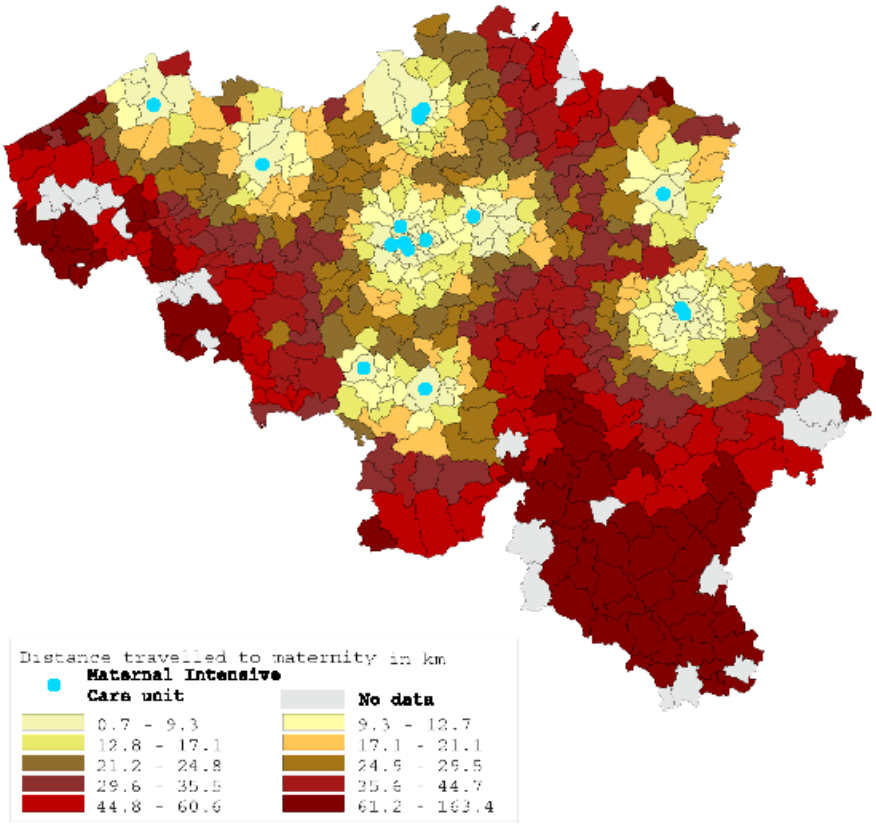
More details are shown in the maps underneath.

**Figure 8: Distance travelled by women to maternity without MIC-service**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Figure 9 Distance travelled by women to maternity with a MIC-service**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

This map clearly reflects the organizational structure of the Belgian perinatal care. Due to the P* functions, the care for high-risk mothers and baby's is centred on referral MIC-services, mainly situated in big cities ( province's capitals). Women in the northern part of the province of 'Antwerpen' and 'Limburg' and in the southern part of 'West-Vlaanderen' travel around 40 km to a MIC-service.

As seen in figure 9, the Southern part of Belgium is also quite 'red', the mean distance travelled to a MIC-service by women living in the province of 'Hainaut', and Namur' is 40 km. The distance travelled by women living in Province 'Luxembourg' varies from 40 to 160 km.

### *B. Mode of deliveries*

Table 18 shows the detailed distribution of deliveries between the two types of maternities.

**Table 21: Distribution of women and type of deliveries among non-MIC and MIC-services (N= 97.718 in-patient deliveries)**

| | ***Maternities with MIC-services*** | | ***Maternities without MIC-services*** | | *Total* | |
|---|---|---|---|---|---|---|
| **Mode of delivery** | *Nb* | *%* | *Nb* | *%* | *Nb* | p |
| Vaginal deliveries | 21,380 | *78.3%* | 57,314 | *81.4%* | 78,694 | <0.0001 |
| C-sections | 5,598 | *20.5%* | 12,566 | *17.8%* | 18,164 | <0.0001 |
| **Total** | **26,978** | ***98.8%*** | **69,880** | ***99.3%*** | **96,858** | |
| Embryotomies | 0 | *0.0%* | 4 | *0.0%* | 4 | 0.2128 |
| Miscarriages | 340 | *1.2%* | 516 | *0.7%* | 856 | <0.0001 |
| *Total* | 27,318 | *100.0%* | 70,400 | *100.0%* | 97,718 | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

In maternities with a MIC-service, 20.5% of the deliveries are by caesarean section. In maternities without a MIC-service, and the c-section rate is 17.8 % by caesarean section. The difference in c-section rate is statistically significant (p < 0,0001).

### *C. Length of stay*

#### STAYS INCLUDING DELIVERY

The mean length of stay for a vaginal delivery in non-MIC services is 4.9 days (P10= 3 days; P50=5 days; P90= 6 days). In maternities with a MIC-service the mean length of stay is 5.1 days (P10= 4 days; P50=5 days; P90= 6 days), while for caesarean delivery these figures are 7.3 days (P10= 5 days; P50= 7 days; P90=9 days) and 8.5 days (P10= 5 days; P50=7 days; P90= 11 days) for no-MIC and MIC, respectively. The differences between the means are statistically significant ($\chi^2$ test, p value < 0.0001), and this is mainly due to a distribution skewed to the right in the MIC-services.

#### STAYS DURING PREGNANCY AND POSTPARTUM

8,908 (12.7%) women who delivered in a Maternity without MIC-services were admitted a first time during **pregnancy**[46].

The mean length of stay for these women admitted during pregnancy was 6.8 days (P10= 2; P50 = 4; P90 = 14).

Among the women **who delivered** in maternities with MIC-services, 4,350 (16.1%) were admitted to a hospital during pregnancy. The mean length of stay for these women admitted during pregnancy is 8.0 days (P10= 2; P50 = 4; P90 = 18).

The difference in proportion of women admitted during pregnancy in the maternities with a MIC-service and others is statistically significant ($\chi^2$ test, p value <0.0001)

46 These in-patients stays do not include the stays in which the delivery occurs.

Among the women who delivered in a Maternity without MIC-services, 658 women (0.8%) had a postpartum readmission; among the women who delivered in a Maternity with MIC-services, 580 women (1.8%) had a postpartum readmission.

The difference in proportion of women admitted during post-partum in the maternities with MIC-service and others is statistically significant ($\chi^2$ test, p value <chi-square <0.0001

### *D. Transfers of mothers (during pregnancy or postpartum)*

A total of 992 (1.02%) women are transferred from one hospital to another and account for 1,073 transfers; 80.3% (n=862) to hospitals with a MIC-service, 19.7 % (n=211) to hospitals without a MIC-service.

660 (61.5%) transfers are intrauterine transfers, 413 (38.5%) transfers are postpartum transfers. Among these intrauterine transfers, 510 (77.3%) are addressed to maternities with a MIC-service.

22.7% of intra-uterine transfers are directed to a maternity without a MIC-service, some of these transfers may be 'retransfers' from a MIC-service to a maternity without a MIC-service.

The IUT transfer rate is then 0.67%, in the report (2007) from the College of Physicians for Mother and Newborn, the authors estimate from inquiry to hospitals, the Belgian IUT rate at 0.9% and the neonatal transfer rate at 0.3% (total 1.8%) in 2004. These rate are then similar to those from this study.

The distribution of transfers among the different MIC-services in our database, is shown in table 22 below.

**Table 22: Transfers received by MIC-services**

| Province | Hospitals | Nb of M beds | Nb of MIC beds | **All transfers** | *Transfers / MIC beds* | Intra-uterin transfers | *IUT / all transfers* |
|---|---|---|---|---|---|---|---|
| **Région Bruxelles-Capitale - Brussels Hoofdstedelijk gewest** | | | | | | | |
| | UCL | 36 | 16 | 82 | 5,1 | 50 | 61.0% |
| | CHU St Pierre | 40 | 15 | 19 | 1,3 | 18 | 94.7% |
| | CHU Brugmann + hôpital des enfants | 30 | 9 | 35 | 3,9 | 14 | 40.0% |
| | Erasme | 27 | 8 | 39 | 4,9 | 27 | 69.2% |
| | VUB | 40 | 8 | 58 | 7,3 | 28 | 48.3% |
| | Edith Cavell | 54 | 8 | 4 | 0,5 | 2 | 50.0% |
| **Vlaams gewest** | | | | | | | |
| Antwerpen | U.I.A | 20 | 8 | 98 | 12,3 | 62 | 63.3% |
| | AZ Middelheim | 36 | 8 | 35 | 4,4 | 8 | 22.9% |
| | AZ St Augustinus | 49 | 8 | 20 | 2,5 | 10 | 50.0% |
| Vlaams Brabant | KUL | 65 | 20 | 104 | 5,2 | 71 | 68.3% |
| West Vlaanderen | AZ St Jan | 38 | 8 | 42 | 5,3 | 30 | 71.4% |
| Oost Vlaanderen | UZ Gent | 31 | 8 | 102 | 12,8 | 60 | 58.8% |
| Limburg | ZOL | 60 | 8 | 46 | 5,8 | 28 | 60.9% |
| **Région Wallonne** | | | | | | | |
| Hainaut | CHU Tivoli | 28 | 8 | 47 | 5,9 | 24 | 51.1% |
| | CH Notre Dame / Reine Fabiola | 45 | 8 | 40 | 5,0 | 21 | 52.5% |
| Liège | CH St Vincent et Ste Elisabeth | 61 | 16 | 34 | 2,1 | 19 | 55.9% |
| | CH La Citadelle | 53 | 8 | 57 | 7,1 | 38 | 66.7% |
| **Total** | | **713** | **172** | **862** | **5,0** | **510** | **59.2%** |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

Table 22 shows that The number of transfers received by each hospital with MIC-service varies from 4 to 104. The proportion of tranfers per MIC-beds varies from 0.5 to 12.8 transfers per MIC-bed.

The university hospital in Gent with 12.8 transfers per MIC-beds and the university hospital in Antwerp with 12.3 transfers per MIC-bed are the maternities with the highest proportion of tranfers per MIC-bed.

The non-MIC maternities receive 211 transfers among which 150 were IUT. Among these maternities, two have 15 NIC-beds: the CHU de Charleroi received 12 transfers of mothers (9 IUT and 3 postpartum) and the CHR de Namur receives 4 transfers (0 IUT and 4 postpartum). The RHMS (Réseau Hospitalier de Médecine Sociale) receives 10 transfers (10 IUT), the hospital Famenne-Ardennes receives 6 transfers (4 IUT and 2 postpartum).

### *E. Neonates*

#### PLACE OF BIRTH

Of the 98,240 neonates, 28.1% (N = 27,628) were born in a maternity with MIC-services.

As shown in the tables underneath, this proportion varies according to the neonates' characteristics.

**Table 23: Place of birth and status of newborn according to type of maternity**

| Status | *Maternities without MIC-services* | | *Maternities with MIC-services* | | All | |
|---|---|---|---|---|---|---|
| Life birth | 70,348 | *99.6%* | 27,269 | *98.7%* | 97,617 | *99.4%* |
| Still born | 226 | *0.3%* | 207 | *07%* | 433 | *0.4%* |
| Died during in-patient stay | 36 | *0.1%* | 145 | *0.5%* | 181 | *0.2%* |
| *Other* | 2 | | *7* | | *9* | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of stillborns within the two types of maternities is 0.3 % without MIC-services versus 0.7 % with MIC-service. The difference in proportion is statistically significant ($\chi^2$ test, p value <0.0001).

The proportion of newborns that died during the hospital stay is higher in the MIC-services (0.5% MIC versus 0.1% non-MIC, the difference is statistically significant $\chi^2$ test, p value <0.0001).

#### PROPORTION OF MULTIPLE PREGNANCIES

**Table 24: Proportion of multiple pregnancies according to type of maternity**

| Status | *Maternities without MIC-services* | | *Maternities with MIC-services* | | All | |
|---|---|---|---|---|---|---|
| Single | 68,464 | *97.0%* | 26,026 | *94.2%* | 94,490 | *96.2%* |
| Twins | 1,890 | *2.7%* | 1,330 | *4.8%* | 3,220 | *3.3%* |
| Multiple (more than 2) | 16 | *0.0%* | 60 | *0.2%* | 76 | *0.1%* |
| *Missing information and other* | *242* | | *212* | | *454* | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The maternities with a MIC-service admit a higher proportion of women with twin pregnancies than the other maternities (4.8% versus 2.7%, $\chi^2$ test, p value <0.0001). They also admit more multiple pregnancies but these pregnancies are very rare.

### DISTRIBUTION OF GESTATIONAL AGE

**Table 25: Distribution of gestational age according to type of maternity**

| Gestational age | *Maternities without MIC-services* | | *Maternities with MIC-services* | | All | |
|---|---|---|---|---|---|---|
| 22-28 : Extreme prematurity | 136 | *0.2%* | 427 | *1.5%* | 563 | *0.6%* |
| 29-32 : Very preterm | 316 | *0.4%* | 679 | *2.5%* | 995 | *1.0%* |
| 33-36 : Preterm delivery | 4,430 | *6.3%* | 2,128 | *7.7%* | 6,558 | *6.7%* |
| 37-42 : Term delivery | 65,716 | *93.1%* | 24,383 | *88.3%* | 90,099 | *91.7%* |
| >=42 : Prolonged pregnancy | 5 | *0.0%* | 4 | *0.0%* | 9 | *0.0%* |
| *Missing information* | *9* | | *7* | | *16* | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The maternities with a MIC-service deliver more women with premature neonates than the others (1.5% versus 0.2% for the extremely premature; 2.5% versus 0.4% for the very preterm; 7.7% versus 6.3% for the premature). The difference is statically significant; $\chi^2$ test, p value < 0.0001.

**24.5% of the extremely preterm babies and 31.8 % of the very preterm were born in a maternity without a MIC-service.**

### DISTRIBUTION OF BIRTH WEIGHT

**Table 26: Distribution of birth weight according to type of maternity**

| Birth weight | *Maternities without MIC-services* | | *Maternities with MIC-services* | | All | |
|---|---|---|---|---|---|---|
| 500 - 999 : Extreme low birth weight | 103 | *0.1%* | 341 | *1.2%* | 444 | *0.5%* |
| 1000 - 1499 : Very low birth weight | 188 | *0.3%* | 442 | *1.6%* | 630 | *0.6%* |
| 1500 - 2499 : Low birth weight | 3,940 | *5.6%* | 2,164 | *7.8%* | 6,104 | *6.2%* |
| 2500 - 3999 : Normal birth weight | 60,920 | *86.3%* | 22,828 | *82.6%* | 83,748 | *85.2%* |
| >=4000 : High birth weight | 5,430 | *7.7%* | 1,805 | *6.5%* | 7,235 | *7.4%* |
| *Missing information* | *31* | | *48* | | *79* | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The birth weight is tightly linked to the term of the newborn.

The proportion of neonates with extremely low birth weight (ELBW) (1.2% versus 0.1%), of very low birth weight (VLBW)(1.6% versus 0.3%) and of low birth weight (7.8% versus 5.6%) is higher in the maternities with MIC-service than in the others. The difference is statistically significant; $\chi^2$ test, p value < 0.0001.

**Overall 23.2% of the neonates with ELBW, 29.8% of the VLBW and 64.5% of the LBW (Low Birth Weight) were born in maternities without MIC-service.**

### APGAR SCORES

**Table 27: Apgar scores at 1 and 5 minutes in the two types of maternities**

| Apgar score at 1 minute | *Maternities without MIC-services* | | *Maternities with MIC-services* | | **All** | |
|---|---|---|---|---|---|---|
| 0-3 | 1,317 | *1.9%* | 839 | *3.0%* | 2,156 | *2.2%* |
| 4-6 | 3,878 | *5.5%* | 1,660 | *6.0%* | 5,538 | *5.6%* |
| 7-10 | 65,409 | *92.6%* | 25,126 | *90.9%* | 90,535 | *92.2%* |
| *Missing information* | *8* | | *3* | | 11 | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |
| **Apgar score at 5 minute** | | | | | | |
| 0-3 | 421 | *0.6%* | 320 | *1.2%* | 741 | *0.8%* |
| 4-6 | 818 | *1.2%* | 376 | *1.4%* | 1,194 | *1.2%* |
| 7-10 | 69,364 | *98.2%* | 26,927 | *97.5%* | 96.291 | *98.0%* |
| *Missing information* | *9* | | *5* | | 14 | |
| **All** | **70,612** | *100.0%* | **27,628** | *100.0%* | **98,240** | *100.0%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of newborns with a low Apgar score (0-3) at 1 minute is higher in the maternities with MIC-services. The proportion of newborns with a low Apgar score (0-3) at 5 minutes is also higher in the maternities with MIC-services. Nonetheless, the differences are slight. Apgar score are also linked to prematurity.

### PROPORTION OF ADMISSIONS TO NIC AND N*

In maternities without MIC-service, 22.1% of the neonates are reported being admitted separately from their mother (0.4 % in NIC-service and 21.7% in N*- service).
In maternities with MIC-services, 18.8% of the neonates are reported being admitted separately from the mother (14.7 % in NIC-service and 4.1% in N*-service).
These results are shown in the table 28 below.

**Table 28: Proportion of neonates admitted to NIC and N* according to type of maternity**

| Admissions | *Maternities without MIC-services* | | *Maternities with MIC-services* | | **All** | |
|---|---|---|---|---|---|---|
| NIC | 271 | *0.4%* | 4,093 | *14.7%* | 4,364 | *4.4%* |
| N* | 15,307 | *21.7%* | 1,129 | *4.1%* | 16,436 | *16.7%* |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The use of NIC or N*-services seems to depend highly from the availability of services.
There are two maternities with NIC-service without a MIC-service. All the others have MIC- as well as NIC -beds.
These isolated NIC-services admit 12.9 % of the newborns separately from their mother (10.7% in NIC and 2.2 in N*-service).

### 4.2.11 Key messages

- **Information about 97,648 women who were admitted for delivery or miscarriage between 01/10/2003 and 30/09/2004 was available through a merge between the MKG/RCM and the IMA/AIM databases.**
- **106 maternity departments account for a total of 3,200 accredited maternity beds and realise some 115,000 deliveries annually.**
- **Among those, 17 maternities host a MIC-service, i.e. 13.3% to 44.4% of their M beds are registered as MIC-beds. Overall, MIC-beds account for 5.4% of maternity beds.**
- **In maternities with MIC-service, there are more premature babies, more stillbirths, more multiple pregnancies and more socially deprived women**
- **The proportion of women with a low socio-economical status delivering in hospitals with a MIC-service is seen for the country as a whole . However, this shift is actually limited to Brussels, Vlaams Brabant, Limburg, West en Oost Vlaanderen.**
- **The data do not allow to ascertain that the above-mentioned complications are indeed treated in MIC-beds.**
- **The proportion of women delivering in MIC-services is closely related to geographical availability; the transfer rate from non-MIC services towards MIC-services is very low (0,5 to 12,8) transfers per MIC-bed per year; the mean distance between place of delivery and place of residence is comparable for MIC and non-MIC services.**

# 5 THEORETICAL MODEL

## 5.1 INTRODUCTION

As already mentioned in the literature review, the most important obstacle within our search for evidence was the terminology used, i.e. we were not able to find any literature which mentioned or referred to the concept "maternal intermediate care". Concepts as "high-dependency care" and "obstetrical intermediate care" appeared to be best comparable to the typical Belgian MIC-concept. The result of this systematic literature review on maternal intermediate care (MIC, cf. supra) provided a very diverse, but limited amount of scientific literature.

A reasonable amount of articles/studies was found about specific aspects of intensive or critical obstetric care. Research on for example hypertensive problems and pregnancy, cardiac disease and pregnancy, haemorrhage, etc. were omnipresent. All of these articles addressed certain aspects of (possible) life-threatening situations in relation to maternal-foetal morbidity. Most of these studies were literature reviews with levels of evidence between 3 and 4, very little systemic reviews or randomised controlled studies were found.

Few articles studied, investigated the functioning of maternal intermediate care and the organisational aspects of the associated hospital ward in depth. We identified 171 eligible articles of which 13 relevant MIC articles of relatively good quality were selected (used critical appraisal tool: Checklist for observational studies, AHRQ). Almost every study focused on a tertiary centre based retrospective analysis of hospital records of parturients admitted to the (obstetrical) ICU or, in a few articles, to the high dependency unit. These studies explored the individual tertiary settings and findings can not be generalized because of the limited number of patients and the randomly selected criteria for admission. Nearly all evidence regarding maternal intermediate care was indirect evidence through ICU literature.

Moreover, the available literature did not provide evidence-based indications for women who require a level of maternal intermediate care. Due to the lack of evidence and utilizable criteria, a list of indications (based on expert opinion) leading to intermediate care was created specially for this study.

Similar to the definition of maternal intermediate care, an evidence-based model of admission criteria doesn't exist. In the underneath listing we present a summary of admission criteria internationally widely used. (Pre)eclampsia and haemorrhage are the two commonest mentioned reasons for admission within the reviewed literature. The underneath list complications is a brief synthesis and is not exhaustive.

**Direct** obstetrical complications [47] : pre-eclampsia, HELLP, severe haemorrhage, trombo-embolic disorders, sepsis, placental abruption/praevia, inevitable premature labour (before 32 weeks), premature rupture of the membranes (before 32 weeks), intra uterine growth retardation (on vascular basis), congenital malformation wherefore early treatment is recommended, multiple pregnancy (more than 2 neonates or threatening premature birth before 34 weeks), …

47 The distinction between direct and indirect obstetrical causes of admission in MIC unit is proposed by many authors (Waterstone, Bewley & Wolfe, 2001; Ancel et al, 1998; Panchal, Arria & Harris, 2000; Murphy & Charlett, 2002; Dao et al, 2003; Koeberlé et al, 2000; Geller et al, 2002; Mirghani et al, 2004; Oettle et al, 2004 and Mantel et al, 1998) Direct obstetrical complication are those resulting from previous existing disease or disease that developed during pregnancy and that was not due to direct obstetric cause but was aggravated by the physiological effects of pregnancy (ICD-10).Indirect obstetrical causes are obstetrical complications resulting from previous existing disease or disease developed during pregnancy which was not due to direct obstetrical causes but which was aggravated by the physiological effects of pregnancy.

**Indirect** obstetrical complications: Cardiac and vascular disease (e.g. hypertension, thyrotoxicosis, plasmapheresis, anaemia, …), pulmonary disease (e.g. asthma or pneumonia, …), neurological disease , gastro-intestinal disease (e.g. diabetes mellitus, cholecystitis, pancreatitis, appendicitis, peritonitis, …), endocrine disease

(e.g. thyrotoxicosis, …), infectious and parasitical disease, drug dependence, intoxication, trauma, psychiatric disease, …

As mentioned above a widely used consensus list of indications for admission on a MIC-service doesn't exist, every country/hospital has its own way of referring and admitting high risk obstetrical patients. Therefore we try to develop a "Belgian" list.

## 5.2 METHODOLOGY

The process of retrieving the indications (see annex) for admission to (in-hospital) obstetric intermediate care followed different systematically ordered steps, as explained below.

First, the **P.I.C.O**. (Patient, Intervention, Comparison, Outcome) model for clinical questions was used to identify all relevant information and keywords about admission criteria for the maternal intermediate care unit and to get a clear view on the problem wherefore information was to be found. In this phase we mainly focused on (clinical) guidelines, due to the lack of evidence on the topic.

The databases were accessed through CEBAM (a portal site that gathers up to date evidence based search engines, CEBAM digital library is the Belgian branch of the Cochrane collabouration). The following search engines were systematically used for evidence based guidelines on standards for maternal intermediate or intensive care (as defined in deliverable 1).

In the **Dutch**-language databases (CBO, Nederlands Huisartsengenootschap, Richtlijnen Kenniscentrum (KCE), RIZIV richtlijnen and WVVH Domus Medica), all topics related to peripartal care were investigated for guidelines on intermediate obstetric care. Three guidelines concerning prenatal and postpartum care were identified. These guidelines provide standards for low-risk pregnancies, but very limited information about intermediate care for complicated or problematic pregnancies within a hospital setting. In other words no Dutch guideline fitted to the goal of the query. Furthermore, **Anglo-Saxon** guidelines search engines (Guideline Finder UK, National Guideline Clearinghouse, New Zealand Guidelines Group, Prodigy Guidelines and WHO) were used with keywords: obstetric (intermediate) care, peripartal care, pregnancy care and high risk, maternity services (and high risk), maternity care, disease and pregnancy, high dependency unit. These keywords were also combined with each other when the number of guidelines found was too large. Within the potential relevant guidelines we searched for everything related to high-risk, complication and problem. Time restrictions were set on 1995 to 2007.

### 5.2.1 Guidelines

This extensive search resulted in two types of guidelines, general (low risk) maternity care guidelines and guidelines on a specific topic of complicated peripartal care e.g. diabetes & pregnancy, cardio-vascular problems, … . This same tendency was seen in the general literature search. We found no specific guidelines concerning overall intermediate obstetrical care, we did found some general guidelines concerning admission and discharge from general intensive care and high dependency/intermediate care units. Within these general admission and discharge criteria nothing was specifically mentioned for pregnancy and childbirth.

Due to the poor results of the searches in the above mentioned guideline databases, the EBM search engines Tripdatabase and Sumsearch were subsequently searched and gave access to respectively evidence based synopses, clinical questions, systematic reviews, guidelines (North America, Europe and other), core primary research and e-textbooks related to a specific topic (see keywords). One relevant guideline was identified: Finnish Medical Society Duodecim (2006). *Systemic diseases in pregnancy*. Retrieved May 15, 2007 from Cebam, National guideline clearinghouse : www.guideline.gov.

This guideline specifies management/treatment of pregnant women with heart and vascular diseases (hypertension, heart disease), thrombotic complications, metabolic disorders (diabetes, hypothyroidism, hyperthyroidism, obesity), neurological diseases (epilepsy, migraine, disturbances of cerebral circulation), renal diseases, rheumatic disorders, psychiatric problems, bronchial asthma, cancer.

An important limitation of this valuable tool (and most other guidelines) was the lack of recommendations on the appropriate level of care for each pathology. No literature or guidelines where found that specifically mentioned on which level of care women with certain (combination of) pathology(ies) should be admitted.

### 5.2.2 Construction of the theoretical list of indications

The extensive search for guidelines and evidence concerning obstetric intermediate care retrieved a few guidelines and articles of low accuracy. Therefore the construction of the list of indications had to be based on a **clinically designed list** of indications for admission on the MIC-service. Two resident obstetricians[48], active within an academic tertiary setting, devised a clinical list as an answer to the daily problem of identifying MIC-patients. The list was divided into two groups, pregnancy related pathology and not-pregnancy related pathology.

The rough structure of this list (organised by anatomical structures) served as a starting point and gradually more detailed information concerning the different pregnancy and not pregnancy related pathology was added. As mentioned above, guidelines concerning specific complications of pregnancy were relatively easy to find. Per problem cited in the clinical list, the Dutch and Anglo-Saxon search engines, were systematically explored for relevant evidence based guidelines. Where evidence based guidelines were found, information on specific problems was included. With the help of 2 gynaecologists and 1 epidemiologist proposals for indications for intermediate care admission, the disease classification types and risk stratification were formulated.

Subsequently an intensive process of internal validation using the **Delphi-method** was started. During the first phase (written phase) the list was sent by email to all seven members of the research-group who were asked to send their written feedback to the coordinator. All feedback and comments were gathered, discussed and added to the list. In a second phase these written comments were discussed during a meeting. After the meeting the adaptations were made and sent back for additional feedback and approval to the research-partners. The list evoked a lot of discussion and this process had to be repeated four times to obtain consensus. The consensus-list was divided into three groups: not pregnancy related pathology, pregnancy related pathology and foetal pathology. The not pregnancy related pathology was grouped into endocrinologic, nephrologic, cardio-vascular, thrombotic, infectious, pulmonary, autoimmune, connective tissues, skeletal, neuromuscular, haematologic, oncologic, socio-economic, trauma, psychiatric, uro-genital and gastro-intestinal disorders. The pregnancy related pathology was grouped into pregnancy interruption, intra-uterine death, PPROM, preterm birth, IUGR (Intra Uterine Growth Retardation), immunisation, multiple pregnancies, hypertension, thromboembolism, haemorrhage and miscellaneous disorders. The foetal pathology was not stratified into different subgroups.

The initial purpose of this list was to group woman (and their foetuses) suffering from a specific pathology (pregnancy or not-pregnancy related) and attribute them the level of care (standard, intermediate and intensive care) they ideally need. Later on, it became clear that the admission criteria for intensive care were clear-cut (see definition in literature review), but the criteria for admission to standard and intermediate care were very unclear.

Therefore we decided to create **three levels of care** (standard care, 'grey zone' and intermediate care). The addition of the category 'grey zone' was made to increase the clinical applicability of the list of indications.

48 Dr. Kristien Roelens and dr. Ellen Roets, the Gent University Hospital

This list wants to group theoretically ideal levels of care needed by women (and their foetuses) suffering from a pathology (pregnancy of not-pregnancy related). In other words, this list of indications gives an overview of the required levels of care in an ideal world. It is important to keep in mind that we created the list based on our definition of intermediate care: 'a woman requiring more than standard care could benefit from intermediate care'. This does not mean that these women with a pathology grouped in the intermediate care category should also be admitted to an intermediate care unit. We only created theoretical risk profiles that indicate that woman could benefit from 'more-than-standard-care'.

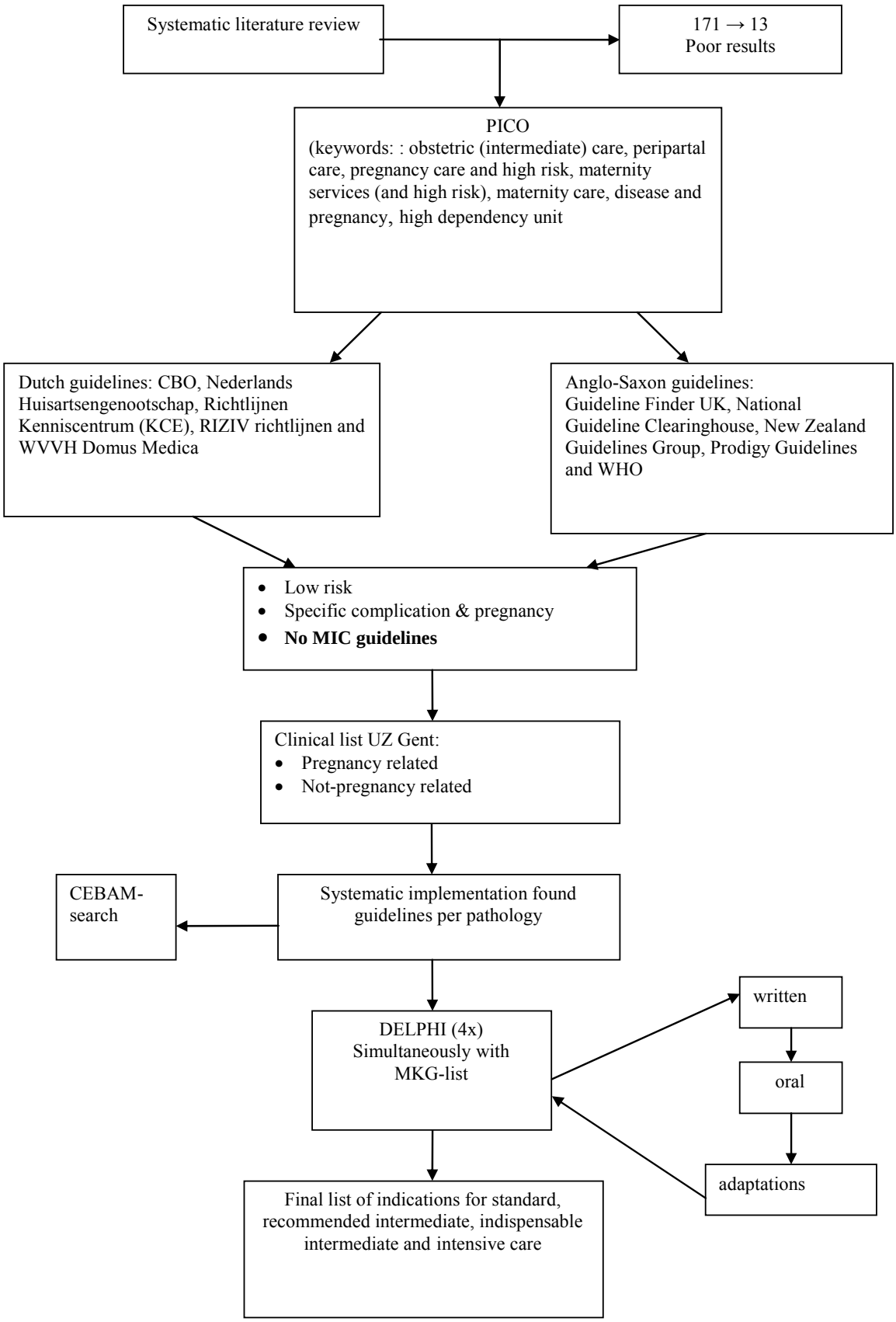
Due to the fact that not much evidence was found on the topic, most of the recommended levels of care are based on the expert opinions of the members of the MIC research group. It is evident that the few indications wherefore sufficient evidence was found, were also included.

In addition to the theoretical work on the list and the approval process, monthly reunions of an **ad hoc working group** tested the clinical relevance of the admission criteria. This working group of the Gent University Hospital enclosed two obstetricians, the head midwife, a MKG codification specialist and a MIC researcher. All patients admitted to the MIC-service were individually screened, the diagnosis was compared to the list of indications. In case the pathology was listed as standard care, the patient was considered as a maternity patient. If the pathology was listed as intermediate care, the patient was considered as a MIC-patient. If the pathology was not on the list, it was discussed (cf. supra) and if relevant, added to the list. Patients, from whom the situation was not clear, were extensively discussed by and decided to group into the grey zone or intermediate care.

These valuable monthly exercises (from February 2007 to March 2008) tested the list of admission criteria for clinical relevance and the potential implementation within the daily practice. The relevant conclusions of these discussions where systematically included into the list of admission criteria.

## 5.3 SCHEMATIC OVERVIEW CONSTRUCTION THEORETICAL MODEL

A complete version of the list of indications is included in the annexes


Systematic literature review
171 → 13
Poor results
PICO
(keywords: : obstetric (intermediate) care, peripartal care, pregnancy care and high risk, maternity services (and high risk), maternity care, disease and pregnancy, high dependency unit
Dutch guidelines: CBO, Nederlands Huisartsengenootschap, Richtlijnen Kenniscentrum (KCE), RIZIV richtlijnen and WVVH Domus Medica
Anglo-Saxon guidelines: Guideline Finder UK, National Guideline Clearinghouse, New Zealand Guidelines Group, Prodigy Guidelines and WHO
Low risk
Specific complication & pregnancy
No MIC guidelines
Clinical list UZ Gent:
Pregnancy related
Not-pregnancy related
CEBAM-search
Systematic implementation found guidelines per pathology
DELPHI (4x)
Simultaneously with MKG-list
written
oral
adaptations
Final list of indications for standard, recommended intermediate, indispensable intermediate and intensive care

## 5.4 TRANSLATION AND VALIDATION OF THE PATHOLOGY AND RISK FACTORS INTO ICD-9-CM/IMA DATA

The theoretical list was used as a starting point to identify pathologies in the database described before. During each phase of the construction process (cf. supra), the theoretical concepts were systematically translated into respectively ATC (Anatomic Therapeutical Classification) -codes, ICD-9-CM, (International Classification of Diseases version 9 - Clinical Modification) and RIZIV-INAMI nomenclature. The main structural work was done by a team of ICD-9 codification experts[49]. An intense collaboration between the Gent codification experts, IMA experts and the Gent research team was responsible for the right interpretation of the theoretical indications into the correct codes. The list of codes was systematically reworked every time the research-group made adaptations to the theoretical list.

During this translation-process (in close consultation with the obstetricians) it became clear that specific medication (ATC) given to pregnant women for non pregnancy related problems were not specific enough to evaluate the severity of illness. The main focus remained the MKG/RCM codes that can distinguish peripartal women with or without certain disorders. For most pathology the MKG-code was composed of one or more disease-codes and a V-code . The code for pregnancy (648.X) was added to each pathology for not pregnancy related disorders. The pregnancy related pathology has its own specific codes. When the ICD-9 code (incl. the V-code) was not specific enough, the combination with additional ATC and RIZIV-INAMI was made.

For the not-pregnancy related pathology, the nuance between pathologies requiring 'grey zone' care and intermediate care was difficult to make. The theoretical exercise appeared very difficult to translate into the available data. For example for 'severe nephrologic infections (except pyelonephritis)' there is no possibility to make the distinction between severe or not, based on ICD-9, ATC or RIZIV-codes. Malaria (with systemic symptoms), severe pulmonary infections (incl. complicated pneumonia) and well controlled epileptic patient (with active medical treatment), are other not pregnancy related disorders wherefore the distinction between severe or less severe was not possible.

Other theoretical concepts could not be translated into codes e.g.: with or without positive thyroid antibodies, in consultation with a diabetologist, creatinine > 1,5 mg/dl, with suspected or confirmed foetal anomalies, with maternal clinical symptoms and foetal anomalies, > 5 units alcohol a day and severe drug abuse.

All disorders, with pre-existing medical problems, in relation to pregnancy and postpartum generated difficulties. An enormous amount of medication, treatments and variations of severity in relation to pregnancy was encountered. For the pregnancy-related and foetal problems there was less discussion, nevertheless the listed specific problems of the peripartum were relatively difficult to code.

The final coded list of admission criteria was verified and corrected by two other MKG/RCM codification experts[50]. When experts had a different opinion, codes were discussed with the researchers and adaptations were made.

49 Dr. E. Baert & Ms. Van Coppenolle of the Gent University Hospital

50 namely one from the KULeuven and one from the ULG

## 5.5 FEEDBACK MEETING OF EXPERTS

The list of indications provoked continuing discussion within the research-group, it was consequently decided to consult a group of experts to evaluate it. The evaluating process consisted of two phases, a preparatory and discussion phase (cf. Delphi method internal validation of the list).

The finalized version of the list was sent by email to eleven experts[51] who were requested to provide feedback. These experts were simultaneously invited to a discussion meeting on November 13th, 2007. Four experts were excused, one of them made some written comments.

During the meeting, [52]several items were thoroughly discussed, namely diabetes, the use of creatinine as an indicator for renal insufficiency, toxoplasmosis and CMV (cytomegalovirus), pregnant women taking medication, asthma, cholestasis, intra uterine death, PPROM, IUGR, multiple pregnancies, smoking and foetal indications for maternal admission.

All comments were gathered and the Gent research team decided which adaptations to make to the list. The modified theoretical list was sent to the Gent codification team, who made the necessary adaptations to the coded list.

## 5.6 DATA EXTRACTION

The coded list of indications translated into a SAS syntax was applied to the data-set. During this translating-process, additional difficulties emerged. Some codes were not accurate, others were not specific and were used to code several pathologies. Assisted by the codification team, more changes were made to the list. The main adaptations were made to the labels of the different groups of pathologies. For example the theoretical indication: 'any form of thrombophilia needing thromboprophylaxis (for maternal reasons)' became 'any form of thrombophilia needing thromboprophylaxis'. Inflammatory bowel disease (Crohn/colitis ulcerosa) with antecedents of surgery, corticoid therapy and/or immunosuppressive agents became 'Crohn/colitis ulcerosa' or 'severe Crohn/colitis ulcerosa' when ICD-9 code was associated with immunosuppressive drugs and/or more than 28 DDD of corticosteroids.

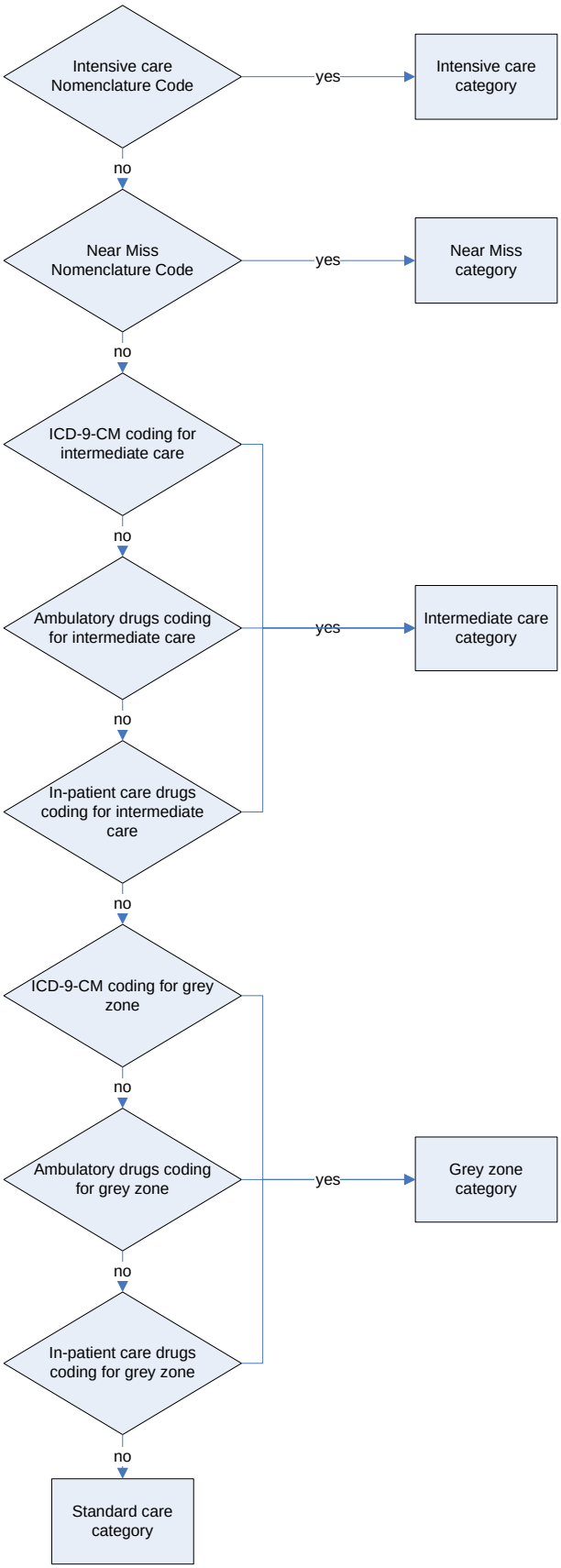
This process of translation of a theoretical/clinical list of pathologies into ICD-9-CM, ATC and or nomenclature codes was a very complex and time-consuming process, mainly because of the lack of specificity of ICD-9 codes.

In order to be able to classify the data of the women in our database according to their health risks, we devised the following algorithm (cf. figure 10 infra).

51 Dr. De Plaen (nephrologist), dr. Vincent (intesivist), Dr. De vlieger (gynaecologist), Dr. Detemmerman (pediatrist), Dr. Nobels (endocrinologist), Mevr. Katelijne De Coster (midwife), Mevr. De Thysebaert (midwife), dr Seuntjens (family physician), Dr. Cools (neonatologist), dr Debiève (gynaecologist), Dr. Vogelaers (infectiologist) ,

52 Attended by: Dr. De vlieger (gynaecologist), Dr. Detemmerman (pediatrist), Dr. Nobels (endocrinologist), Mevr. Katelijne De Coster (midwife), Dr Seuntjens (family physician) , Dr. Cools (neonatologist), Dr. Debiève (gynaecologist)

**Figure 10: Algorithm for classification of women into categories based on the list of indication**




Source: IMA 2008

First of all, the computer retrieves nomenclature or 'department' codes classifying women into Intensive care or Near Miss categories. If those codes were not found, ICD-9-CM codes were located.

If none of these codes were found in the database, the computer looked for ambulatory drugs from the list of indications. Only when none of this medication was found, medication used during the in-patient stay was taken into account.

The results of the first application of the algorithm on the database were carefully analysed for consistency. Some frequencies were unusual and were the consequence of the lack of specificity of some ICD-9 or ATC codes. As a consequence, some of these unspecific codes were added to the category 'grey zone'; some other ICD-9 codes were grouped with ATC codes and/or other conditions to translate the severity.
For example codes 646.8X+493.X2 for asthma was classified in the 'grey zone' while the same codes in combination with 28 days of oral corticosteroids treatment coded for severe asthma and was classified in the intermediate care category. The isolated code 658.1X (premature rupture of the membranes) classifies into the grey zone but in combination with a baby born before 35 weeks or a length of stay of more than 7 days before delivery, to the women is classified in the Intermediate Care category.

The mean of classification of the women included in the database into the different categories is presented in the following table.

**Table 29: Mode of classification of women to levels of care**

**Mode of attribution of type of care**

| | *Standard* | *Nomnenclature code* | *ICD-9-CM* | *icd9<Amb drugs* | *icd9<Hops drugs* | *Amb drugs* | *Hops drugs only* | *Total* | |
|---|---|---|---|---|---|---|---|---|---|
| Standard Care | 54,603 | 0 | 0 | 0 | 0 | 0 | 0 | 54,603 | 55.88 |
| | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| Grey Zone | 0 | 0 | 30,128 | 82 | 12 | 1,850 | 874 | 32,946 | 33.72 |
| | 0.00 | 0.00 | 91.45 | 0.25 | 0.04 | 5.62 | 2.65 | | |
| Intermediate care | 0 | 0 | 9,327 | 0 | 0 | 91 | 3 | 9.421 | 9.64 |
| | 0.00 | 0.00 | 99.00 | 0.00 | 0.00 | 0.97 | 0.03 | | |
| Near-Miss | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 31 | 0.03 |
| | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| Intensive Care | 0 | 717 | 0 | 0 | 0 | 0 | 0 | 717 | 0.73 |
| | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | |
| Total | 54,603 | 748 | 39,455 | 82 | 12 | 1,941 | 877 | 97,718 | 100.00 |
| | 55.88 | 0.77 | 40.38 | 0.08 | 0.01 | 1.99 | 0.90 | | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

55.9% of the women are classified into the category 'standard care', 33.7% into the grey zone, 9.6 % in 'intermediate care' and 0.7% into intensive care (near miss + intensive care).

The table underneath gives an overview of the proportion of women in the different levels of care, divided into two groups, the maternities with and without MIC-services.

**Table 29(a) : Classification of women into levels of care categorized by maternities with and without MIC-services**

| | **Total** | Mat. with MIC -services | Mat. without MIC-services |
|---|---|---|---|
| **Pregnancies** | **97.718** | 27.318 | 70.400 |
| Standard care | 54.603 | 12.838 | 41.765 |
| Grey zone care | 32.946 | 10.324 | 22.622 |
| Intermediate care | 9.421 | 3.813 | 5.608 |
| Near miss | 31 | 8 | 23 |
| Intensive care unit | 717 | 335 | 382 |

**The women in the standard care category do not have any recorded pathology**, while "intermediate care" women suffer from at least one pre-defined pathology. Main pathologies that classified women into 'intermediate care' are listed in the table 30 below. Almost every woman (99.0 %) entered the 'intermediate care class' thanks to ICD-9 codes and only 1.0% through ambulatory drugs.

The algorithm classifies a woman in the intermediate care category on the basis of only one 'coded pathology', although in 13.9% of the cases 2 pathologies were attributed, and in 3.5% of the cases several pathologies were attributed.

**Table 30: 10 Main pathologies[53] classifying women into 'Intermediate Care'**

| Pathology | Number of cases | Proportion |
|---|---|---|
| Mild or unspecified pre-eclampsia | 1,472 | 15.8 |
| Diabetes with insulinetherapy | 1,262 | 13.5 |
| PPROM | 1,009 | 10.8 |
| Prenatally assessed severe fœtal malformation | 1,009 | 10.8 |
| Placenta preavia | 998 | 10.7 |
| Placenta accreta and percreta | 684 | 7.3 |
| Oligohydramnios | 390 | 4.2 |
| Intrauterine death | 362 | 3.9 |
| Infection of amniotic cavity | 324 | 3.5 |
| History of recurrent perinatal loss | 215 | 2.3 |
| Polyhydramnios | 207 | 2.2 |
| Severe psychiatric disorders | 192 | 2.06 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

As regards "grey zone" women, 91.5 % were qualified as such on the basis of ICD-9 codes, 5.6% through ambulatory medication and 2.7% through hospital medication.

The most frequent pathologies within the 'Grey Zone' are listed in table 31. They mainly include poorly specified health conditions.

**Table 31: 10 Main pathologies[54] classifying women into 'Grey Zone'**

| Pathology | Number of cases | Proportion |
|---|---|---|
| Anemia | 5,201 | 17.2 |
| Previous Caesarean section | 3,870 | 12.8 |
| Preterm labour | 3,364 | 11.1 |
| Fœtal distress | 3,166 | 10.5 |
| Advanced maternal age | 2,754 | 9.1 |
| Poor fœtal growth | 1,467 | 4.9 |
| Rhesus immunisation | 1,443 | 4.8 |
| Baby on NICU | 1,057 | 3.5 |
| Excessive fœtal growth | 996 | 3.3 |
| Complicated uro-genital disorders | 965 | 3.2 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

Thirty one women are classified in the 'Near Miss' category thanks to the following pathologies: hysterectomy (n=11), invasive uterine surgery n=10), surgery for uterine rupture (n=1) and acute pulmonary embolism (n=2).

Seven hundred and seventeen women were according to our methodology in the 'Intensive care' category.

53 The main pathologies total 7,115 out of 9,723
54 The main pathologies total 24,283 out of 30,128

494 women were classified in this category because during their in-patient stay, they spent some time in the intensive care unit
211 women needed respiratory assistance, 12 women needed emergency respiratory assistance.. These 223 (0.2%) women who needed respiratory assistance were the actual intensive care cases.
An in depth study of intensive care is not included in the objectives of this study.

## 5.7 MODEL PERFORMANCE

In order to check the clinical significance of the categories based on the expert consensus list, we compared some characteristics of the women in the different categories.

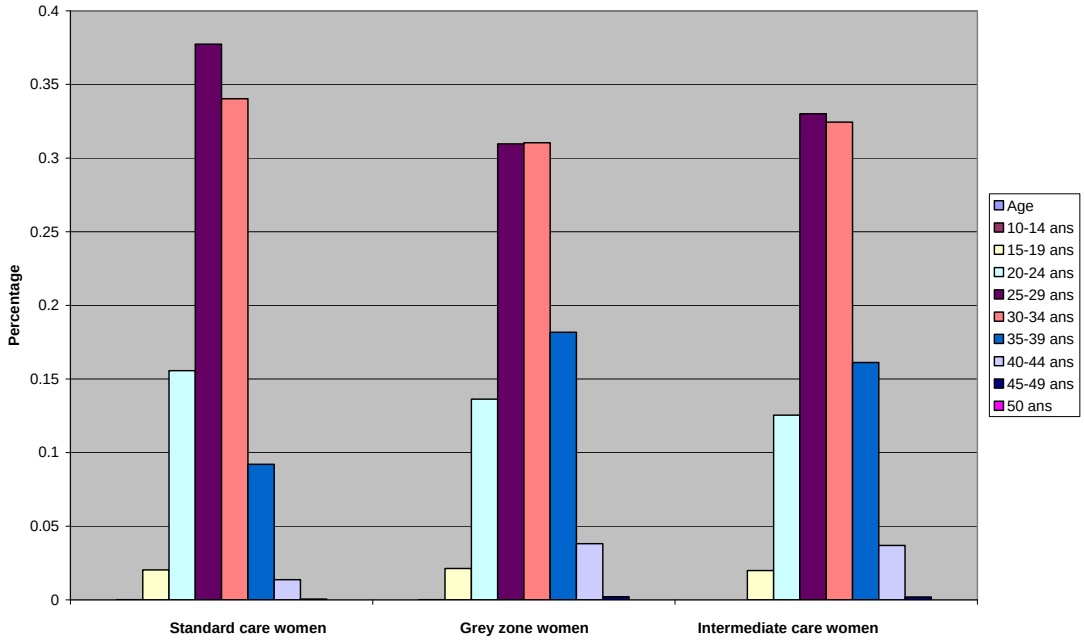
### 5.7.1 Comparison between theoretical and observed case-mix

#### *5.7.1.1 Age according to categories*

The mean age in 'standard care category' is 28.8 years, in 'grey zone' 30.1 years and 30.0 years in 'intermediate care category'.

Figure 12 shows the age distribution across categories. Despite very slight differences between means, the graph shows that age distribution differs. Standard care women are mainly aged between 25 and 35 years old. The age category 35-39 is significantly higher within intermediate care women compared to the standard care women.

**Figure 11: Age distribution across the categories of women**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

It is important to note that this age distribution (and consequently mean age) is largely influenced by the criteria of attribution of category. Indeed, women who have an ICD-9-code 'Older maternal age' without any other pathology are classified into the 'grey zone' category.

#### *5.7.1.2 Socio-economic characteristics according to categories*

The proportion of women with low socioeconomic status increases from standard care to intermediate care, thus the proportion of women with low socio-economic status is higher in the category with serious pathology.

**Table 32: Socio-economic characteristics**

| | Denominator | | Standard care | | Grey zone care | | Intermediate care | |
|---|---|---|---|---|---|---|---|---|
| | Freq | % | Freq | % | Freq | % | Freq | % |
| **Nb of pregnant women** | **97,718** | | **54,603** | | **32,946** | | **9,421** | |
| Maf social and/or BIM | 8,051 | 8.2% | 3,991 | 7.3% | 2,97 | 9.0% | 987 | 10.5% |
| Maf revenu | 5,649 | 5.8% | 2,429 | 4.4% | 2,327 | 7.1% | 802 | 8.5% |
| Isolated women without child | 6,450 | 6.6% | 3,346 | 6.1% | 2,234 | 6.8% | 808 | 8.6% |
| Isolated women with child | 5,723 | 5.9% | 2,847 | 5.2% | 2,252 | 6.8% | 575 | 6.1% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *5.7.1.3 Mode of deliveries according to categories*

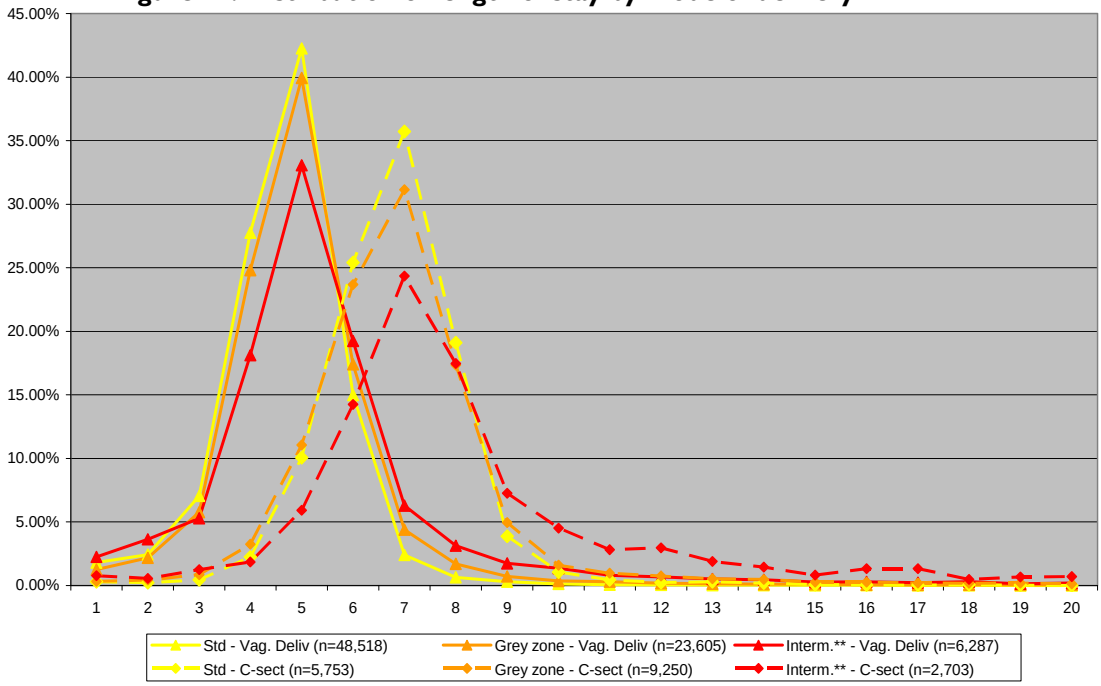
The c-section rate varies across categories. It is 10.5% among women in the 'standard care category', 28.1% among the women in 'Grey zone' and 28.7% among women in the 'Intermediate care category'.

For the 'grey zone' group, the association between health status of the women and c-section rate is not straightforward. The c-section rate is nearly as high as the c-section rate in the 'intermediate care group' but it is a consequence of the selection of indications leading to the classification in 'Grey Zone'. Table 31 listing the main pathologies in the 'Grey zone' shows that 12.8% of the women in this category were classified in this category because of a previous c-section, status linked to a high risk of repeated caesarean section (78.3% of the women with this code deliver by c-section). The women with a diagnosis 'foetal distress' have a c-section rate of 30.5%, those with a diagnostic of poor foetal growth have the same c-section rate, those with a diagnostic of 'foetal cardiac arrhythmia have a c-section of 29.1%.

### *5.7.1.4 Length of stay according to categories*

The distribution curves of the length of stay of the 3 main categories (standard care, grey zone and intermediate care) ordered by mode of delivery are presented on the graph 12 below.

**Figure 12: Distribution of length of stay by mode of delivery**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

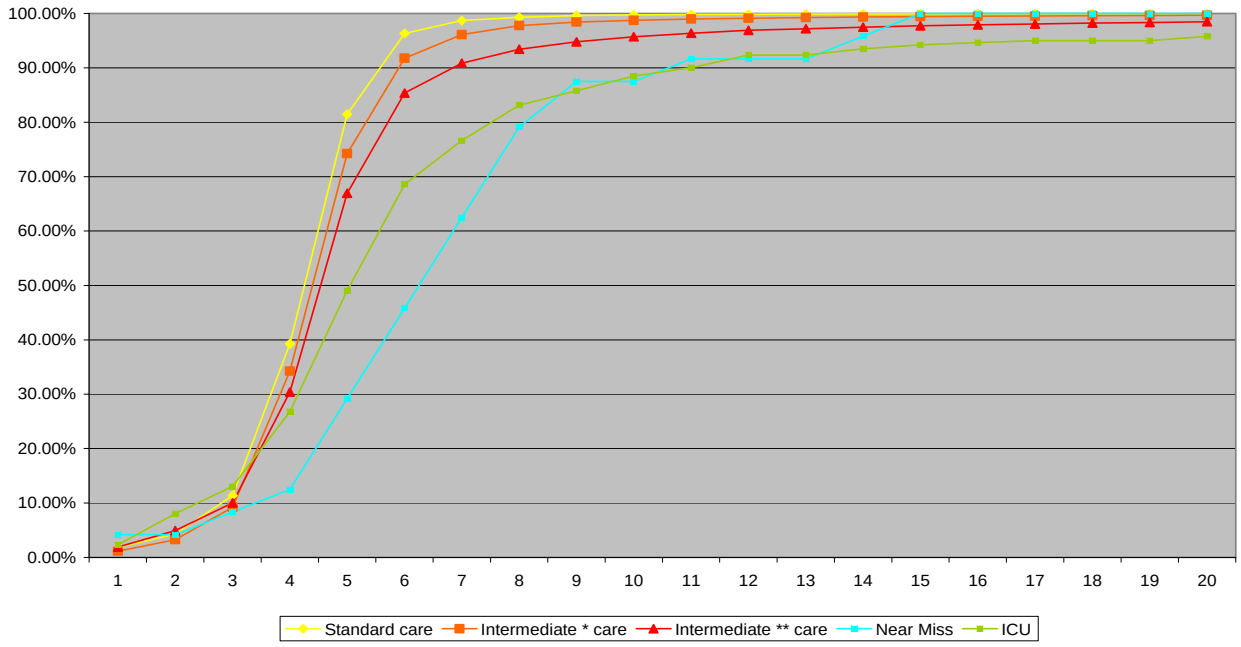
As regard the vaginal deliveries, for all 3 categories the median LoS is the same (P50 = 5 days).

For the c-section group the median LoS is 7 days for standard care and the grey zone, yet 8 days for the intermediate care category.

Hence, the mean LoS for both types of deliveries is higher within the intermediate care category. The mean LoS for a vaginal delivery, within standard care is 4.7 days, in the grey zone 5.1 days and in intermediate care 6.0 days ($\chi^2$ test, p value <0.0001). The mean LoS for a CS in standard care is 6.8 days, in the grey zone 7.3 and in intermediate care,10.1 days. ($\chi^2$ test, p value <0.0001). The variation in LoS is situated in the extremes. No relevant variations in LoS were found comparing maternities with and without MIC-services.

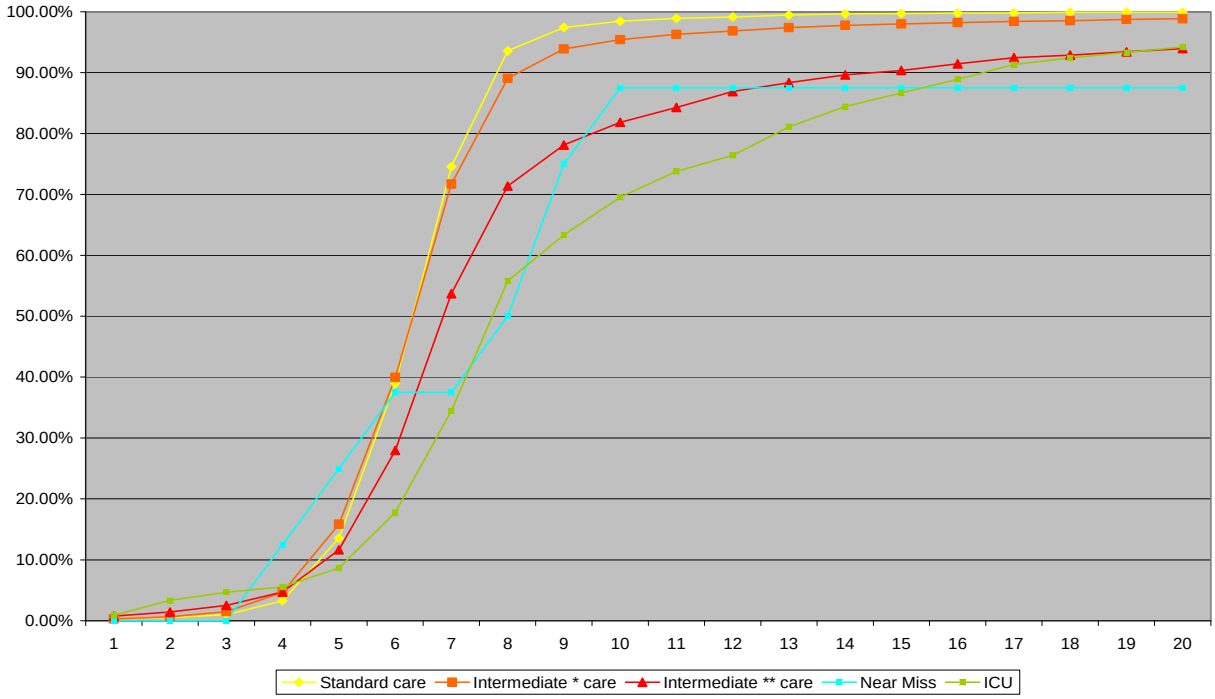
These same differences appear from the two following graphs presenting the cumulative LOS.

**Figure 13: Cumulative LoS vaginal delivery**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Figure 14: Cumulative LOS c-section delivery**



### 5.7.1.5 *Characteristics of the newborns by category of care of mothers*

Intensive care women must be considered separately so their results are not presented here.

#### *A. Status at birth*

Table 33 below describes the characteristics of newborns according to the category of their mothers. 9.5% (n=9,378) of the 98,240 neonates were born from women in the intermediate care category, 34.4% (n=33,797) from women in the grey zone, and 55.2% (n=54,274) from women in standard care.

**Table 33: Place of birth and status of newborn according to category of women[55]**

| | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| | Standard care mothers | | Grey zone care mothers | | Intermediate care mothers | |
| **Status** | | | | | | |
| Life birth | 54,230 | *99.9%* | 33,731 | *99.8%* | 8,890 | *94.8%* |
| Still born | 32 | *0.1%* | 25 | *0.1%* | 364 | *3.9%* |
| Died during in-patient stay | 10 | *0.0%* | 39 | *0.1%* | 119 | *1.3%* |
| **All** | **54,272** | *100.0%* | **33,795** | *100.0%* | **9,373** | *100.0%* |

*Nb of newborns with intensive care mothers = 786 - Missing or incomplete data = 14*

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of stillborn babies is 0.1% in standard care and grey zone category and 3.9% in the intermediate care category. The difference is statistically significant ($\chi^2$ test, p value < 0.0001)

The proportion of newborns that died during the hospital stay increases from 0.0% in standard care to 0.1 in grey zone and 1.3 % in intermediate care. The difference of proportion is statistically significant ($\chi^2$ test, p value < 0.0001)

#### *B. Proportion of multiple pregnancies*

**Table 34: Proportion of multiple pregnancies according to category of women**

| | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| | Standard care mothers | | Grey zone care mothers | | Intermediate care mothers | |
| **Status** | | | | | | |
| Single | 54,016 | *99.6%* | 31,672 | *93.8%* | 8,150 | *90.5%* |
| Twins | 222 | *0.4%* | 2,093 | *6.2%* | 784 | *8.7%* |
| Multiple (more than 2) | 0 | *0.0%* | 3 | *0.0%* | 67 | *0.7%* |
| **All** | **54,238** | *100.0%* | **33,768** | *100.0%* | **9,001** | *100.0%* |

*Nb of still borns = 421*

*Nb of newborns with intensive care mothers = 786 - Missing or incomplete data = 26*

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of twins varies from 0.4 % in standard care to 6.2% in the grey zone and 8.7% in intermediate care. The difference is statistically significant ($\chi^2$ test, p value < 0.0001). The figures for multiple pregnancies (more than 2) are very small and therefore can not be interpreted.

55 There are 5 missing values

### *C. Distribution of gestational age*

**Table 35: Distribution of gestational age according to categories of women**

| Gestational age | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| | Standard care mothers | | Grey zone care mothers | | Intermediate care mothers | |
| 22-28 : Extreme prematurity | 33 | *0.1%* | 113 | *0.3%* | 377 | *4.0%* |
| 29-32 : Very preterm | 45 | *0.1%* | 273 | *0.8%* | 571 | *6.1%* |
| 33-36 : Preterm delivery | 1,709 | *3.1%* | 2,873 | *8.5%* | 1,766 | *18.9%* |
| 37-42 : Term delivery | 52,481 | *96.7%* | 30,531 | *90.3%* | 6,652 | *71.0%* |
| >=42 : Prolonged pregnancy | 5 | *0.0%* | 3 | *0.0%* | 1 | *0.0%* |
| **All** | **54,273** | *100.0%* | **33,793** | *100.0%* | **9,367** | *100.0%* |

*Nb of newborns with intensive care mothers = 786 - Missing or incomplete data = 21*

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of preterm newborns also increases from standard care to intermediate care mothers.

The category 'Extreme prematurity', varies from 0.1% in standard care to 0.3% in the grey zone to 4.0% in intermediate care.

The proportion 'Very Preterm' varies from 0.1% in standard to 0.8% in the grey zone to 6.1% in intermediate care category.

The proportion 'Preterm' newborns, varies from 3.1% in standard to 8.5% in grey zone and 18.9% in intermediate care category.

### *D. Distribution of birth weight*

**Table 36: Distribution of birth weight according to categories of women**

| Birth weight | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| | Standard care mothers | | Grey zone care mothers | | Intermediate care mothers | |
| 500 - 999 : Extreme low birth weight | 25 | *0.0%* | 92 | *0.3%* | 300 | *3.2%* |
| 1000 - 1499 : Very low birth weight | 25 | *0.0%* | 181 | *0.5%* | 351 | *3.8%* |
| 1500 - 2499 : Low birth weight | 1,188 | *2.2%* | 2,961 | *8.8%* | 1,741 | *18.7%* |
| 2500 - 3999 : Normal birth weight | 49,369 | *91.0%* | 27,546 | *81.5%* | 6,396 | *68.6%* |
| >=4000 : High birth weight | 3,655 | *6.7%* | 3,002 | *8.9%* | 541 | *5.8%* |
| **All** | **54,262** | *100.0%* | **33,782** | *100.0%* | **9,329** | *100.0%* |

*Nb of newborns with intensive care mothers = 786 - Missing or incomplete data = 81*

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of 'Low Birth weight' neonates as well as the proportion of 'preterm newborn' increases from standard care to intermediate care mothers.

The proportion 'Extreme low birth weight' neonates varies from 0.0% in standard to 0.3% in the grey zone to 3.2% in intermediate care %.

The proportion 'Very low birth weight' neonates varies from 0.0% in standard to 0.5% in grey zone to 3.8% in intermediate care.

The proportion 'Low birth weight' neonates, varies from 2.2% in standard to 8.8% in the grey zone to 18.7% in intermediate care.

All the differences are statistically significant ($\chi^2$ test, p value < 0.0001).

### *E. Apgar scores*

**Table 37: Apgar scores at 1 and 5 minutes**

| | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| **Apgar score at 1 minute** | **Standard care mothers** | | **Grey zone care mothers** | | **Intermediate care mothers** | |
| 0-3 | 539 | *1.0%* | 782 | *2.3%* | 738 | *7.9%* |
| 4-6 | 2,265 | *4.2%* | 2,339 | *6.9%* | 831 | *8.9%* |
| 7-10 | 51,466 | *94.8%* | 30,673 | *90.8%* | 7,805 | *83.3%* |
| **All** | **54,270** | *100.0%* | **33,794** | *100.0%* | **9,374** | *100.0%* |
| *Nb of newborns with intensive care mothers = 786 - Missing and Incompleted data = 16* | | | | | | |
| **Apgar score at 5 minute** | | | | | | |
| 0-3 | 108 | *0.2%* | 138 | *0.4%* | 462 | *4.9%* |
| 4-6 | 382 | *0.7%* | 538 | *1.6%* | 229 | *2.4%* |
| 7-10 | 53,779 | *99.1%* | 33,117 | *98.0%* | 8,682 | *92.6%* |
| **All** | **54,269** | *100.0%* | **33,793** | *100.0%* | **9,373** | *100.0%* |
| *Nb of newborns with intensive care mothers = 786 - Missing and Incompleted data = 19* | | | | | | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of newborns with a low Apgar score (0-3) at 1 minute increases from standard care to intensive care mothers. The differences are statistically significant ($\chi^2$ test, p value < 0.0001).

The low Apgar score (0-3) at 5 minutes increase from standard care to intermediate care.

### *F. Proportion of admissions to NIC and N**

**Table 38: Proportion of neonates admitted to NIC and N* according to level of care[56]**

| | Newborn babies from each category of women | | | | | |
|---|---|---|---|---|---|---|
| **Admissions** | **Standard care mothers** | | **Grey zone care mothers** | | **Intermediate care mothers** | |
| NIC | 86 | *0.2%* | 2,165 | *6.4%* | 1,647 | *17.6%* |
| N* | 8,554 | *15.8%* | 6,145 | *18.2%* | 2,119 | *22.6%* |
| *Nb of newborns with intensive care mothers = 786 - Missing and Incompleted data = 5* | | | | | | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The proportion of newborns admitted to a NIC-service or N*-service increases following the classification of mothers from standard care to intermediate care.

The proportion of neonates staying in NIC-services varies from 0.2% in standard to 6.4% in the grey zone to 17.6% in intermediate care .

The proportion of neonates staying in N* varies from 15.8% in standard to 18.2% in grey zone to 22.6% in intermediate care category.

All these differences are statistically significant ($\chi^2$ test, p value <chi-square < 0.0001).

56 The table presents the admission-proportion of newborns based on the classification of their mothers into standard, grey zone, intermediate.

### 5.7.2 Comparison between theoretical and observed case-mix

The classification of pathologies (see theoretical model) in different levels of care led to a "theoretical" model.

An empirical index of 'MIC orientation' based on the data observation has been assigned to each pathology in order to determinate a list of pathologies that are more often treated in maternities with MIC-services.

The index takes into account the proportion of MIC-beds of maternities where the women were treated.

Practically, the index was created through the following steps:

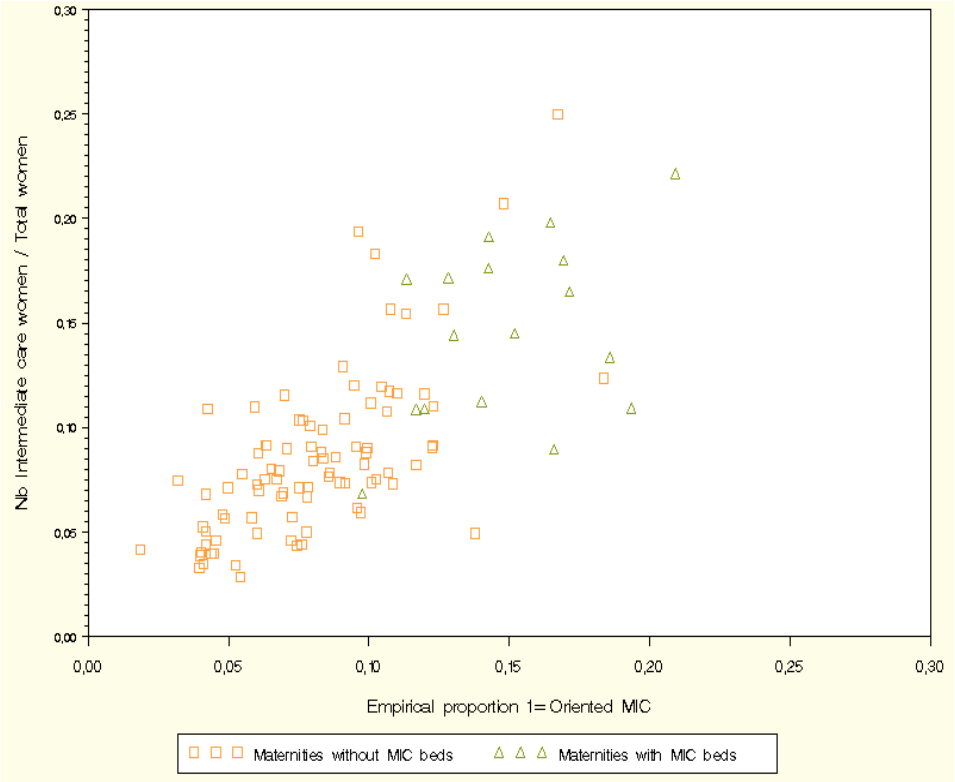
1. Identifying the pathology(ies) of each woman;
2. Weighting of her pathology(ies) by using the proportion of MIC/M beds of the maternity where the woman is treated;
3. Summing up this weighted coefficients by pathology to create a "MIC-beds-weighed index" by pathology.

Afterwards, this index was assigned to each pathology of each woman. These indexed pathologies were then summed by woman and by maternity so that each maternity received a weighed score indicating the hospital-specific load of those pathologies that are more likely to be encountered in MIC-services.

This score of the maternities was afterwards compared with the percentage of women theoretically requiring intermediate care in each maternity.

The correlation between the observed and theoretical score has been displayed graphically in a scatter plot.

**Figure 15: Correlation between the observed and theoretical score**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

According to the performance of the model, there is a good correlation (y=0, 8417 x + 0.0178 $R^2$=0.5291) between the observed and theoretical case-mix: maternity services that are more MIC-oriented receive a higher proportion of intermediate care women. It confirms moreover that the case-mix of the MIC-services is only moderately MIC-oriented.

### *Key messages*

- **Applying the Delphi method, an expert group listed the clinical conditions which should be treated in MIC-beds. Women identified as suffering from at least one of such conditions in the database were defined as "intermediate care women". Women without such conditions were labelled "standard care women". For a number of clinical conditions, no consensus was reached as regards the adequate level of care. Women reported as suffering from such conditions were labelled as "grey zone women".**
- **The list of conditions was translated into ICD-9 codes. Categorization of women used a data extraction algorithm. 9.6 % and 33.7% of women were classified "intermediate care" and "grey zone", respectively.**
  **Moreover, the correlation between a theoretical and empirical score of MIC orientation by hospital was tested, and found significant.**
- **The expert list was assessed by comparing patient and health service characteristics between the groups. "Intermediate care women" had a lower socio-economic status, a higher c-section rate, a longer hospital stay, more stillborns, more twins, and more preterm deliveries.**

# 6 COMPARATIVE ANALYSIS

In this chapter we present the results of the comparison between the care currently delivered in MIC- and non-MIC services and the care theoretically required in these services. Following parameters are shown for women theoretically requiring intermediate care (~intermediate care women):

- place of delivery
- type of morbidity,
- rate of referrals and transfers
- proportion of Very Low Birth Weight-infants and premature neonates

A logistic regression model was also used to apprehend the factors associated with an admission in a maternity with MIC-beds.

## 6.1 PLACE OF DELIVERY

### 6.1.1 Proportion of "intermediate care women" in MIC-services by province

**Table 39: Per province, proportion of intermediate care women and grey zone women delivering in hospitals with a MIC-service**

| Region | Province | Proportion of maternities with MIC beds | Proportion of women who delivered in maternities with MIC beds | Proportion of **"Intermediate care" women** who delivered in maternities with MIC beds | Proportion of **"Grey zone" women** who delivered in maternities with MIC beds |
|---|---|---|---|---|---|
| **Région Brussels** | **Bruxelles-Capitale Hoofdstedelijk gewest** | 54.55% | **48.03%** | **62.13%** | **51.31%** |
| **Vlaams Gewest** | Antwerpen | 15.79% | 27.25% | 34.81% | 33.45% |
| | Vlaams Brabant | 16.67% | 37.66% | 45.73% | 40.44% |
| | West Vlaanderen | 7.14% | 10.66% | 17.70% | 16.59% |
| | Oost Vlaanderen | 7.14% | 10.00% | 21.29% | 9.51% |
| | Limburg | 12.50% | 26.54% | 40.00% | 24.05% |
| | ***Total*** | 11.50% | **21.95%** | **32.57%** | **24.71%** |
| **Région Wallonne** | Brabant Wallon | 0.00% | 45.70% | 59.92% | 53.08% |
| | Hainaut | 13.33% | 22.11% | 31.48% | 23.62% |
| | Liège | 20.00% | 51.88% | 64.27% | 54.12% |
| | Luxembourg | 0.00% | 6.43% | 18.09% | 9.13% |
| | Namur | 0.00% | 8.75% | 15.47% | 9.95% |
| | ***Total*** | 11.80% | **30.24%** | 43.00% | 33.59% |
| *Unknown* | | 0.00% | *25.52%* | *31.11%* | *28.70%* |
| **Belgium** | | 16.00% | **27.96%** | **40.47%** | **31.34%** |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Globally, only 40% of the "intermediate care women" are currently admitted in a maternity with a MIC-service**. This proportion goes from a low 15.5% in Namur to 64.1% in Liège.

### 6.1.2 Proportion of "intermediate care women" in hospital with MIC-services

**Table 40: Intermediate care women by maternity with MIC-service**

| Province | Hospitals | Nb of MIC beds | Nb of hospitalized women | Proportion MIC beds/ M beds | Proportion intermediate care women | *Intermediate care women / MIC bed* | *Hospitalized women / M bed* |
|---|---|---|---|---|---|---|---|
| **Région Bruxelles-Capitale - Brussels Hoofdstedelijk gewest** | | | | | | | |
| Région Bruxelles-Capitale Brussels Hoofdstedelijk gewest | UCL | 16 | 1,267 | 44.4% | 19.8% | ***15.7*** | *35.2* |
| | CHU St Pierre | 15 | 1,728 | 37.5% | 13.4% | ***15.4*** | *43.2* |
| | CHU Brugmann + hôpital des enfants | 9 | 1,437 | 30.0% | 17.1% | ***38.4*** | *47.9* |
| | Erasme | 8 | 1,509 | 29.6% | 10.9% | ***20.6*** | *55.9* |
| | VUB | 8 | 1,573 | 20.0% | 17.2% | ***33.8*** | *39.3* |
| | Edith Cavell | 8 | 2,248 | 14.8% | 11.3% | ***31.6*** | *41.6* |
| *Totaal Brussels Hoofdstedelijk gewest* | | **64** | **9,762** | **28.2%** | ***14.5%*** | ***22.1*** | ***43.0*** |
| **Vlaams gewest** | | | | | | | |
| Antwerpen | U.I.A | 8 | 821 | 40.0% | 22.2% | ***22.7*** | *41.1* |
| | AZ Middelheim | 8 | 1,241 | 22.2% | 6.8% | ***10.6*** | *34.5* |
| | AZ St Augustinus | 8 | 2,498 | 16.3% | 10.9% | ***34.0*** | *51.0* |
| Vlaams Brabant | KUL | 20 | 2,031 | 30.8% | 17.6% | ***17.9*** | *31.2* |
| West Vlaanderen | AZ St Jan | 8 | 1,004 | 21.1% | 9.0% | ***11.2*** | *26.4* |
| Oost Vlaanderen | UZ Gent | 8 | 821 | 25.8% | 19.1% | ***19.6*** | *26.5* |
| Limburg | ZOL | 8 | 1,733 | 13.3% | 14.4% | ***31.3*** | *28.9* |
| *Totaal Vlaams gewest* | | **68** | **10,149** | **22.7%** | ***13.7%*** | ***20.5*** | ***33.7*** |
| **Région Wallonne** | | | | | | | |
| Hainaut | CHU Tivoli | 8 | 1,099 | 28.6% | 18.0% | ***24.7*** | *39.3* |
| | CH Notre Dame / Reine Fabiola | 8 | 1,684 | 17.8% | 10.9% | ***22.9*** | *37.4* |
| Liège | CH St Vincent et Ste Elisabeth | 16 | 3,368 | 26.2% | 16.5% | ***34.7*** | *55.2* |
| | CH La Citadelle | 8 | 1,929 | 15.1% | 14.5% | ***35.0*** | *36.4* |
| *Totale Région Wallonne* | | **40** | **8,080** | **21.4%** | **15.1%** | ***30.4*** | ***43.2*** |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

Table 40 shows that the proportion of "intermediate care women" among women hospitalized in MIC-services varies strongly from 6,8% to 22%.

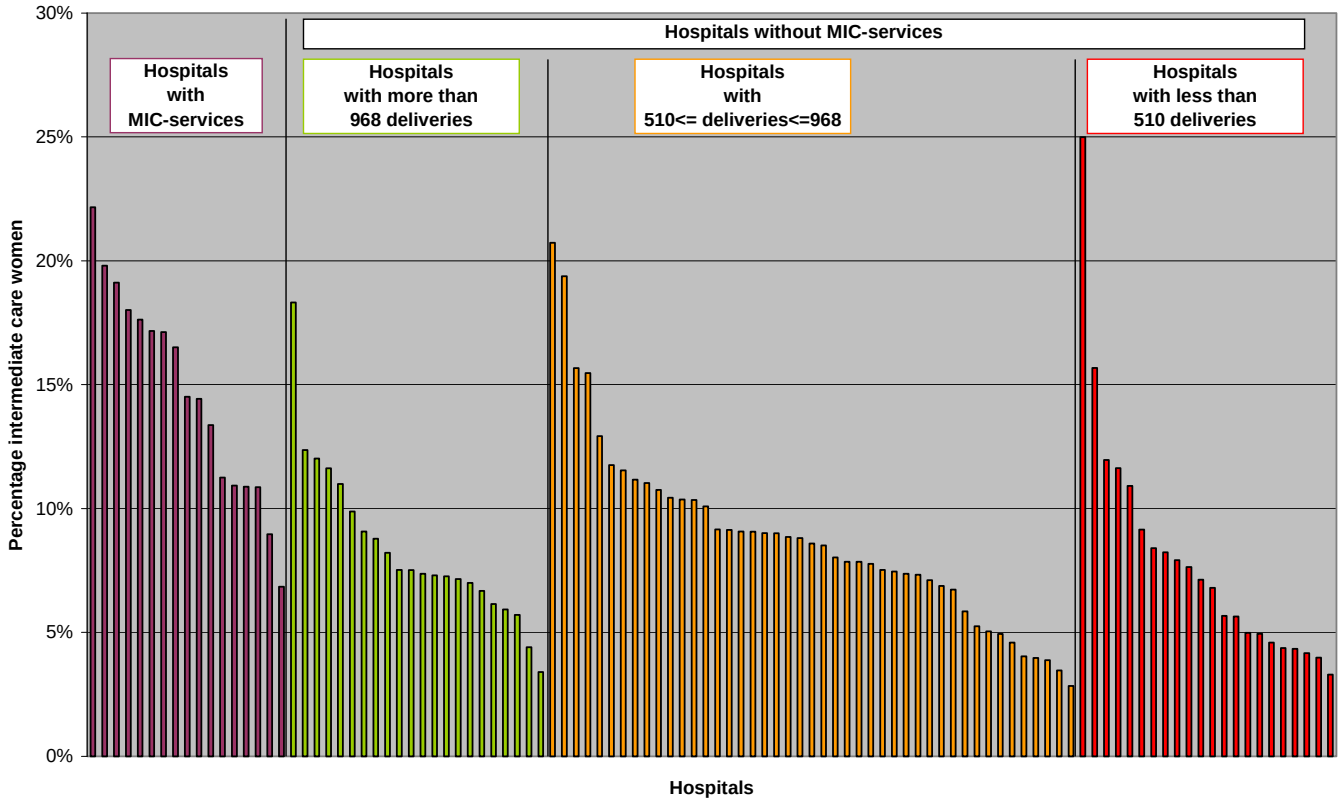
The number of "intermediate care women" per MIC-bed represents the MIC-bed occupancy ratio. This occupancy ratio varies from 10 to 38, indicating a relative variability between MIC-services. The global occupational rate of the maternity is measured by the total number of hospitalized women per Maternity-bed and acts as reference. The proportion of "intermediate care women" is, in most cases, lower than the proportion of MIC-beds in the maternity

The variability in the proportion of intermediate care women admitted in maternities with and without MIC-services as well as the variability observed among the maternities with MIC-services leads to question the potential factors underlying the admission of parturients: Is the variability related to the volume of deliveries (vaginal deliveries and C-sections), used as an indicator of the activity level of the maternities? Is the variability explained by morbidity differences for the intermediate care women in both types of maternities?

### 6.1.3 Proportion of intermediate care women in hospital according to activity levels in maternities

All maternities without MIC-service were taken into account and classified according to their number of deliveries. Three categories were created, according to their volume of deliveries (in percentiles): less than 510 deliveries (P0 to P24; n=22), between 510 and 968 deliveries (P25 to P75; n=45) and more than 968 deliveries (P76 to P100; n=22).

**Figure 16: Proportion of intermediate care women by maternity by category of volume of deliveries**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

Some non-MIC services admit a higher proportion of intermediate care women than some MIC-services.

Figure 16 shows the lack of association between the proportion of intermediate care women admitted in maternities without MIC-service and the volume of deliveries in a hospital.

## 6.2 TYPE OF MORBIDITY

There is some indication that the type of morbidity within the category of intermediate care women differs between MIC- and non-MIC services. The pattern of classifying pathologies related to intermediate care women is considered as an indicator for the type of morbidity in maternities with and without MIC-services.

Table 41 shows the frequency of the first pathology classifying the women into the intermediate care, presented by maternities with or without MIC-services. It is important to note that these figures are not epidemiological data. They only give a limited indication of the amount of pathologies in the intermediate care category by type of hospital.

**Table 41: Frequency of coded pathology for intermediate care in maternities with and without MIC-services (15 first more frequent pathologies)**

| Hospitals with MIC-services (n=) | | | Hospitals without MIC-services (n=) | | |
|---|---|---|---|---|---|
| Naming of pathology | Frequency | Percent | Naming of pathology | Frequency | Percent |
| 1st PPROM | 577 | 15.3% | 1st Mild or unspecified pre-eclampsia | 1,052 | 19.0% |
| 2nd Severe fœtal malformation | 531 | 14.1% | 2nd Women with convention diabetes | 855 | 15.4% |
| 3rd Mild or unspecified pre-eclampsia | 420 | 11.1% | 3rd Placenta previa , without hemorrhage | 638 | 11.5% |
| 4th Women with convention diabetes | 407 | 10.8% | 4th Placenta accreta and percreta without hemmorhage | 515 | 9.3% |
| 5th Placenta previa , without hemorrhage | 360 | 9.5% | 5th Severe fœtal malformation | 478 | 8.6% |
| 6th Infection of amniotic cavity | 182 | 4.8% | 6th PPROM | 432 | 7.8% |
| 7th Olygodramnios | 173 | 4.6% | 7th Olygodramnios | 217 | 3.9% |
| 8th Placenta accreta and percreta without hemmorhage | 169 | 4.5% | 8th Intrauterine death | 214 | 3.9% |
| 9th Intrauterine death | 148 | 3.9% | 9th Infection of amniotic cavity | 142 | 2.6% |
| 10th History of recurrent perinatal loss | 119 | 3.2% | 10th Polyhydramnios | 130 | 2.3% |
| 11th Severe psychiatric disorders | 91 | 2.4% | 11th Major puerperal infection | 111 | 2.0% |
| 12th Polyhydramnios | 77 | 2.0% | 12th Severe psychiatric disorders | 101 | 1.8% |
| 13th Homozygote/double heterozygous haemoglobinopathy | 63 | 1.7% | 13th History of recurrent perinatal loss | 96 | 1.7% |
| 14th Substance dependency | 60 | 1.6% | 14th Acquired heart diseases | 71 | 1.3% |
| 15th Major puerperal infection | 50 | 1.3% | 15th Thyreotoxicosis | 60 | 1.1% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004
* PPROM: Preterm premature rupture of the membranes

All pathologies listed in table 41, were considered as indicators to require intermediate care. However, for pathologies such as severe foetal malformation or PPROM, there are almost twice as many women (in proportion) admitted in MIC-services as in non-MIC services. Logically, the maternities with MIC service that possess always an associated NIC service treat more pathologies related to prematurity than non MIC maternities.
For other pathologies such as women with convention diabetes and placenta previa, accreta and percreta, the number of women treated in non-MIC services is reasonably higher than in MIC-services. Women that were classified in the intermediate care category by the ICD-9 codes for mild or unspecified pre-eclampsia, were surprisingly outnumbered in the non-MIC hospitals. We have to note that the ICD-9 code for this pathology encompasses a large scope of criteria.

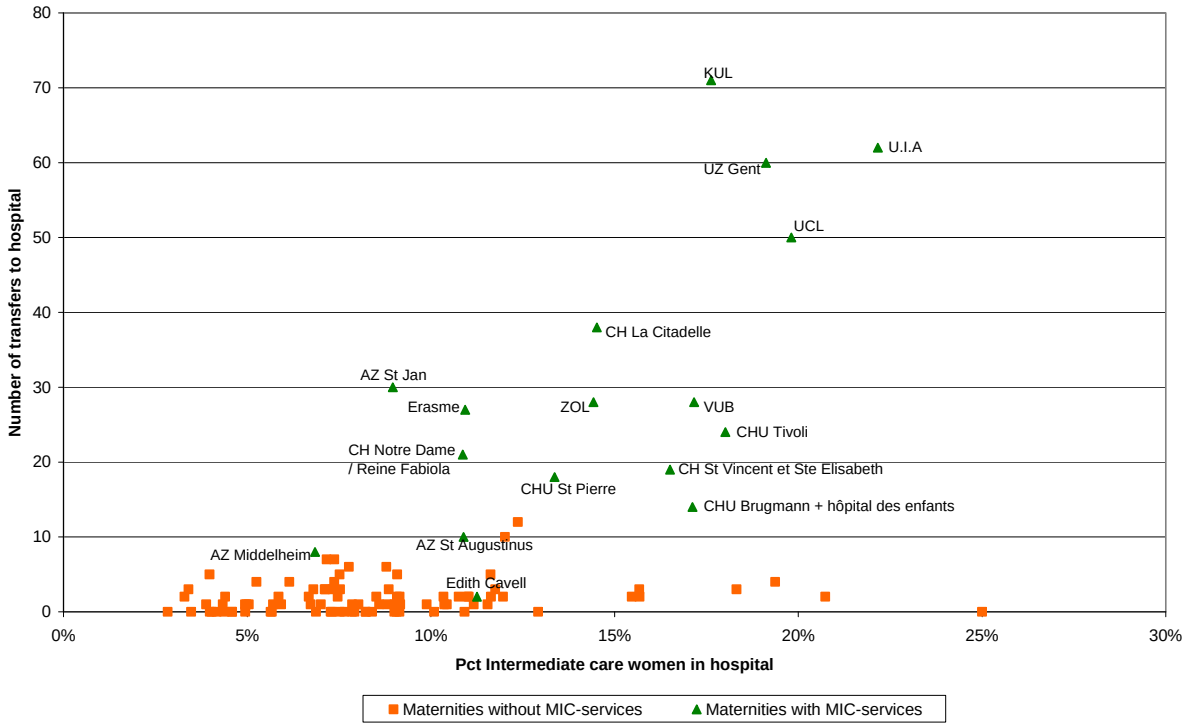
## 6.3 TRANSFERS

### 6.3.1 Transfers during pregnancy from a non-MIC to a MIC-service

Figure 18 shows all transfers of women during hospitalisation compared to its proportion of intermediate care women.

Indeed, 862 women were transferred to a hospital with a MIC-service and 211 women (19%) were transferred to a maternity without a MIC-service.

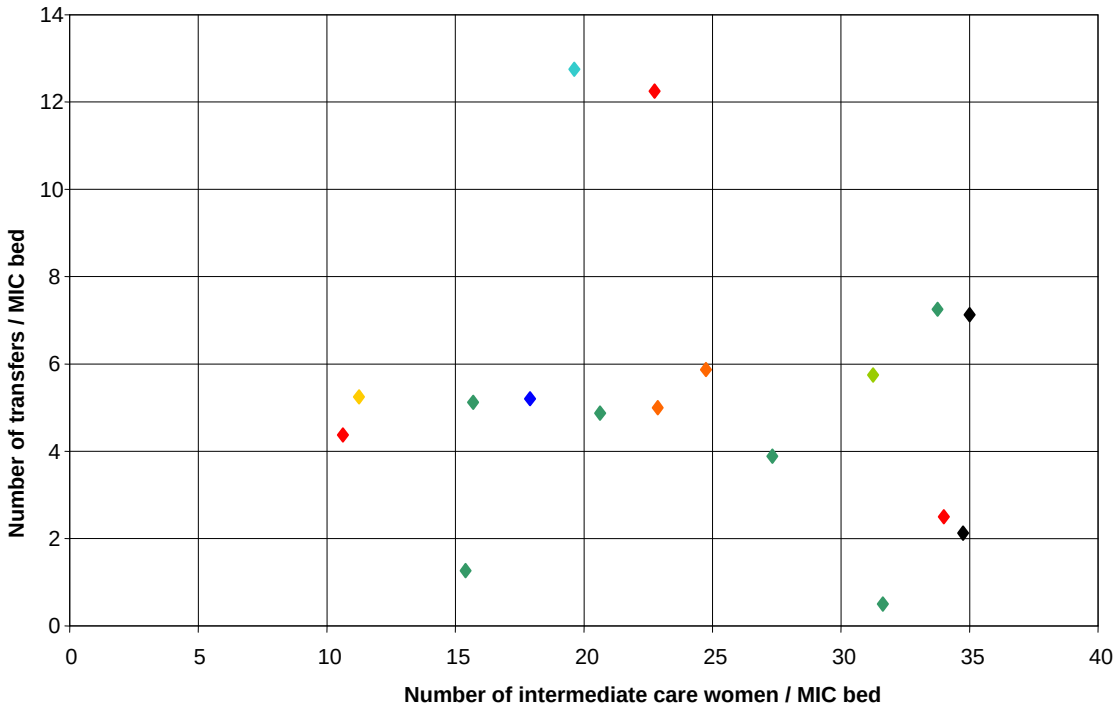
**Figure 18: Number of transfers towards a maternity compared to its proportion of intermediate care women**




The figure shows that, except 3 maternities with a MIC-service, having less than 10 transfers a year, all other maternities with MIC-services receive more transfers than maternities without a MIC-service.

Figure 19 maps the MIC-beds occupation ratio by intermediate care women and the number of transfers received per MIC-bed.

**Figure 19. Intermediate care activity and transfers reception by maternities with a MIC-service**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

Figure 19 shows that the majority of the MIC-services receive from 4 to 8 transfers per MIC-bed and this does not seem related to the ratio of intermediate care women treated per MIC-bed. Two MIC-services receive more than 12 transfers per MIC-bed whereas 2 MIC-services receive less than 2 transfers per MIC-bed.

It is important to notice that the transfers analysed here are those that occur from hospital to hospital during an hospitalisation. Other referrals of high risk pregnancies to MIC service that occur in ambulatory care during pregnancy at the ob-gyn or the women initiative are not recorded in our data. These ambulatory referrals may influence the amount of transfers during hospitalisation as more ambulatory transfers would generate less transfers during hospitalisation.

**Figure 20: Distance travelled by standard care women to reach a hospital with a MIC-service**

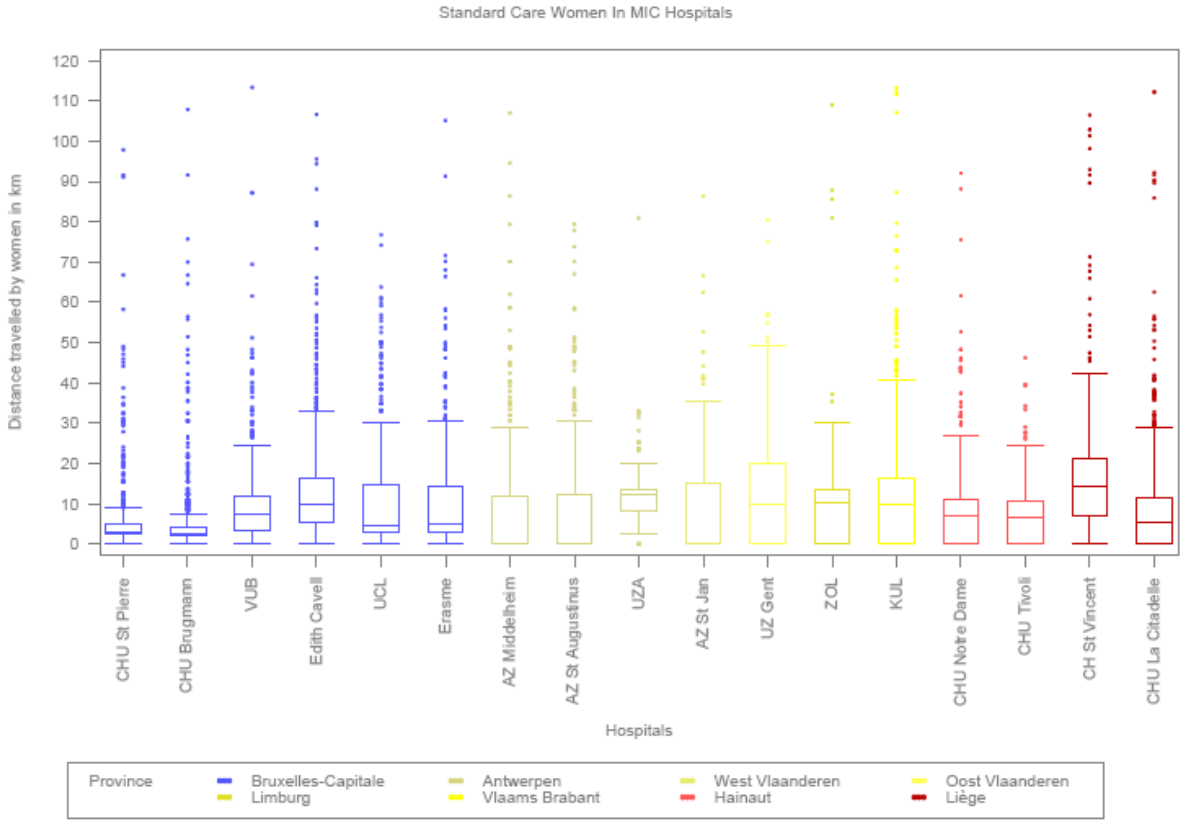
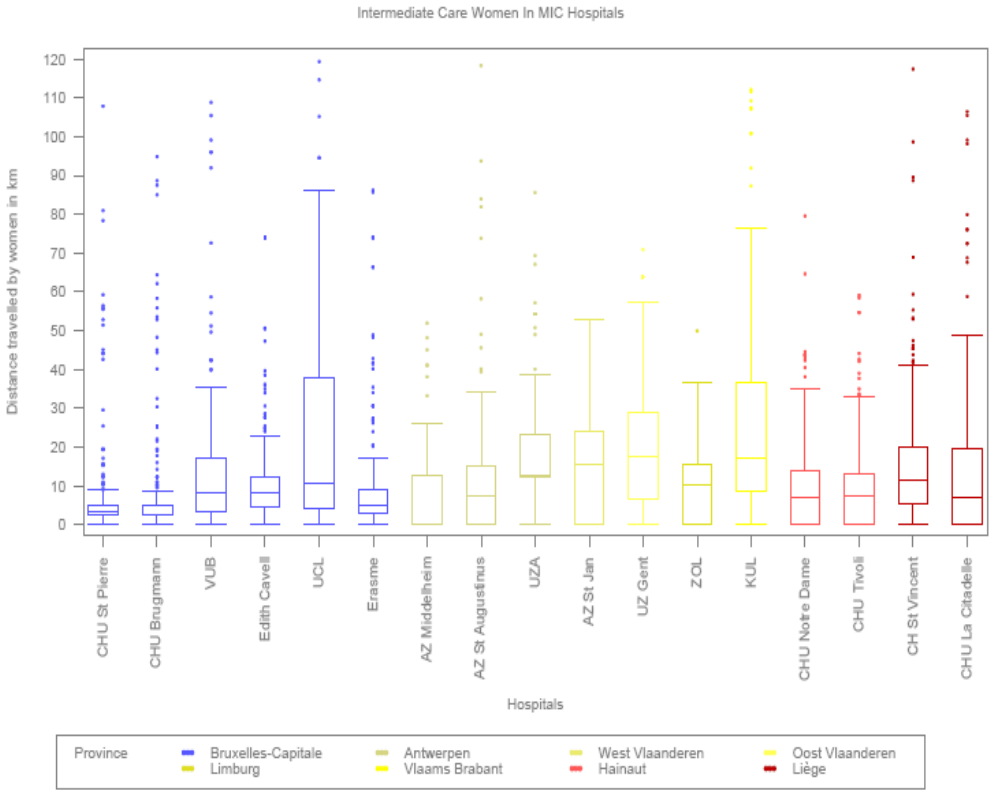



**Figure 21: Distance traveled by intermediate care women to reach a hospital with a MIC-service**



As seen in the above figures 20 and 21, women requiring intermediate care travel longer distances to reach a MIC maternity than standard care women. The travelled distance of standard care women is similar in all hospitals with a MIC-service and do not exceed 40kms except for the UZ Gent. The figure 21 shows that some centres the UCL or KUL and in a lower proportion AZ Sint Jan, UZ Gent and CHU La Citadelle admit intermediate care women who travel longer distance. These centres may be attractive thanks to their reputation or specialisation. Nevertheless, this attractivity should play an equal role for standard care or intermediate care.
On the other hand, the longer distance travelled by some intermediate care women question the accessibility of MIC units in some areas. This problem of accessibility could that as seen in table 39, in some province less than 20% of the intermediate care women delivered in a maternity with MIC service .

## 6.4 PREMATURE NEONATES AND VERY LOW BIRTH WEIGHT-INFANTS

This study chose to focus on an evaluation of the MIC-services in Belgium.and an important parameter to evaluate the quality of the care received by pregnant woman is the health of the newborn.

The NIC-audit 2000-2007eee states that: "in a high-quality perinatal care system it is anticipated that, whenever possible, most of this vulnerable group of Very Low Birth Weight-infants (VLBW) should be born in a maternity hospital with prenatal and neonatal intensive care facilities". This assertion is emphasized in Tency's thesis (2007) (see4.2.10). Women with severe complications in pregnancy should be transferred as soon as possible to a MIC-service, as intra-uterine transfer improves the outcome for mother and child.

Consequently, we analysed the place of birth of the premature neonates (<32 weeks) delivered by IC mothers. Many of those neonates are VLBW-infants.

Our database contains 1,558 premature neonates (< 32 weeks) among which 942 were delivered by intermediate care woman.

eee NICaudit Synoptic Report 2000-2007; Federal Public Service, Health, Food chain safety and Environment

**Table 42: Comparison of the proportion of premature neonates (<32 weeks) born from IC mothers between MIC and non-MIC services per province**

| | Number of premature < 32 weeks | | | |
|---|---|---|---|---|
| | Non-MIC | MIC | Total | Proportion of < 32 weeks born in MIC |
| **Bruxelles** | 8 | 116 | 124 | 93.5 |
| | | | | |
| **Vlaanderen** | | | | |
| | | | | |
| Antwerpen | 23 | 142 | 165 | 86.1 |
| | | | | |
| Vlaams brabant | 13 | 77 | 90 | 85.6 |
| | | | 0 | |
| West Vlaanderen | 31 | 54 | 85 | **63.5** |
| | | | 0 | |
| Oost Vlaanderen | 26 | 73 | 99 | 73,7 |
| | | | 0 | |
| Limburg | 15 | 71 | 86 | 82.6 |
| Total VLanderen. | 108 | 417 | 525 | 79.4 |
| **Wallonie** | | | 0 | |
| | | | 0 | |
| Brabant Wallon | 4 | 26 | 30 | 86.7 |
| | | | 0 | |
| Hainaut | 43 | 79 | 122 | **64.8** |
| | | | 0 | |
| Liège | 11 | 87 | 98 | 88.8 |
| | | | 0 | |
| Luxembourg | 6 | 13 | 19 | **68.4** |
| | | | 0 | |
| Namur | 12 | 12 | 24 | **50.0** |
| Total Wallonie | 76 | 217 | 293 | 74 |
| Total Belgium | 192 | 750 | 942 | 79.6 |

Globally, 80% of all premature neonates born from intermediate care women were delivered in maternities with MIC-services. However, this global proportion covers various situations. Notably, this number is lower in a few provinces (Namur, Hainaut, West-Vlaanderen) but in Namur, there is a non-MIC centre that has a NIC centre as well as in Charleroi. Finally, the proportion of premature neonates who are born in maternities without MIC-services is higher in Wallonia than in Flanders.

**Table 42 (bis). Comparison of the proportion of neonates <1 500 grams (from IC mothers) between MIC and non-MIC services per province**

| **neonates <1 500 grams** | | | | |
|---|---|---|---|---|
| | Non-MIC | MIC | total | % MIC |
| **Bruxelles** | 6 | 90 | 96 | 93,8 |
| **Vlaanderen** | | | | |
| Antwerpen | 16 | 94 | 110 | 85,5 |
| Vlaams brabant | 7 | 44 | 51 | 86,3 |
| West Vlaanderen | 22 | 37 | 59 | **62,7** |
| Oost Vlaanderen | 20 | 46 | 66 | **69,7** |
| Limburg | 9 | 54 | 63 | 85,7 |
| Total Vl. | 74 | 275 | 349 | 78,7 |
| **Wallonie** | | | | |
| Brabant Wallon | 2 | 20 | 22 | 90,9 |
| Hainaut | 32 | 61 | 93 | **65,6** |
| Liège | 6 | 55 | 61 | 90,2 |
| Luxembourg | 3 | 7 | 10 | **70,0** |
| Namur | 9 | 9 | 18 | **50,0** |
| Total W | 52 | 152 | 304 | **74,5** |
| Total BELGIQUE | 132 | 517 | 649 | 79,6 |

Furthermore, our database contains 1,074 neonates (< 1,500 grams) among which 649 were delivered by IC mothers. The situation of VLBW born of intermediate care women is similar to this of premature neonates: globally, 80% of them are born in a MIC-service.

## 6.5 LOGISTIC REGRESSION MODEL

To apprehend individually the factors associated with an admission in a maternity with MIC-beds, a logistic regression model was used.

The dependent variable was "Hospitalisation in a MIC-service" (Y/N). The independent variables were:

- categories of care (intermediate care versus standard and grey zone);
- mode of delivery (caesarean versus vaginal);
- age in 5 years category (reference group: 25-29 years, this group is the least likely to go in a MIC-service);
- the socioeconomic status (BIM vs. no BIM);
- the categorized minimum distance (in kilometres) to reach a MIC-service by municipality (place of residence of the woman).

**Table 43: Logistic regression model. Adjusted odds ratios : Delivery in maternities with or without MIC-services**

| Variable | Value | OR | IC 95% | | P value * | Signif |
|---|---|---|---|---|---|---|
| Age (years) | 10-24 | 1.001 | 0.957 | 1.048 | 0.9522 | |
| | 25-29 | 1 | | | | |
| | 30-34 | 1.119 | 1.080 | 1.161 | <0.0001 | *** |
| | 35-39 | 1.271 | 1.212 | 1.332 | <0.0001 | *** |
| | 40-50 | 1.396 | 1.275 | 1.528 | <0.0001 | *** |
| Social status (BIM) | | | | | | |
| | yes | 1.431 | 1.349 | 1.518 | <0.0001 | *** |
| | no | 1 | | | | |
| Woman Care Type | | | | | | |
| | Standard Care | 1 | | | | |
| | Grey Zone | 1.364 | 1.321 | 1.409 | <0.0001 | *** |
| | Intermediate Care | 2.149 | 2.047 | 2.256 | <0.0001 | *** |
| Theoratical distance to MIC hospital | | | | | | |
| in km | Distance < 30 | 25.790 | 20.916 | 31.799 | <0.0001 | *** |
| | 30<=distance<60 | 3.688 | 2.968 | 4.582 | <0.0001 | *** |
| | 60<=distance<90 | 1 | | | | |
| | 90<=distance<120 | 1.860 | 1.264 | 2.735 | 0.0016 | *** |
| | Distance > 120 | 3.271 | 1.887 | 5.669 | <0.0001 | *** |

* P-value of the Wald Chi-Square
Non-significant variable : cesarean delivery
Max-rescaled R-Square = 0.1517
P-value of the H-L test : <0.0001
Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

The result of the Hosmer and Lemeshow test was 0.1517; in other words, the model presented did have a low 'goodness-of-fit' (theoretical good range ≅ 0.8). According to the nature of the available data, this score can be considered as a relatively good one. Nevertheless, the fact must be kept in mind that there are a lot of other factors that could explain an admission in a MIC-service but these data were unavailable in our database.

However, we can determine a series of explaining factors.

All other factors being equal, the risk of women older than 30 years being hospitalized in maternities with a MIC-service is higher than for women aged 25-29. This risk increases with age categories (OR = 1.119 for 30-34 years; OR = 1.271 for 35-39 years old and finally, OR = 1.396, for the 40-50 years old group).

Women with low social status have also a higher risk (OR=1.431) of being hospitalized in maternities with MIC.

One major determinant of an admission in a MIC-service is the geographical proximity. However, the picture is blurred as the probability of admission also increases for people living far away from a MIC-service (>120 km). One possible explanation is that women far away from a MIC-service (over 120 km) are probably carefully screened and referred to a MIC-service .

## 6.6 SUMMARY OF RESULTS

The very low proportion of intermediate care women actually cared for in a maternity with a MIC service represents one of the most important piece of information of this chapter as well as the variability of this proportion between provinces. Information that need to be linked to the longer distances that the women need to travel to reach a MIC unit in some provinces and the varying rate of premature babies cared for in MIC maternities between provinces.

Table 44 summarizes some of the important information gathered in this chapter about the intermediate care activity of the MIC-services.

Description of the column:

- Column 1 is the total number of women that delivered in that hospital
- Column 2 is the number of MIC-beds in that hospital
- Column 3 is the Ratio MIC beds/M beds
- Column 4 is the proportion of women theoretically requiring intermediate care in that hospital
- Column 5 is the proportion of women theoretically requiring intermediate care divided by the amount of MIC-beds in that hospital
- Column 6 is the proportion of transfers to that hospital divided by the amount of MIC-beds in that hospital
- Column 7 is the total amount of transfers in that hospital
- Column 8 is the amount of intra-uterine transfers in that hospital
- Column 9 is the number of premature neonates (<32weeks) born in maternity with MIC services
- Column 10 is the number of premature neonates (<32weeks) born in maternity without MIC services

**Table 44: MIC-services activities**

| Province | Hospitals | 1.Nb of women | 2.Nb of MIC beds | 3.Ratio MIC beds/ M beds | 4.Proportion intermediate care women | 5.Intermediate care women / MIC bed | 6.Transfers / MIC bed | 7.All transfers | 8.IUT | 9.Number of premature born in MIC/ | 9.Number of premature born out of MIC/ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Région Bruxelles-Capitale - Brussels Hoofdstedelijk gewest** | | | | | | | | | | | |
| Région Bruxelles-Capitale Brussels Hoofdstedelijk gewest | UCL | 1,267 | 16 | 0.44 | *19.8%* | 15.7 | 5.13 | 82 | 50 | 81 | |
| | CHU St Pierre | 1,728 | 15 | 0.38 | *13.4%* | 15.4 | 1.27 | 19 | 18 | 53 | |
| | CHU Brugmann + hôpital des enfants * | 1,437 | 9 | 0030 | *17.1%* | 27.3 | 3.89 | 35 | 14 | 40 | |
| | Erasme | 1,509 | 8 | 0.30 | *10.9%* | 20.6 | 4.88 | 39 | 27 | 66 | |
| | VUB | 1,573 | 8 | 0.20 | *17.2%* | 33.8 | 7.25 | 58 | 28 | 75 | |
| | Edith Cavell | 2,248 | 8 | 0.15 | *11.3%* | 31.6 | 0.50 | 4 | 2 | 8 | |
| *Totaal Brussels Hoofdstedelijk gewest* | | **9,762** | **64** | | | | | **237** | **139** | **323** | **8** |
| **Vlaams gewest** | | | | | | | | | | | |
| Antwerpen | U.I.A | 821 | 8 | 0.40 | *22.2%* | 22.8 | 12.25 | 98 | 62 | 99 | |
| | AZ Middelheim | 1,241 | 8 | 0.22 | *6.8%* | 10.6 | 4.38 | 35 | 8 | 28 | |
| | AZ St Augustinus | 2,498 | 8 | 0.16 | *10.9%* | 34.0 | 2.50 | 20 | 10 | 54 | |
| Vlaams Brabant | KUL | 2,031 | 20 | 0.31 | *17.6%* | 17.9 | 5.20 | 104 | 71 | 142 | |
| West Vlaanderen | AZ St Jan | 1,004 | 8 | 0.21 | *9.0%* | 11.3 | 5.25 | 42 | 30 | 73 | |
| Oost Vlaanderen | UZ Gent | 821 | 8 | 0.26 | *19,1%* | 19.6 | 12.75 | 102 | 60 | 76 | |
| Limburg | ZOL | 1,733 | 8 | 0.13 | *14.4%* | 31.3 | 5.75 | 46 | 28 | 64 | |
| *Totaal Vlaams gewest* | | **10,149** | **68** | | | | | **447** | **269** | **536** | **108** |
| **Région Wallonne** | | | | | | | | | | | |
| Hainaut | CHU Tivoli | 1,099 | 8 | 0.29 | *18.0%* | 24.8 | 5.88 | 47 | 24 | 39 | |
| | CH Notre Dame / Reine Fabiola | 1,684 | 8 | 0.18 | *10.9%* | 22.9 | 5.00 | 40 | 21 | 52 | |
| Liège | CH St Vincent et Ste Elisabeth | 3,368 | 16 | 0.26 | *16.5%* | 34.8 | 2.13 | 34 | 19 | 91 | |
| | CH La Citadelle | 1,929 | 8 | 0.15 | *14.5%* | 35.0 | 7.13 | 57 | 38 | 65 | |
| Brabant Wallon | | | | | | | | | | | |
| Namur | | | | | | | | | | | |
| Luxembourg | | | | | | | | | | | |
| *Total Région Wallonne* | | **8,080** | **40** | **0.88** | | | | **178** | **102** | **217** | **76** |
| **Total Belgique** | | **28,527** | **172** | **0.88** | | | | **862** | **510** | **750** | **192** |

* The Brugmann Hospital declared 9 accredited MIC-beds but has 8 financed MIC-beds according to FPS.

The high variability in intensity of use of MIC beds between maternities must be highlighted and related also to the number and proportion of intermediate care women cared for in non-MIC maternities (2 of which having a NIC unit).

Every hospital with accredited MIC-beds receives an extra amount of money to pay for the FTE of midwives with experience in high-risk pregnancies (see point 1.2.5). This amount of money depends on the number of MIC-beds. Consequently, the effectiveness of MIC-services can notably be estimated using proxy-indicators like the number of IC women per MIC-bed and the number of transfers per MIC-bed.

Following the R.D. (see point 1.1), MIC-service is dedicated to admission of patients were the baby most probably will need intensive care after delivery. The WENZ-study and NIC report emphasised that it is better to transfer the mother before the delivery (intra-uterine transfer), rather than to transfer the newborn after the delivery, when one can predict that the newborn will need neonatal intensive care as for example premature neonates (<32 weeks) and if the transfer is possible in a reasonable time allowed.

# 7 GENERAL DISCUSSION AND CONCLUSION

## 7.1 CONTEXT

Any evaluation of the functioning of MIC in Belgium should basically translate into an evaluation of how well MIC-services fulfil their legally defined function. However, neither the Royal Decree on Maternal Intensive Care nor any consensus statements stipulate unambiguously the indicated use of MIC-services. This leaves admission patterns to a MIC-unit governed by practice rather than through formal admission criteria and referral pathways. Therefore, current utilization of MIC-care is a cause of concern as it remains unclear whether the levelling of maternal care as defined by the Royal Decree on Maternal Intensive Care serves the goals it was intended to, i.e. providing optimal maternal care in a cost-efficient way.

## 7.2 OBJECTIVES

The primary objectives of this health services research project were to assess the effectiveness and the efficiency of the MIC function in Belgium and to assess the equity of access to MIC care.

Determining the effectiveness of the MIC function in Belgium (research question 2) would basically entail an evaluation of the degree to which the MIC-services comply with their function as set out by the Royal Decree on the MIC function. Partly, the adequate use of the MIC function can be approximated by comparing real disease-specific admission rates to the anticipated admission rates derived from a theoretical, expert-based model.

The efficiency of the MIC function in Belgium (research question 3) relates to the proper use of resources allocated to maternity facilities with a MIC function. Therefore real disease-specific admission rates were compared to the anticipated admission rates derived from a theoretical, expert-based model, using various proxy-indicators of efficiency.

Equity of access to MIC care in Belgium (research question 4) was approached through a geographical distribution of MIC-services, the proportion of women delivering in maternities with a MIC-service, the proportion of prematurely born babies in maternities with a MIC service and socio-economic indicators of patients admitted.

It should be emphasized that the present study was not intended, nor designed, to measure the quality of maternity care.

## 7.3 ADEQUATE USE OF MIC-BEDS

The women delivering in hospitals with a MIC-service show some statistically significant differences compared to the population in hospitals without a MIC-service: more women with premature babies or stillbirths, more multiple pregnancies, more socially deprived women (measured through available proxy variables) and a larger proportion of older women. For Belgium as a whole, a higher proportion of women with a low socio-economical status (defined as BIM or MAF) are delivering in hospitals with MIC service, although this difference is not statistically significant in all provinces separately.

When comparing the characteristics of women (according to the recommended levels of care for the observed situation of admissions) in hospitals with and without MIC-services, the concordance between expected versus observed levels of maternal care is relatively poor. However, an important finding was that, of all women who should theoretically have been allocated to intermediate care (according to the registered diagnosis), only 40% was actually admitted to a maternity with a MIC-service. This proportion of so-called *'adequate use'* varies widely across provinces, from as low as 15.5% in the province of Namur up to 64.1% in the province of Liege. In other words, in Belgium 60% of women considered to require intermediate care currently do not deliver in maternity services intended to provide such care.

Two types of referrals to a MIC-service are observed, either during a hospitalization (transfer from one hospital to another) or during pregnancy (referral from an outpatient clinic). These transfers or referrals are either initiated by the women or by the gynaecologist. There are no data about referrals occurring before hospitalisation. Among the 97 718 pregnant women in our database, merely 1073 (1.02%) were transferred from one hospital to another of which 660 transfers (61.5%) occurred before the delivery (intrauterine transfer) and 413 transfers (38.5.1%) took place after delivery. Among the intrauterine transfers, 510 (77.3%) occurred towards maternities with a MIC-service, while 22.7% of intra-uterine transfers were towards a maternity without MIC because some isolated maternities without MIC-beds also receive those transfers (RMST[fff] and CHR-Namur[ggg]). Maternities belonging to teaching hospitals received the highest proportions of transfer per MIC-bed (> 10%), except for maternities in Brussels (local competition or referral rate ?).

## 7.4 PROVISION OF SERVICES ADEQUACY

Every hospital with MIC-beds receives extra financial support to pay for midwives experienced in high-risk pregnancies. The additional MIC-budget is worth 2.29 points (or €46 347.54) per MIC-bed (physician fees not included). Because the administrative and financial registration of the MIC-activities does not discriminate between M- and MIC-beds, we do not have specific financial data on MIC-beds as currently the Belgian hospitals register MIC-beds similarly as they do M-beds.

We first compared two indices to measure MIC-bed use: (1) *the MIC/(M+MIC)* bed ratio reflects the proportion for a given MIC-service of MIC-beds relative to the total number of maternity (M and MIC) beds in that centre, and (2) *the intermediate care/all maternity care ratio* represents the proportion of all women recommended to receive MIC care according to theoretical model delivering during the index period in the index centre. The *intermediate care/all maternity care ratio* was consistently lower than the MIC/(M+MIC) bed ratio, meaning that hospitals admit less women for intermediate care than would be expected from the MIC-bed capacity of each centre. Intermediate care patients, however, have significantly longer stays and therefore the intermediate care/all maternity care ratio has to be adjusted by weighing for length of stay, but even taking this into consideration these data seem to suggest at least to some extent an under-use of available MIC-beds. When looking at yet another ratio this became even more apparent. The *intermediate care patient/MIC bed ratio* describes the proportion of intermediate care women giving birth in a hospital with a MIC- centre service. This resulted in a wide range across the various MIC-centres in bed occupancy of MIC-beds by intermediate care patients, with at the lower end merely 10 women being admitted on average per MIC-bed during the one-year reference period as compared to 35 women at the higher end of the range. So basically, the proportion of women considered as requiring intermediate care relative to the hospital-specific numbers of women is not significantly different between maternities with and without MIC-services, and this proportion does not depend on maternity size.

## 7.5 EQUITY OF ACCESS TO CARE

Several issues that explain the apparent failure of levelled maternity care in Belgium need to be addressed. It is obvious that the geographical distribution of the 17 MIC-services does not parallel the Belgian population and hence delivery density. MIC-services are largely clustered in the urban area of Brussels with few MIC- services dispersed in the various provinces both in the North-Western and the Southern parts of Belgium.

Transfer rates from maternities without MIC service to maternities with MIC service were found to be fairly low, compared with the number of IC women. Accordingly, it could be expected that proximity of a hospital is an important determinant for admission for pregnancy-related pathology or delivery.

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[fff] Réseau de Médecine Sociale à Tournai

[ggg] CHR-Namur has a NIC service

Women requiring intermediate care travel on average longer distances to reach a hospital with a MIC-service compared to women requiring standard care. We demonstrated in a multivariable model that intermediate care classification of the women increased the likelihood of being admitted to a MIC-service with an adjusted odds ratio of 2.1 (95% CI 2.047 – 2.256). However, the mere fact of living within a distance of 30 km from a MIC-service increased the odds ratio much more: 25.8 (95% CI 20.916 – 31.799) independently of the intermediate care classification. Overall, MIC-admission in Belgium seems to be primarily determined by living in the vicinity of a hospital with a MIC-service. The observation that several non-MIC services admitted larger numbers of intermediate care women than some specific MIC-services raises questions. Have those maternities developed the role of referral centre in regions distant from 'official' MIC-services? How are those centres dealing with the higher costs caused by providing intermediate care? How about the quality of care in these kind of referral centres functioning, de facto, as MIC-services?

In our study, the global rate of prematurity (defined as <32 weeks) is 1.5% for all risk categories, but increases to 8.8% for IC pregnant women. For the whole country, 80% of all premature neonates from IC mothers are born in a MIC-service. This proportion is indeed reached in Brussels and in Flanders (overall) but not in Wallonia. The provinces of West Vlaanderen (63.5%), Hainaut (64.8%), Luxembourg (68.4%) and Namur (50%) have much lower proportions than the national average.

## 7.6 DISCUSSION OF THE METHOD

### 7.6.1 Identification of MIC population

Based on our classification of admission criteria, 55.6% of the women are classified into the category 'standard care', 33.7% into the grey zone, 9.6 % in 'intermediate care' and 0.7% into intensive care (including near misses). This would obviously imply that merely half of all women could be taken care of at the standard level of care. This was probably due to the difficulties encountered in allocating women with specific conditions or indications (anaemia, VBAC, preterm labour, foetal distress, advanced maternal age, IUGR, macrosomia, Rh allo-immunisation, complicated uro-genital disorders, and neonatal admission respectively) which were felt to be beyond standard care but yet insufficient to justify a MIC admission.

Consequently, unless an additional level of care would be created, the most pragmatic solution would be to revise and/or to refine the indication sets as to reallocate women in grey zone to either standard care or MIC level care. Indeed, it appears as if the grey zone encompasses for the most part maternal and foetal morbidity that can reasonably be assumed to belong to the secondary level of maternity care, as does standard maternity care. Some indication for the re-allocation of the grey zone-defined patients also comes from several perinatal indices, with quite different distributions across the various levels of care, indicating the morbidity load within each level: the stillbirth rate was 0.1 % at the standard care level and the grey zone level, however as high as 3.9% at the MIC level; the proportion of twins varies from 0.4 % in standard care to 6.2% in the grey zone to 8.4% in intermediate care; overall, preterm birth occurred with 3.2% of women in standard care, with 8.5% in the grey zone and with 18.8% in intermediate care. Similarly gross differences were observed from preterm birth and low birth weight subcategories also: 1 and 5 minute Apgar scores tended to be substantially worse at the MIC level; the proportion of neonates admitted to a NIC unit varies from 0.2% in standard to 6.4% in the grey zone to 17.6% in intermediate care, while similarly the proportion of neonates staying in N* units varies from 15.8% in standard to 18.2% in grey zone to 22.6% in intermediate care.

### 7.6.2 Limitations

An obvious limitation in our analyses is that, due to the nature of the registration process, we were unable to discriminate between real MIC-beds and M beds, as data registration is currently done for a maternity service as a whole. Therefore, we can only approximate the use of MIC-beds through differences observed in admission characteristics between hospitals with or without MIC-services.

Our findings may also have been biased to what is known as "DRG-creeping", i.e. the MKG coding system was designed to register clinical diagnoses to calculate disease load-based financing and such coding is therefore always prone to morbidity overrating. Therefore, the apparent similarity in case mix between MIC and non-MIC services should not only be assessed in terms of numbers of patients admitted. Indeed, it appears as if differences actually do exist between MIC and non-MIC services in terms of types of specific pregnancy-related morbidities.

Due to the many limitations of this study on the one hand and to a lack of a valid registration and predefined quality indicators and evidence based guidelines in maternities with MIC-services on the other hand, it was impossible to assess the quality of care delivered in those maternities.

## 7.7 CONCLUSION

From this health services research investigation we conclude that the introduction of a multileveled maternity care model in Belgium aimed at optimal maternity care in a cost-efficient way, has insufficiently resulted in a formal levelling of maternity care and proper use of resources as was originally intended. This is mainly due to the absence of any formal admission criteria or referral pathways.

Of all women who are considered, according to the theoretical model, to receive intermediate care and hence are considered to benefit from admission to a specialized MIC-service, only 40% actually delivers in a maternity with a MIC-service. The other are admitted to a hospital considered to act at the secondary or basic level of obstetric care. Conversely, MIC-services seem to care at a much higher rate for women recommended to receive standard maternity care than would be expected from their specialized bed capacity. Despite the fact that referral pathways are not clearly defined, with rates of intra-uterine transfer to a MIC-service being disproportionately low, admission to a MIC-service is not only guided by medical indications but also by geographical proximity. The proportion of IC women delivering in maternities with MIC-services varies widely across various regions and hospitals.

In addition, the concept of intermediate care remains broad and ill defined. Neither the literature, nor the local data make it possible to conclude that all of the 'so-called' intermediate care pregnancies would benefit from an admission in a MIC-service.

It is not the case with regard to the threat of premature birth (< 32 weeks). Especially for this vulnerable group, the NIC-report emphasised that it is better to transfer the pregnant woman to a MIC service (intra-uterine transfer), rather than to transfer the newborn to a NIC service. Therefore, maternity units having MIC beds need to be located at an acceptable distance. Unfortunately, in some areas, women have to cover a long distance (over 40 km) to reach a maternity unit having MIC beds, while other areas have a high concentration of MIC centres. This observation also raises the question of the fair distribution of the public means including affordability and equal access. This question of the fair distribution of means is also raised by the apparent under usage of MIC-beds. Consequently, the distribution of MIC-beds should be re-examined by taking into account the various indices suggested previously.

# 8 APPENDICES

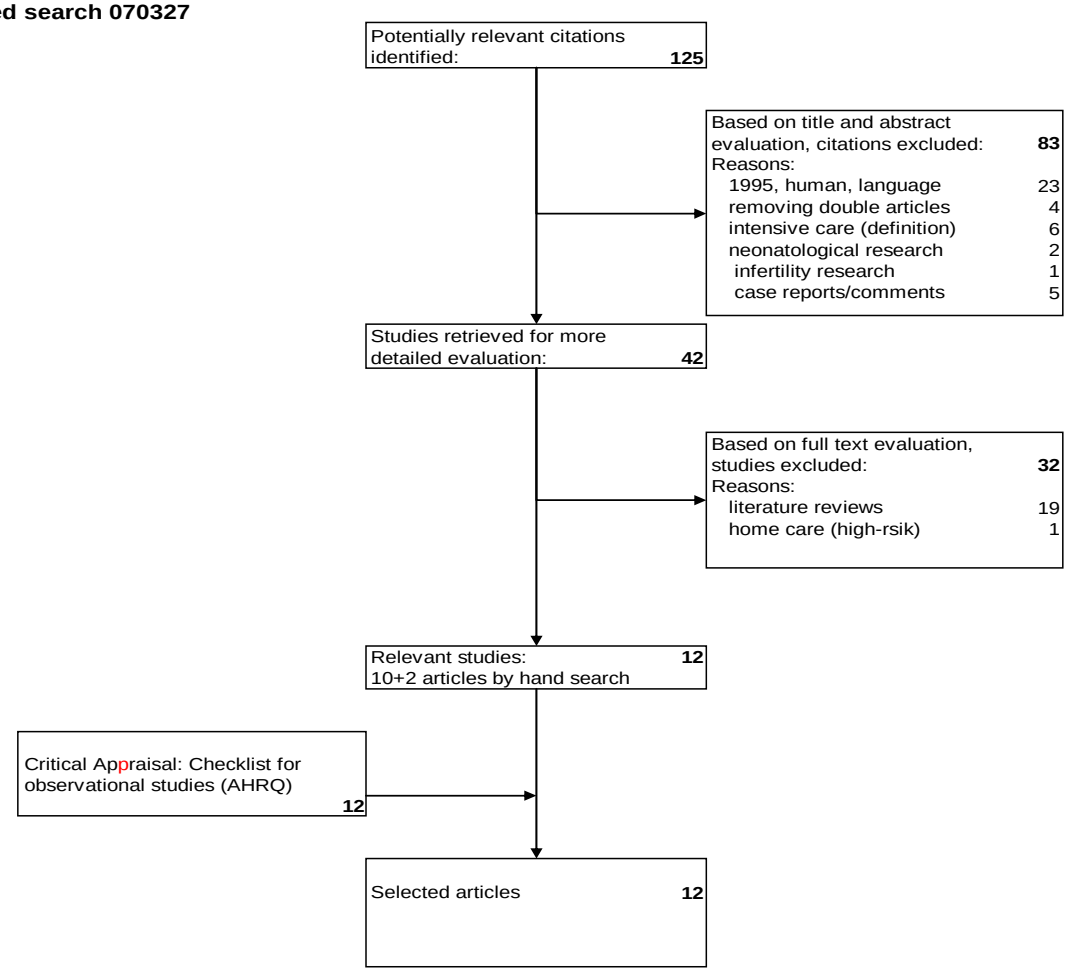
# APPENDIX CHAPTER 3

## ANNEX 1: KEYWORDS LITERATURE REVIEW MIC-DEFINITIONS, PUBMED-SEARCH

| | |
|---|---|
| Date | 27/03/07 |
| Database<br>(name + access ; eg Medline OVID) | Pubmed (limits: 1997-2007, human)<br>Central library Ghent, www.pubmed.gov |
| Search Strategy<br>(attention, for PubMed, check « Details ») | Database: Ovid MEDLINE(R) <1950 to March Week 4 2007><br>Search Strategy:<br>----------<br>1 Subacute Care/ (612)<br>2 Subacute unit?.mp. (31)<br>3 Subacute intensive care.mp. (2)<br>4 Hospital Units/ (6959)<br>5 Intermediate care.tw. (692)<br>6 Intermediate care unit?.mp. (167)<br>7 Intermediate care bed?.mp. (15)<br>8 Intermediate care team?.mp. (4)<br>9 Post acute care.mp. (133)<br>10 Critical Care/ (18237)<br>11 "Sub intensive care".mp. (3)<br>12 Progressive Patient Care/ (1085)<br>13 Progressive Patient Care / (14392)<br>14 Postnatal Care/ (2534)<br>15 Perinatal Care/ (1307)<br>16 Obstetrical Nursing/ (2380)<br>17 Neonatalogy/ (0)<br>18 Pregnancy/ (552736)<br>19 Postpartum Period/ (12628)<br>20 Maternal Mortality/ (5698)<br>21 exp Pregnancy Complications/ (253793)<br>22 Infant, Newborn/ (388794)<br>23 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 (854359)<br>24 13 or 14 or 16 or 18 or 19 or 20 or 21 (580177)<br>25 1 or 2 or 3 or 6 or 7 or 8 or 9 or 10 or 11 or 12 (20157)<br>26 4 and 5 (34)<br>27 25 or 26 (20164)<br>28 24 and 27 (418)<br>29 limit 28 to ("review articles" and yr="2000 - 2007") (46)<br>30 limit 28 to "review articles" (93)<br>31 limit 28 to yr="2000 - 2007" (78)<br>32 30 or 31 (125)<br>33 from 32 keep 1-125 (125) |

# ANNEX 2: DETAILED FLOW CHART SEARCH STRATEGY MIC-DEFINITIONS, PUBMED-SEARCH

**pubmed search 070327**



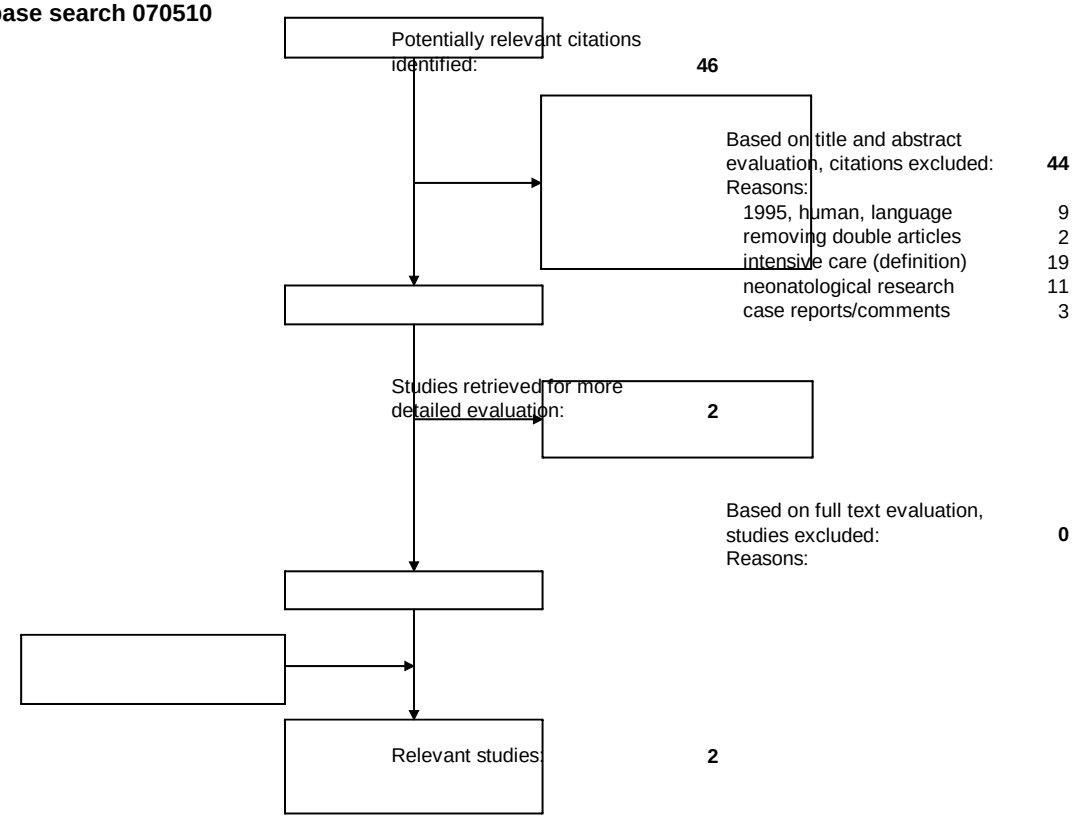
# ANNEX 3: KEYWORDS LITERATURE REVIEW MIC-DEFINITIONS, EMBASE-SEARCH

| | | | |
|---|---|---|---|
| Date | 13/02/07 | | |
| Database<br>(name + access ; eg Medline OVID) | Embase<br>KCE, www.embase.com | | |
| Search Strategy<br>(attention, for PubMed, check « Details ») | **No.** | **Query** | **Results** **Date** |
| | #1. | 'subacute care' | 710 02 May 2007 |
| | #2. | 'subacute unit' | 26 02 May 2007 |
| | #3. | 'subacute units' | 18 02 May 2007 |
| | #4. | 'subacute intensive care' | 2 02 May 2007 |
| | #5. | 'maternal intensive care' | 10 02 May 2007 |
| | #6. | 'hospital department'/exp | 17,164 02 May 2007 |
| | #7. | 'intermediate care' | 865 02 May 2007 |
| | #8. | 'intermediate care unit' | 143 02 May 2007 |
| | #9. | 'intermediate care units' | 85 02 May 2007 |
| | #10. | 'intermediate care bed' | 3 02 May 2007 |
| | #11. | 'intermediate care beds' | 17 02 May 2007 |
| | #12. | 'intermediate care team' | 1 02 May 2007 |
| | #13. | 'intermediate care teams' | 3 02 May 2007 |
| | #14. | 'post acute care' | 178 02 May 2007 |
| | #15. | 'critical care' | 71,454 02 May 2007 |
| | #16. | 'sub intensive care' | 3 02 May 2007 |
| | #17. | 'progressive patient care' | 94 02 May 2007 |
| | #18. | 'prenatal care'/exp/mj | 36,015 02 May 2007 |
| | #19. | 'postnatal care'/exp/mj | 14,589 02 May 2007 |
| | #20. | 'perinatal care'/exp/mj | 9,778 02 May 2007 |

| | |
|---|---|
| | #21. 'obstetrical nursing'/exp 80 02 May 2007<br>#22. neonatology 88 02 May 2007<br>#23. 'pregnancy'/exp 451,648 02 May 2007<br>#24. 'puerperium'/exp 23,765 02 May 2007<br>#25. 'maternal mortality'/exp 8,327 02 May 2007<br>#26. 'pregnancy complication'/exp 81,325 02 May 2007<br>#27. 'newborn'/exp 365,759 02 May 2007<br>#28. #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR # 25 OR #26 OR #27 788,964 02 May 2007<br>#29. #1 OR #2 OR #3 OR #4 OR #8 OR #9 OR #10 OR #11 OR 1,242 #12 OR #13 OR #14 OR #16 OR #17 02 May 2007<br>#31. #28 AND #29 27 02 May 2007<br>#32. #28 AND #15 2,560 02 May 2007<br>#33. #28 AND #6 1,501 02 May 2007<br>#34. #7 AND #6 10 02 May 2007<br>#35. #5 OR #31 OR #34 46 02 May 2007 |

# ANNEX 4: DETAILED FLOW CHART SEARCH STRATEGY MIC-DEFINITIONS, EMBASE-SEARCH

**Embase search 070510**

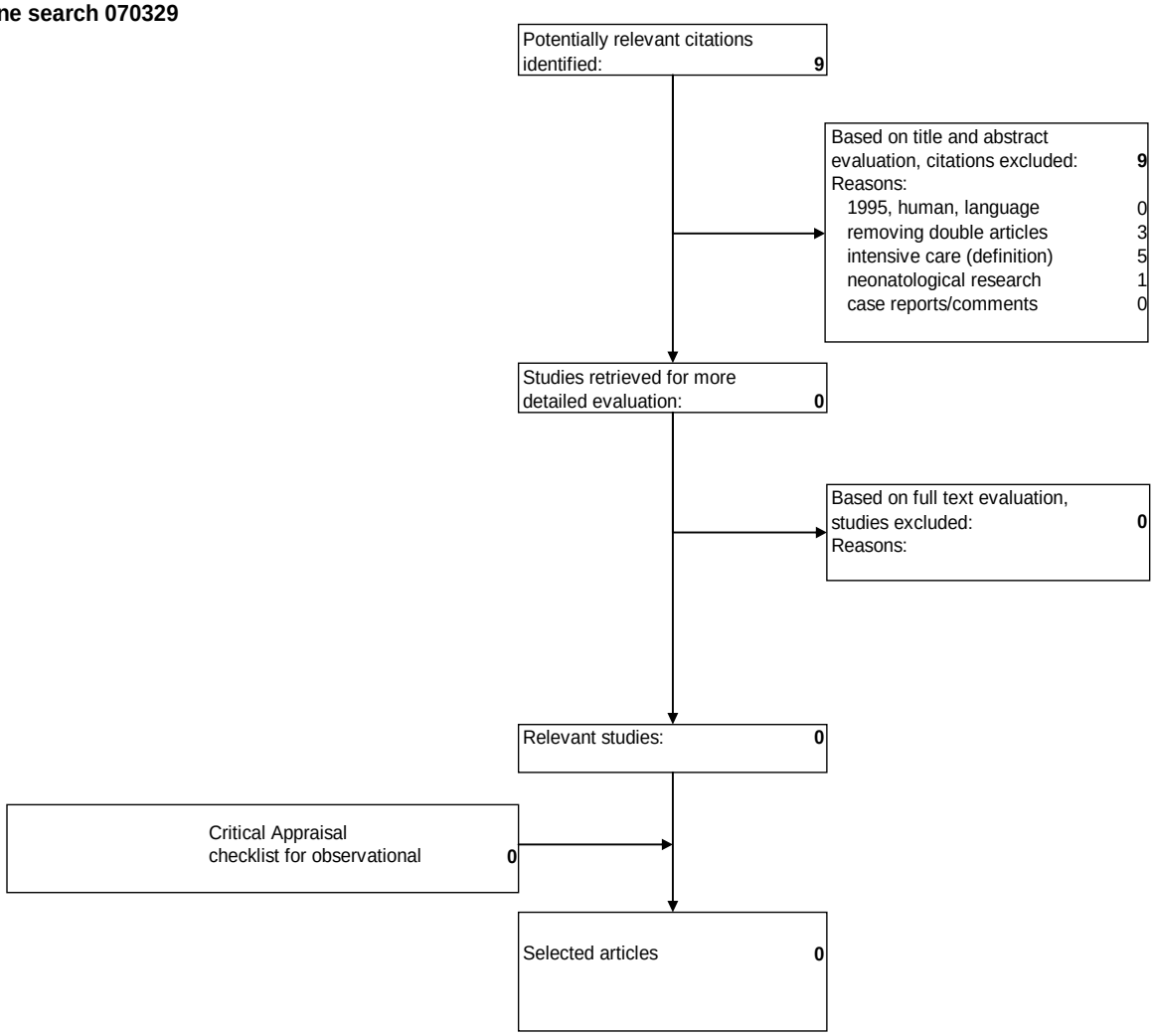


# ANNEX 5: KEYWORDS LITERATURE REVIEW MIC-DEFINITIONS, COCHRANE-SEARCH

| | |
|---|---|
| Date | 27/03/07 |
| Database<br>(name + access ; eg Medline OVID) | Cochrane<br>Central library Ghent,<br>www3.interscience.wiley.com |
| Search Strategy<br>(attention, for PubMed, check « Details ») | (obstetrical intensive care):ti,ab,kw<br>"obstetrical intensive care **in** Title, Abstract or Keywords **in** The Cochrane Central Register of Controlled Trials" = **5 results**<br><br>MeSH descriptor **Intensive Care** explode all trees<br>"MeSH descriptor **Intensive Care** explode all trees in **The Cochrane Database of Systematic Reviews**" = **6 results**<br>(reproductive health services, maternal health services, "MeSH descriptor **Maternal Health Services** explode all trees in **The Cochrane Database of Systematic Reviews)**<br>"maternal intermediate care **in** Title, Abstract or Keywords **in** The Cochrane Central Register of Controlled Trials" = **3 results** |

# ANNEX 6: DETAILED FLOW CHART SEARCH STRATEGY MIC-DEFINITIONS, COCHRANE-SEARCH

**Cochrane search 070329**



# ANNEX 7: KEYWORDS LITERATURE REVIEW MIC-DEFINITIONS, CINHAL-SEARCH

| | |
|---|---|
| Date | 3/4//07 |
| Database<br>(name + access ; eg Medline OVID) | CINHAL<br>Central library Ghent, CINHAL OVID |
| Search Strategy<br>(attention, for PubMed, check « Details ») | |

| | Query | Results |
|---|---|---|
| S21 | (((Pregnancy Complications) and (S20 or S19 or S18 or S17 or S16 or S15 or S14 or S13)) and (S12 or S11 or S10 or S9 or S8 or S7 or S6 or S5 or S3 or S2 or S1)) and (S5 and S4) | 0 |
| S20 | Pregnancy Complications | 4930 |
| S19 | Maternal Mortality | 1189 |
| S18 | Postpartum Period | 534 |
| S17 | Pregnancy | 53370 |
| S16 | Neonatalogy | 2 |
| S15 | Obstetrical Nursing | 42 |
| S14 | Perinatal Care | 1017 |
| S13 | Postnatal Care | 1625 |
| S12 | Progressive Patient Care | 92 |
| S11 | "Sub intensive care" | 1 |
| S10 | Critical Care | 18164 |
| S9 | Post acute care | 93 |
| S8 | Intermediate care team | 4 |
| S7 | Intermediate care bed | 2 |
| S6 | Intermediate care unit | 35 |
| S5 | Intermediate care | 362 |
| S4 | Hospital Units | 2515 |
| S3 | Subacute intensive care | 1 |
| S2 | subacute unit | 18 |
| S1 | subacute care | 808 |

# ANNEX 8: EVIDENCE TABLE LITERATURE REVIEW MIC-DEFINITION

| Study | Ref. | Country | Population | Methodology | Study type | Summary | Critical appraisal[hhh] | EL[iii] |
|---|---|---|---|---|---|---|---|---|
| Neto, M.T. (2006) | 1 | Portugal | Perinatal care in Portugal | Nationwide evaluation of the organisational perinatal care reformation, data obtained from National Institute for statistics (INE) reports, Eurostat & the National Committee for mother and child health (from 1989). After 1996 data was also obtained from the Portuguese National VLBW. Number of hospitals with deliveries, rate of in-hospital deliveries, maternal death rate, perinatal mortality, late fetal mortality, causes of fetal and infant mortality, IUT percentages, neonatal transport rates, national rates of prenatal steroids, mortality rates of VLBW were examined. | National perinatal database analysis | **OBJECTIVE**: To share information on the organization of perinatal care in Portugal. **RESULTS**: In 1989, perinatal care in Portugal was reformed: the closure was proposed of maternity units with less than 1500 deliveries per year; hospitals were classified as level I (no deliveries), II (low-risk deliveries, intermediate care units) or III (high-risk deliveries, intensive care units), and functional coordinating units responsible for liaison between local health centres and hospitals were established. A nationwide system of neonatal transport began in 1987, and in 1990 postgraduate courses on neonatology were initiated. With this reform, in-hospital deliveries increased from 74% before the reform to 99% after. Maternal death rate decreased from 9.2/100,000 deliveries in 1989 to 5.3 in 2003 and, in the same period, the perinatal mortality rate decreased from 16.4 to 6.6/1000 (live births + stillborn with > or = 22 wk gestational age), the neonatal mortality rate decreased from 8.1 to 2.7/1000 live births, and the infant mortality rate from 12.2/1000 live births to 4/1000. **CONCLUSION**: Regionalization of perinatal care and neonatal transport are key factors for a successful perinatal health system. | 1?<br>2?<br>3+<br>4?<br>5+<br>6NVT<br>7?<br>8+<br>9+<br>10-<br>Score:+/- | 3 |
| Keizer, J.L., Zwart, J.J., | 3 | The Netherlands | 142 women admitted at ICU | Retrospective tertiary centre based, analysis of medical records | Retrospective tertiary centre | **OBJECTIVE**: To review all pregnant women who required admission to an | 1+<br>2+ | 3 |

[hhh] Based on checklist for observational studies (AHRQ), retrieved from www.cebam.be on March 3rd, 2007

[iii] EL: Evidence Level

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Meerman, R.H., Harinck, B.I.J., Feuth, H.D.M. & van Roosmalen, J. (2006) | | | Leiden University Medical Centre (1991-2001) | of all obstetric admissions to the multidisciplinary ICU 1990-2001. Post-operative recovery women were excluded. Data on: diagnosis at the time of ICU admission, therapeutic interventions, maternal outcome, perinatal mortality and length of ICU and hospital stay. Special attention was given to the relation between ICU admission and ethnic background (Caucasian or not-Caucasian). Focuses on several important disorders of critically ill obstetric patients and reviews issues of respiratory failure in pregnancy. | based analysis of medical records of all obstetric admissions ICU | Intensive Care Unit (ICU) during pregnancy, childbirth or puerperium. **RESULTS**: Over these 12 years, 142 women required ICU admission (0.76% of all deliveries, 0.70% of all adult ICU admissions). The most common reasons for ICU admission were (pre)eclampsia (62.0%) and obstetric haemorrhage (18.3%). Twenty-seven out of 142 women (19.0%) were of non-caucasian origin. The most common therapeutic interventions were transfusion of erythrocytes (66.2%), caesarean section (50.7%) and artificial ventilation (44.4%). We observed seven maternal deaths (4.9%). **CONCLUSION**: We need better information about high-risk obstetric patients in order to prevent severe maternal morbidity and to improve maternal care. The high number of non-caucasian women requiring ICU admission indicates the need for a study into the role of ethnicity. We have initiated a nationwide confidential enquiry into the causes of severe maternal morbidity. | 3+<br>4+<br>5+<br>6+<br>7?<br>8+<br>9+<br>10?<br>Score:ok | |
| Zeeman, G. (2006) | 4 | The Netherlands | / | Literature review of 30 articles (last 15 years) describing characteristics and treatment of critically ill pregnant or puerperal women. Items like the lack of ICU scoring systems for critically ill obstetric patients, obstetric high-dependency care unit (and the indications for intermediate and ICU-care), maternal morbidity as indicator for quality of care, preeclampsia, hemorrhage and who cares for the critically ill obstetric patient are discussed. | (syst.) literature review | **OBJECTIVE**: The purpose of this review is two-fold: first, to provide an update on currently available reports pertaining to important critical care issues of the obstetric patient population and, second, to present current comprehensive treatment options for preeclampsia and massive obstetric hemorrhage because both are responsible for the majority of maternal mortality and morbidity worldwide. **RESULTS**: The most common reasons for intensive care unit admission are hypertensive disorders and massive obstetric hemorrhage. Timely delivery and prompt | 1+<br>2?<br>3+/-<br>4?<br>5?<br>6+<br>7nvt<br>Score: twijfel-achtig | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | initiation of antihypertensive therapy for severe hypertension form the mainstay of care in preeclampsia. Restoration of circulating blood volume and rapid control of bleeding and impaired coagulation are the main factors in the management of massive obstetric hemorrhage. Puerperal morbidity has become the main topic of quality of care issues in maternity care. Although the Acute Physiology and Chronic Health Evaluation II score is commonly used in the intensive care unit, it does not seem to be appropriate for pregnant women because it overestimates their mortality rates. A high-dependency care unit suits the needs for at least half of the obstetric patient population in need of higher acuity care and will save considerable cost. **CONCLUSION**: Emphasis on early detection of maternal problems and prompt referral to tertiary centers with intensive care unit facilities to provide optimum care of the circulation, blood pressure, and respiration at an early stage could minimize the prevalence of multiple organ failure and mortality in critically ill obstetric patients. | | |
| Fowler, S.J. (2005) | 9 | New Zealand (Wellington) | 240 (76,4%) hospitals | (Inter)nationwide (Australia & New Zealand) retrospective health care survey of all units that offer operative obstetric services. Hospitals with fewer than 50 deliveries per year and military hospitals were excluded. Postal questionnaires concerning major obstetric haemorrhage management have been send to all Australian & New Zealand operative obstetric services. An assessment of facilities relevant to | International retrospective health care survey of operative obstetric services | **OBJECTIVE**: The aim of this study was to assess facilities relevant to major obstetric haemorrhage management in all units in Australia and New Zealand that offer operative obstetric services **RESULTS**: Responses were received from 240 (76.4%) of the 314 hospitals surveyed (187 public and 53 private). One hundred and nine units (45%) had fewer than 500 deliveries per year (a lot of small facilities). Distances to referral facilities were frequently very large. Of the 90 hospitals (38.1%) without an onsite blood bank, 12 did | 1+<br>2+<br>3+<br>4?<br>5?<br>6+<br>7-?<br>8+<br>9+<br>10?<br>Score:ok | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | major obstetric haemorrhage was made. Data about demographics, facilities, staffing, policies and guidelines, drugs, procedures, equipment, point of care testing, availability of O neg blood were obtained. | | not have a supply of blood for emergencies. Half of all units (n=121) had on-site intensive care or high dependency facilities and 72.9% (n=175) had an on-site cardiac arrest team. Only 58.8% of units (n=141) had a written haemorrhage protocol. **CONCLUSION:** Haemorrhage responds well to appropriate treatment, although careful preparation and anticipation of problems is required. In our region geographical factors and different systems of healthcare complicate provision of obstetric services. Observation of blood loss > 1000ml should ideally be in an HDU. Where facilities are limited, women should be offered antenatal transfer to a larger centre. | | |
| Biswas, A.B. et al (2005) | 10 | India (West Bengal) | 408 health facilities | A health facility based case finding cross sectional study on process indicators and min. level of EmOC in all government health facilities and registered private health institutions providing maternity services in 4 districts of West Bengal. Relevant records and registers for 2001 of all studied facilities in the districts were reviewed to collect data using a pre-designed assessment schedule designed by UNICEF. Interviews with key health officials and staff members were conducted (jan-dec 2001) if clarification of any recorded data was required.. Measured process indicators: number of basic EmOC facilities, number of comprehensive EmOC facilities, geographical distribution of EmOC facilities, proportion of | Cross sectional health facility survey of minimum levels of EmOC | **OBJECTIVE:** This study aims to asses the availability and use of emergency obstetric care (EmOC) services based on 7 process indicators prescribed by WHO/UNICEF/UNFPA. These indicators have been recommended to monitor the availability and use of EmOC services. **RESULTS**: The numbers of basic and comprehensive EmOC facilities were inadequate in all the four districts compared to the minimum acceptable level. Overall, 26.2% of estimated annual births took place in the EmOC facilities (ranged from 16.2% to 45.8% in 4 districts) against the required minimum of 15%. The rate of caesarean section calculated for all expected births in the population varied from 3.5% to 4.4% in the four districts with an overall rate of 4%, which is less than the minimum target of 5%. Only 29.9% of the estimated number of complications (which is 15% of all births) was managed in the EmOC facilities. The | 1+<br>2+<br>3+<br>4?<br>5?<br>6+/-<br>7?<br>8+<br>9+<br>10?<br>Score:+/- | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | all births in basic and comprehensive EmOC facilities, met need for EmOC: proportion of women estimated to have complications who are treated in EmOC facilities, caesarean section as percentage of all births in the population and case fatality rate in EmOC. All these indicators are compared to the minimum acceptable level recommended by WHO/UNICEF/UNFPA. | | combined case-fatality rate in the basic/comprehensive EmOC facilities was 1.7%. Major obstetric complications contributed to 85.7% of maternal deaths, and pre-eclampsia/eclampsia was the most common cause.<br>**CONCLUSION**: It can be concluded that all the process indicators, except proportion of deliveries in the EmOC facilities, were below the acceptable level. Certain priority measures, such as making facilities fully functional, effective referral and monitoring system, skill-based training, etc., are to be emphasized to improve the situation. | | |
| Schatz et al ( | 15 bis | USA | 1739 pregnant asthmatic patients, < 26 weeks gestation | Prospective observational cohort study from 1994-1999 in 16 Maternal-Fetal Medicine Units. This study evaluates the relationship between asthma severity classification (1993) during pregnancy and gestational asthma exacerbations. 873 pregnant patients with mild asthma, 814 moderate & 52 severe asthma patients were included. Participants were excluded for known multiple gestation, intrauterine fetal demise, major congenital abnormalities, active pulmonary disease other than asthma, inability to schedule an ultrasound for gestational age confirmation, or gestational age greater than 25 weeks and 6 days at intake.<br>All obstetric patients were asked for physician diagnosed asthma. Information regarding symptom frequency, asthma medication use, | Prospective observational cohort study | **OBJECTIVE**: The objective of this study was to evaluate the relationship between asthma severity classification during pregnancy and gestational asthma exacerbations.<br>**RESULTS**: Initial asthma classification (mild, moderate, or severe) was significantly related to subsequent asthma morbidity during pregnancy (hospitalizations, unscheduled visits, corticosteroid requirements, and asthma symptoms during labor and delivery). Exacerbations during pregnancy occurred in 12.6% of patients initially classified as mild, 25.7% of patients classified as moderate, and 51.9% of patients classified as severe ($P$ < .001). Asthma morbidity was similar, whether patients were classified as moderate or severe by symptoms and spirometry or by medication requirement. Thirty percent of initially mild patients were reclassified as moderate-severe during pregnancy, and 23% of the initially moderate-severe patients were reclassified as mild later in pregnancy; asthma morbidity in these patients changed | 1+<br>2+<br>3+<br>4+/-<br>5+<br>6+/-<br>7?<br>8+<br>9+/-<br>10-<br>Score:ok | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | and the occurrence of exacerbations were obtained on each monthly study visit. The incidence of 1 or more asthma hospitalizations, unscheduled visits, or oral corticosteroid courses, as well as the proportion of patients with any exacerbation or symptoms during labor and delivery were analyzed as a function of asthma severity classification. Proportions were compared between severity groups by means of the Fisher exact test. | | accordingly.<br>**CONCLUSION:**: The National Asthma Education Program Working Group on Asthma and Pregnancy classification of asthma severity, adapted to include medication use, predicts subsequent asthma morbidity during pregnancy | | |
| Lee, B. (2004) | 25 | UK | / | This article/rapport was the result of a meeting. It describes and evaluates the creation of maternity HDU in a referral teaching hospital (2000) in the UK. | Meeting report of the Forum on Maternity and the Newborn, Royal Society of Medicine (17 June 2004) | Following the advances in science and technology and the recommendations of the confidential enquiry into maternal deaths the initiative was taken to set up critical care (HDU) within a maternity unit of the Chelsea and Westminster Hospital. This article describes high risk conditions for admission, a definition and aim of the HDU/maternity recovery, the constitution of the team, staffing and training issues, necessary equipment, guidelines and protocols. Maternal mortality and morbidity in the UK in relation to critical care, and a the patient's view on maternal morbidity are discussed as well. | 1nvt<br>2nvt<br>3nvt<br>4nvt<br>5nvt<br>6nvt<br>7nvt<br>8nvt<br>9nvt<br>10nvt<br>Score:nvt | 4 |
| Okafor, U. & Aniebue, U. (2004) | 27 | Nigeria | 18 patients admitted to an obstetric ICU | Tertiary centre based retrospective review of hospital records (case notes and intensive care unit records) of parturients admitted to the ICU of the University of Nigeria Teaching Hospital between 1997 and 2002. Demographics, diagnosis, duration of stay, need for ventilatory | Retrospective tertiary centre based analysis of obstetrical ICU admissions (health care survey) | **OBJECTIVE:** a six-year retrospective study to determine the pattern of admission and outcome for obstetric patients admitted to the intensive care unit of the University of Nigeria Teaching Hospital, Enugu.<br>**RESULTS**: A total of 816 patients were admitted to the intensive care unit during the period under review. Eighteen (2.2%) were obstetric patients. Nine (50%) were | 1+<br>2+<br>3+<br>4+/-<br>5+<br>6?<br>7?<br>8+<br>9- | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | support and deaths were documented. Maternal mortality was used to determine outcome. | | preeclamptic and eclamptic patients. Four patients (22.2%) had obstetric haemorrhage. Five others presented with the following: asthma, postoperative respiratory distress, cervical incompetence, gestational diabetes and hypertension, and caesarean section for terminal carcinoma of the breast. There were six deaths (mortality rate 33.3%). Preeclampsia/eclampsia accounted for four deaths (44% mortality rate amongst preeclamptics/eclamptics), while two deaths accounted for a 50% mortality rate in the obstetric haemorrhage group.<br>**CONCLUSION:** This study confirmed similar reports from the advanced nations and Asia that preeclampsia/eclampsia and obstetric haemorrhage are the leading causes of admission to the intensive care unit. The mortality rate in this study is however higher. | 10-<br>Score:ok<br>Very small sample! | |
| Zeeman, G., Wendel, G. & Cunningham, G. (2003) | 32 | USA | 483 critically ill peripartum women | Tertiary centre based prospective evaluation of all peripartal admissions to the Obstetric Intermediate Care Unit and obstetric admissions to the medical/surgical Intensive Care Unit from 1998-1999. Diagnosis at admission, dwell (verblijf) time and used procedures were collected and analysed. For a comparison of prevailing practises, they surveyed unit or division directors of other large tertiary obstetric services. Specifically they provide information regarding their plan for obstetrical care. | Prospective evaluation and analysis of OICU and M/S ICU obstetrical admissions (health care survey) | **OBJECTIVE:** The purpose of this study was to describe our 2-year experience with 483 critically ill peripartum<br>women and to propose a blueprint for obstetric critical care.<br>**RESULTS:** Almost two thirds of the women had obstetric complications that included pregnancy-associated hypertension and obstetric hemorrhage. Medical disorders were most common in the other one third of the women. At the **OICU** 80% were admitted postpartum, 20% during pregnancy. Mean length of stay was 18 hours. 34 women required transfer to the **M/S ICU**, 24 were transferred for mechanical ventilation. One maternal death occurred in a women with severe preeclampsia and massive intracranial haemorrhage.<br>Results of survey other tertiary centres (6), 3 | 1+<br>2+<br>3+<br>4?+/-<br>5+<br>6?<br>7-?<br>8+<br>9+/-<br>10-<br>Score:ok | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | reported having capability of full intensive services in labor delivery. Limited lengths of stay from 24h -1week. The other 3 units are identical to the OICU as described in the study<br>**CONCLUSION:** An Obstetric Intermediate Care Unit allows for the continuation of care by obstetricians and results in fewer transfers to medical/surgical intensive care units. Patient treatment depends on hospital size<br>and available resources. In most tertiary centers, the critically ill pregnant woman is best cared for by obstetricians in an Obstetric Intermediate Care Unit. In smaller hospitals, transfer to a medical or surgical intensive care unit may be preferable. | | |
| Afessa, B., Green, B., Delke, I. & Kock, K. (2001) | 33 | USA | 74 obstetric patients admitted to the ICU | Tertiary centre based retrospective review of 74 obstetric patients admitted to a multidisciplinary ICU from 1991-1998 to determine the incidence of SIRS and organ failure and to describe the outcomes of critically ill obstetric patients who have been treated in the medical ICU. Medical records of obstetric patients admitted to the medical ICU were reviewed on age, race, underlying chronic disease, duration of pregnancy on admission to the hospital, reason for medical ICU admission, pregnancy related and other medical diagnoses, use of mechanical ventilation and pulmonary artery catheters, length of medical ICU and hospital stay, development of ARDS, | Tertiary centre based retrospective analysis of obstetric ICU admissions (health care survey) | **OBJECTIVE:** to determine the incidence of systemic inflammatory response syndrome (SIRS) and organ failure and to describe the outcomes in critically ill obstetric patients who have been treated in medical ICU's.<br>**RESULTS:** 58% of the patients were admitted to the ICU postpartum, 42% antepartum. Mean age 25,9 years, 64% African American & 34% white. 50% had pre-existing medical conditions, APACHE II 14,0 & predicted mortality rate 17,6%. Most common reason for admission respiratory insufficiency. Preeclampsia in 36% of the patients, HELLP in 7%. SIRS developed in 59% of the patients, ARDS in 15%. Invasive mechanical ventilation was required in 45% & pulmonary arterial catheterization in 35%. In hospital mortality was 2,7%. There were 5 spontaneous abortions and 8 perinatal deaths.<br>**CONCLUSION:** The most common | 1+<br>2+<br>3+<br>4?nvt<br>5?<br>6+<br>7+<br>8+<br>9+<br>10-<br>Score:ok | 3 |

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| | | | | development of SIRS, development of organ failure, maternal morbidity and pregnancy loss. Acute physiology and chronic health evaluation (APACHE) II scores were calculated. | | reason for admission to the ICU of critically ill obstetric patients was respiratory failure. Despite the severity of illness and the development of SIRS and organ failure in most patients, the mortality rate was low. | | |
| Ryan, M., Hamiltin, V., Bowen, M. & McKenna, P. (2000) | 34 | Ireland | 123 patients admitted on the HDU of an regional obstetric centre (free standing maternity unit) | Regional obstetric hospital based retrospective review of on the one hand all records of all obstetric patients admitted to the HDU from 1996 to 1998 and on the other hand a retrospective analysis of medical charts relating to ICU admissions in a tertiary referral hospital from 1994 to 1998.<br>**Clinical information**: patients' characteristics, obstetric history, details of current pregnancy and relevant past medical history .<br>**HDU data**: indication for admission, length of stay, procedures performed and maternal-fetal outcomes<br>**ICU-data**: indication for transfer to ICU, length of stay, procedures performed and maternal-fetal outcomes<br>(Patient subdivision in ICU transfers before the start of the HDU) | Regional obstetric hospital based retrospective analysis of all hospital case notes and HDU/ICU registers from HDU admissions and medical charts from the referral ICU (health care survey) | **OBJECTIVE:** The aim of the study was to review a series of critically ill patients admitted to a high-dependency unit(HDU)in a regional obstetric centre, to assess the HDU utilisation rate and to determine the indications for and rate of transfer to an intensive care unit (ICU) in a tertiary referral centre of was performed. **RESULTS**: One hundred and twenty-three patients were admitted to the HDU in the 2 years following its inception, representing 1.02% of all deliveries. Obstetric complications accounted for 81.3% of admissions. Seventeen patients ere admitted to an ICU during the study period; 12 (0.08%) were transferred before and five (0.04%) after the development of HDU facilities (p . 0.25).<br>**CONCLUSIONS:** The advantages of a HDU within this setting include the concurrent availability of expert obstetric care and critical care management, the avoidance of the hazards of emergency transport and improved continuity of antenatal and postnatal care. | 1+<br>2+<br>3+<br>4+<br>5+<br>6+/-<br>7+<br>8+<br>9+<br>10-<br>Score:ok | 3 |
| Cordingley, J.J., Rubin, A.P. (1997) | 34 bis | UK | 232 consultant obstetric units | Retrospective review between June and November 1994 concerning a postal survey of all units in the UK providing obstetric recovery facilities, high dependency, intensive care and anaesthetic staffing. The questionnaires were addressed to the consultant | Retrospective nationwide health care survey of all UK units providing obstetric recovery facilities, high dependency and intensive care | **OBJECTIVE:** Reports on Confidential Enquiries into Maternal Deaths and the Obstetric Anaesthesits Association have made recommendations about the provision of staff and facilities in consultant obstetric units. This survey aimed to assess post-operative recovery, high dependency and intensive care facilities, monitoring | 1+<br>2+<br>3+<br>4+<br>5+/-<br>6+<br>7+/-<br>8+ | 3 |

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| | | | | anaesthetist but normally completed by a consultant responsible for obstetric anaesthesia. The researcher wanted, in succession of the recommendations in the Confidential Enquiries Mat. Death asses postoperative recovery, HD and IC facilities, monitoring equipment, blood banks and anaesthetic staffing. Results were reported in relation to their number of deliveries (small or large units) | | equipment, blood banks and anaesthetic staffing.<br>**RESULTS:** The results show that although many units had achieved recommended standards, this was not universal. In particular, only 62% had a designated and staffed recovery area, only 41% had specific obstetric high dependency beds and there were a number of units with no consultant anaesthetic sessions or trained anaesthetic assistants available around the clock..<br>**CONCLUSIONS:** Despite the practical and financial difficulties in achieving recommended standards, it should be noted that purchasers of health care have been encouraged to ensure that the recommendations are implemented. | 9?<br>10-<br>Score:ok | |
| Heinonen, S., Tyrvaïnen, E. Saarikoski, S. & Ruokonen, E. (2002) | 42 | Finland | 22 consecutive obstetric patients admitted to a mixed medical/surgical ICU | A retrospective cross-sectional study of intensive care admissions in Kuopio University Hospital from march 2003 to October 2000. Demographics, admitting diagnoses, APACHE II score, clinical outcomes and treatment costs were recorded. Women admitted to the ICU between 18 weeks pregnancy and 4 weeks postpartum were included. Each case requiring IC was classified according to the marker of severe acute maternal morbidity, the primary obstetric factor and any organ dysfunction or failure. Similarly information about length of stay in the ICU, specific interventions and overall outcome of all patients was recorded. TISS (therapeutic intervention scoring system) was used to do an | Retrospective tertiary based review of all obstetric patients treated on the ICU at Kuopio University Hospital | **OBJECTIVE:** The purpose of the study was to note potential obstetric risk factors leading to maternal intensive care and to estimate the frequency, costs and outcomes of management.<br>**RESULTS:** the overall need for maternal intensive care was 0,9 per 1000 deliveries during the study period. The mean age of the patients was 31,7 years and the APACHE score 10,8. The most common admission diagnoses were obstetric haemorrhage (73%) and pre-eclampsia-related complications (32%). The duration of ICU stay was 5,8 days and one of the 21 patients died in the ICU (4,5%). The total cost of IC was in order of 5000 US $ per patient.<br>**CONCLUSION**: Very few obstetric patients develop complications requiring intensive care. Although severel risk factors associated with maternal intensive care were documented, most cases occurred in low- | 1+<br>2+<br>3+<br>4?+/-<br>5+/-<br>6?<br>7?<br>8+<br>9+/-<br>10-<br>Score:ok | 3 |

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| | | | | economic analysis. | | risk women, which implies that the risk is relevant to all pregnancies. Long-term morbidity was rare, and collectively the outcome of intensive care was good. Further research is needed to determine effective approaches in prevention, such as uterine artery embolisation. | | |
| Baskett, T. & Sternadel, J. (1998) | 43 | Canada | 55 patients that required transfer for critical care and 2 maternal deaths | Retrospective review of all maternal deaths and any woman requiring transfer from the free-standing Grace Maternity Hospital in the two adjacent general hospitals (for critical care). Such cases were coded and retrieved through the hospital perinatal database. Complications necessitating transfer and the specialised consultants and services required were analysed over a period of 14 years (1980-1993). Women under 20 weeks of gestation were excluded from the study population. | Retrospective tertiary centred analysis of all maternal deaths and referrals to critical care. | **OBJECTIVE** To determine the level of near-miss maternal mortality and morbidity due to severe obstetric complications or maternal disease in a tertiary maternity hospital.<br>**RESULTS:** Over 14 years there were 76,119 women delivered with two maternal deaths (2-6/100,000).<br>Fifty-five women required transfer for critical care (0.7/1000). The main reasons for transfer were hypertensive disease (25%), haemorrhage (22%) and sepsis (1 *5%).*<br>Transfer to an intensive care unit was required by 80%, and the remainder were transferred to specialised medical or surgical units. Twenty different specialist groups were consulted. The *55* patients spent 280 days in critical care and 464 days hospital after-care (mean 13 days, range 3-92).<br>**CONCLUSION: A** review of near-miss maternal mortality helps delineate the continuing threats to<br>maternal health and the type of support services most commonly required. | 1+/-<br>2+<br>3+<br>4+/-<br>5+<br>6?<br>7?<br>8+<br>9+/-<br>10-<br>Score:+/- | 3 |

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| Umo-Etuk, J., Lumley, J. & Holdcroft, A. (1996) | 2 | UK | 43 ICU admissions | Retrospective analysis of medical records from parturient women admitted to the ICU of the Hammersmith Hospital, from 1989 to 1994. Patient's data were accepted for the study if 1. the admission was a direct result of pregnancy and its complications, 2. ICU admission occurred in the presence of a coincidental pregnancy, or 3. ICU admission was initiated by a medical problem which could have been aggravated by the physiological changes of pregnancy. Data collected included the patient's demographic details (age, gestational age, parity), past medical and obstetric history, ICU management (duration of 80 admission, use of invasive monitoring and inotropes, blood transfusion and special interventions), complications developing in the ICU and outcome (mortality, place of discharge). | Retrospective tertiary centre based analysis of medical records of parturient women admitted to the ICU | **OBJECTIVE**: To compliment the report on Confidential Enquiries into Maternal Deaths, an analysis of 5 years of obstetric data from a UK ICU was considered appropriate.<br>**RESULTS**: Thirty-nine parturient women were admitted to a general intensive care unit (ICU) from April 1989 to March 1994 and of these four were readmitted (total 43 admissions). Twelve women were admitted to the obstetric unit from peripheral hospitals in different regions, but no requirement for intensive care was perceived on referral. Six women were transferred directly into the intensive care unit from different hospitals in the region. The incidence of obstetric patients requiring ICU admission, excluding direct transfers, was 0.64%. The majority (85%) were postpartum, and 64% were primiparous. Morbidity was caused primarily by hypertensive disorders (33%) and haemorrhage (33%). The remainder included medical disorders (21%), sepsis (13%) and surgical problems (5%). Associated major complications were acute renal failure, coagulopathies and adult respiratory distress syndrome. A multidisciplinary approach to management is practised and specialist interventions included haemofiltration and haemodialysis (18%) and radiological arterial embolisation (10%). Ventilatory and inotropic support were given in 38% and 41% of patients respectively. Only one patient died on the intensive care unit, this was from multiorgan failure secondary to sepsis.<br>**CONCLUSION**: ? | 1+/-<br>2+<br>3+<br>4+/-<br>5+<br>6+/-<br>7?<br>8+<br>9+/-<br>10-<br>Score:+/- | 3 |
| Wheatley, E., Farkas, A. & Watson, D. (1996) | 3 | UK | 122 women admitted to an ITU | Retrospective analysis of the notes of obstetric patients admitted to an tertiary ITU at Homerton Hospital from 1989 to 1993. Relevant clinical data were abstracted for mother and baby. Indications for ITU admission, | Retrospective tertiary centre based analysis of notes of obstetric | **OBJECTIVE**: Complications of pregnancy may necessitate admission to an Intensive Therapy Unit (ITU). All obstetric patients admitted to ITU were reviewed in order to assess whether these admissions could have been<br>predicted and to determine the place of intensive care | 1+<br>2+<br>3+<br>4?<br>5+<br>6? | 3 |

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| | | | | interventions and clinical outcome were analysed. They examined whether admission could have been predicted and assess future requirements for intensive care and high dependency nursing. | patients admitted to the ITU | compared with high dependency nursing.<br>**RESULTS**: The majority of women (67%) had no pre-existing medical or obstetric history. The major indications for admission were hypertensive disease of pregnancy (66%) and haemorrhage (19%); 79% followed caesarean section and 40% required ventilatory support. The perinatal mortality rate was 6% and there were three maternal deaths.<br>**CONCLUSION**: The need for admission to ITU was unpredictable in two-thirds of the cases. Many of the women evaluated in this review were ineligible for high dependency care and required full ITU facilities, both of which will always be needed to deal with serious complications of pregnancy. | 7?<br>8+<br>9?<br>10-<br>Score:+/- | |
| Lapinsky, S., Kruczynski, K., Seaward, G., Farine, D. & Grossman, R. (1996) | 4 | Canada | 65 obstetric patients admitted to the ICU | A retrospective chart review was performed of obstetric patients admitted to the intensive care unit of an academic hospital with a **high-risk obstetric service (~MIC)**, during a five-year period (1990-1994). Data obtained included (i) clinical information: demographic data, obstetric history, details of the current pregnancy, past medical history and the presenting problem; (ii) ICU data: indication for ICU admission, length of stay and procedures performed;<br>(iii) laboratory data: on admission to ICU and during ICU stay; (iv) maternal and fetal outcome, and (v) daily APACHE II scores and Therapeutic Intervention Scoring System (TISS) scores. Patients were stratified further into two groups: those with a medical condition (Medical group) or an obstetric complication (Obstetric group), to | Retrospective tertiary centre based chart review of obstetric patients admitted to the ICU | **OBJECTIVE:** To review a series of critically ill obstetric patients admitted to a general intensive care unit in a Canadian centre, to assess the spectrum of diseases, interventions required and outcome.<br>**RESULTS**: Sixty-five obstetric patients, representing 0.26% of deliveries in this hospital, were admitted to the ICU during the study period. All had received prenatal care. Admission diagnoses included obstetric (71%) and nonobstetric (29%) complications. The mean APACHE II score was 6.8 ± 4.2 and mean TISS score was 24 ± 8.1. Twenty-seven patients (42%) required mechanical ventilation. No maternal mortality occurred and the perinatal mortality rate was ! 1 %.<br>**CONCLUSIONS**: A small proportion of obstetric patients develop complications requiring ICU admission. The outcome in this study was excellent, in contrast to that reported in other published studies with similar ICU admission rates. The universal availability of prenatal care may be an important factor in the outcome of this group of patients. The lack of a specific severity of illness scoring system for the pregnant patient makes comparison of case series difficult. | 1+<br>2+<br>3+<br>4+/-<br>5+<br>6?<br>7?<br>8+<br>9+/-<br>10-<br>Score:<br>ok | 3 |

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| | | | | assess the role of the precipitating condition on severity of illness scoring, ICU procedures and outcome. | | | | |
| Bewley, S. & Creighton, S. (1997) | 5 | UK | 30 obstetric transfers to the ITU | Retrospective review of all hospital records from 30 obstetric women transferred from University College Obstetric Hospital (UCU) to the intensive care unit (ITU) over a two-year period (1991-1992). Details of antecedent risk factors, labour and delivery, date and time of transfer, length of stay, principal reason for transfer, relevant subsidiary problems and interventions were recorded. | Retrospective tertiary centre based review of all hospital records of obstetric patients admitted to the ITU | **OBJECTIVE**: A near-miss maternal mortality enquiry was performed at University College Obstetric Hospital, London. **RESULTS**: The obstetric admission rate to ITU was 0´5 (95% CI 0´32±0´67%), or one per 200 women delivered. Haemorrhage and severe pre-eclampsia were the two commonest causes of admission. Sub-standard care was identified in 52% of cases. Blood loss was often massive (> 2000 ml), underestimated and required large volume transfusions (mean transfusion 6´4 units, range 1±24). Although there are problems with definitions, ascertainment and validity, ` near-miss' review is feasible. It is worthwhile for every hospital to carry out its own ` near-miss' enquiry using appropriate local criteria to identify potential areas for improvements. **CONCLUSIONS**: `Near-misses' are more prevalent than deaths and are dominated by conditions that are amenable to treatment. They may be even more sensitive to improvement or deterioration in obstetric services than mortality data. | 1+/-<br>2+<br>3+<br>4?<br>5?<br>6?<br>7?<br>8+<br>9+<br>10-<br>Score:+/- | 3 |
| Mahutte, N., Murphy-Kaulbeck, L., Le, Q., Solomon, J., Benjamin, A. & Boyd, M. (1999) | 6 | Canada | 131 obstetric ICU admissions | Retrospective analyse of all obstetric admissions to the ICU at two tertiary care centers (McGill University Hospitals) from 1991 to 1997. Data collected included maternal age, gestational age, pre-existing medical problems, diagnoses, the Acute Physiology and Chronic Health Evaluation II score, and specific interventions and outcomes in the ICU.11 The patients' critical illnesses (eg, hemorrhage) and the complications that prompted ICU | Retrospective tertiary centre based analysis of all obstetric admissions to the ICU | **OBJECTIVE** To determine whether obstetric admissions to the intensive care unit (ICU) are useful quality-assurance indicators. **RESULTS**: The 131 obstetric admissions represented 0.3% of all deliveries. The majority (78%) of women were admitted to the ICU postpartum. Obstetric hemorrhage (26%) and hypertension (21%) were the two most common reasons for admission. Together with cardiac disease, respiratory disorders, and infection, they accounted for more than 80% of all admissions. Preexisting medical conditions were present in 38% of all admissions. The median Acute Physiology and Chronic Health Evaluation II score was 8.5. The predicted | 1+<br>2+<br>3+<br>4?<br>5+/-<br>6?<br>7?<br>8+<br>9+/-<br>10-<br>Score:+/- | 3 |

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| | | | | admission were recorded separately. Complications prompting ICU admission were categorized as hemodynamic instability, respiratory compromise, or neurologic dysfunction. Disease cofactors such as adult respiratory distress syndrome; multiorgan failure; hemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome; and disseminated intravascular coagulation (DIC) were also examined. Length of time in the ICU, specific interventions, and outcomes were recorded. Mechanical ventilation, central and arterial monitoring, transfusion of blood products, and vasoactive infusions (eg, norepinephrine, dopamine) also were noted. | | mortality rate for the group was 10.0%, and the actual mortality rate was 2.3%.<br>**CONCLUSION**: The most common precipitants of ICU admission were obstetric hemorrhage and uncontrolled hypertension. Improved management strategies for these problems may significantly reduce major maternal morbidity.. | | |
| Cohen, J., Singer, P., Kogan, A., Hod, M, & Bar, J. (2000) | 7 | Israel | 46 obstetric patients admitted to the ICU | A retrospective case series study was performed including all pregnant patients admitted to an 8-bed general intensive care unit at a tertiary care university-affiliated hospital (Rabin Medical Centre) over a 4-year period (1994-1998). All patients referred by the obstetricians were admitted. The files of all patients were reviewed. Patients were divided into two groups: group 1, (*n*½19) those requiring mechanical ventilatory support and group 2, (*n*½27) those requiring intensive monitoring. Data collected included demographics, reason for admission, admission diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE II) and Therapeutic Intervention | Retrospective tertiary centre based case series study of all pregnant patients admitted to a general ICU | **OBJECTIVE:** To characterize the course, interventions required to achieve predetermined endpoints and outcome of obstetric patients admitted to a general intensive care unit.<br>**RESULTS:** Over the study period, 46 obstetric patients were admitted to the intensive care unit, representing 0.2% of all deliveries and an intensive care unit utilization rate of 2.3%. Commonest admission diagnoses were pregnancy-induced hypertension and hemorrhage. Reason for admission was mechanical ventilation in 41% while 59% were admitted for monitoring. Median length of stay was 25°80.9 (mean 48.8) hours. The median APACHE II score was 6°3.9 (mean 7.24) and the TISS score was .20 in both groups. Only one patient died (mortality rate 2.3%).<br>**CONCLUSION:** Despite a short length of stay and low APACHE score, the high TISS score in obstetric patients admitted for both ventilation and monitoring suggests that these patients require a level of | 1+<br>2+<br>3+<br>4+<br>5+<br>6?<br>7+<br>8+<br>9+/-<br>10-<br>Score:ok | 3 |

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| | | | | Scoring System (TISS) scores, intensive care unit course, types of interventions used and outcome. End-points of therapy included systolic blood pressure 110–150 mmHg, urine output ≥ 1 cc/kg/h and oxygen saturation > 95%. | | intervention and care typically provided by a general intensive care unit. | | |
| Panchal, S., Arria, A. & Harris, A. (2000) | 8 | USA (Maryland) | 1023 obstetric ICU admissions | A retrospective case-control analysis of state-maintained database of patient records (Uniform Health Discharge Data Set). The majority of the deliveries are included in the database, home and birthing centre births are not included. The data was collected for a 14 year period (1984-1997). The sampling frame included all patients with DRG (Diagnosis Related Grouping) codes from 370-375 discharged from a Maryland hospital. All patients admitted to the ICU sometime during hospital admission for childbirth were selected from the HSCRC database and defined as "cases." In addition, a "control," defined as a woman who was delivered of a neonate in the same year, but was not admitted to the ICU during hospital admission for delivery, was randomly selected for each case. Controls were randomly chosen for each of the 14 yr using Microsoft Access (Redmond, WA). Demographic variables included age, race, payment source, and marital status. Hospital variables included source of admission (home or another hospital) and hospital type (major teaching, minor teaching, or | Retrospective case control analysis of state-maintained database of patient records | **OBJECTIVE:** This study reports (1) ICU use and morality rates in a statewide population of obstetric patients during their hospital admission for childbirth, and *(2)* the risk factors associated with ICU admission and mortality.<br>**RESULTS*:*** Of the 822,591 hospital admissions for delivery of neonates during the study period, there were 1,023 ICU admissions (0.12%) and 34 ICU deaths (3.3O/o). Age, race, hospital type, volume of deliveries, and source of admission independently and in combination were associated with ICU admission ($P < 0.05$). The most common risk factors associated with ICU admission included cesarean section, preeclampsia or eclampsia, and postpartum hemorrhage *($P < 0.001$).* Black race, high hospital volume of deliveries, and longer duration of ICU stay were associated with ICU mortality *($P < 0.05$).* The most common risk factors associated with ICU mortality included pulmonary<br>**CONCLUSIONS:** This study shows that ICU use and mortality rate during hospital admission for delivery of a neonate is low. These results may influence the location of perinatal ICU services in the hospital setting. (Key words: Critically ill obstetric Patient; maternal morbidity; maternal mofiafiq-) patient records from a state-maintained anonymous database for the years 1984-1997 was used. Outcome variables included ICU use and mortality rates. | 1+<br>2+<br>3+<br>4+/-<br>5?<br>6?<br>7+<br>8+/-<br>9+<br>10?<br>Score: + | 3 |

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| | | | | community). | | | | |
| Quah, T., Chiu, J., Tan, K., Yeo, S. & Tan, H. (2001) | 9 | Singapore | 232 patients admitted to an dedicated (obstetric) ITU | A retrospective tertiary centre based casenotes study of all obstetric patients admitted to the ITU at the KK Women's and Children hospital from January 1998 to December 1999.The purpose of the study was to review all obstetric patients admitted to the ITU. The autors analysed the demographic profile of these admissions, the causes for admission, the type of invasive monitoring and intervention instituted and eventual outcomes. Diagnoses on admission to the ITU were categorised as: (1) pre-eclampsia/hypertension, (2) diabetes mellitus, (3) sepsis, (4) respiratory complications, (5) cardiovascular complications, (6) neurologic complications, (7) haemorrhage and (8) others. The need for invasive monitoring, vasoactive drug infusions and ventilatory support were also documented. | Retrospective tertiary based casenotes review of admissions to the obstetric ITU | **OBJECTIVE**: The aim of this study was to review all obstetric admissions to the ITU at the KK Women's and Children hospital from 1998 to 1999 with respect to the indications for admission, interventions, employed and clinical outcome.<br>**RESULTS:** There were 31.725 deliveries in our hospital during the study period of which there were 239 admissions to the ITU. Of these, 42% were Malays, 41% Chinese, 12% Indians and 5% other races. 65% stayed 1 day, 24% 2 days, 7% 3 days and 4% more than 3 days . The patients' ages ranged from 18 to 44 years. The indications for admission were hypertension (50%), haemorrhage (24%), respiratory insufficiency (10%), neurological problems (11%) and sepsis (3%). Intervention-wise, 43% of patients required vasoactive infusions, 35% had arterial line placements, 22% central venous pressure monitoring, 21% ventilatory support and 2% pulmonary artery catheter placement. The maternal mortality and stillbirth rates were 1,3% and 3,7% of ITU admissions, respectively.<br>**CONCLUSION:** The admission rate to the ITUI in the institution was 0,73%of all deliveries during the 2-year study-period. Hypertensive disease and haemorrhage were the predominant admitting diagnoses. | 1+<br>2+<br>3+<br>4+/-<br>5+/-<br>6?<br>7?<br>8+<br>9+<br>10?<br>Score:+/- | 3 |
| Loverro, G. et al (2001) | 10 | Italy | 41 patients transferred from the department of obstetrics and gynaecology to the ICU | A retrospective tertiary centre based review of women transferred from the department of obstetrics and gynaecology to the ICU of the university hospital of Bari. This study tries to identify the risk factors which required intensive care during puerperium and the outcome of the patients on the grounds of the criteria of admission. During a period of 11 years (1989-1998) patients transferred to the ICU were evaluated considering age, pre- | Retrospective tertiary based review of women transferred from the department of obstetrics and gynaecology to the ICU | **OBJECTIVE:** of this study was to identify risk factors and outcome of patients, which required intensive care during puerperium.<br>**RESULTS**: The overall incidence of admission into Intensive Care Unit was 0.17% (41/23.694) of deliveries. Indications for admission into ICU were: worsening of preeclampsia in 75.6% of cases, severe bleeding in 14.7% of cases, maternal cardiac disease stage III AHA in 4.9% of cases, pulmonary embolism and acute pulmonary oedema respectively in 2.4% of cases.<br>**CONCLUSIONS**: Transfer of patients to ICU due to hypovolemic postraumatic shock seems progressively declining thanks to modern criteria of obstetric | 1+/-<br>2+<br>3+<br>4+/-<br>5+/-<br>6?<br>7?<br>8+<br>9?<br>10?<br>Score:- | 3 |

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| | | | | existing diseases, gestational age, medical complication of pregnancy, mode of delivery, surgical additional procedure, fetal outcome, intrapartum transfusions, and puerperal complications. For each patient clinical and therapeutic aspects during Intensive Care recovery have been examined. | | management; on the contrary we assist to a prevalence of serious intrinsic maternal diseases often preexisting pregnancy or late consequence of preeclampsia, pulmonary embolism and sequelae of abnormal insertion of placenta. | | |
| Hazelgrove, J., Price, C., Pappachan, J. & Smith, G. (2001) | 11 | UK | 210 ICU admissions within 14 studied ICU's in Southern England | A retrospective **multi-center** (namely 14 general adult ICU's in Southern England) analysis of demographic, diagnostic, treatment and severity of illness data within the South West Thames Database. Both innercity and rural populations are represented in the database, only one hospital was a major teaching hospital. Each contributing hospital was visitied and case notes were examined to verify the data. Data of pregnant or postpartum admissions (<42 days) between, 1994 and 1996 was included. The group was identified using APACHE III, place of admission/discharge, and the names of the referring obstetrician | Retrospective multi-center analysis of the SWTD database and case notes of obstetric admissions to 14 general ICU's | **OBJECTIVE**: To identify pregnant and postpartum patients admitted to intensive care units (ICUs), the cause for their admission, and the proportion that might be appropriately managed in a high-dependency environment (HDU) by using an existing database. To estimate the goodness-of-fit for the Simplified Acute Physiology Score II, the Acute Physiology and Chronic Health Evaluation (APACHE) II, and the APACHE III scoring systems in the obstetrical population. **RESULTS**: We identified 210 patients, constituting 1.84% (210 of 11,385) of all ICU admissions and 0.17% (210 of 122,850) of all deliveries. Most admissions followed postpartum complications (hypertensive disease of pregnancy [39.5%] and major hemorrhage [33.3%]). Seven women were transferred to specialist ICUs. There was considerable variation between ICUs with respect to the number and type of interventions required by patients. Some 35.7% of patients stayed in ICU for <2 days and received no specific ICU interventions; these patients might have been safely managed in an HDU. There were seven maternal deaths (3.3%); fetal mortality rate was 20%. The area under the receiver operator characteristic curve and the standardized mortality ratio were 0.92 (confidence interval [CI], 0.85– 0.99) and 0.43 for the Simplified Acute Physiology Score II, 0.94 (CI, 0.86 –1.0) and 0.24 for APACHE II, and 0.98 (CI, 0.96 – 1.0) and 0.43 for APACHE III, respectively. **CONCLUSIONS**: Existing databases can both identify critically ill obstetrical patients and provide important information about them. Obstetrical ICU admissions | 1+<br>2+<br>3+<br>4+/-<br>5nvt<br>6?<br>7+<br>8+<br>9+/-<br>10-<br>Score:+ | 3 |

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| | | | | | | often require minimal intervention and are associated with low mortality rates. Many might be more appropriately managed in an HDU. The commonly used severity of illness scoring systems are good discriminators of outcome from intensive care admission in this group but may overestimate mortality rates. Severity of illness scoring systems may require modification in obstetrical patients to adjust for the normal physiologic responses to pregnancy. | | |
| Gilbert, T., Smulian, J., Martin, A., Ananth, C., Scorza, W. & Scardella, A. (2003) | 12 | USA (New Jersey) | 233 obstetric patients admitted to the medical ICU | A retrospective tertiary centre based analysis of the medical records of consecutive obstetric admissions to the medical ICU from 1991 to 1998. Two investigators reviewed the charts by the means of abstraction forms, the abstracted data included demographics, past medical history, prenatal history, delivery data, indications for ICU transfer, physiologic parameters SAPS II, ICU complications, hospital length of stay and death during hospitalization. Patients are grouped by antepartum or postpartum status and by admitting diagnosis. The SAPS is tested within an obstetric population. | Retrospective tertiary centre based analysis of obstetric admissions to the general ICU | **OBJECTIVE:** To determine whether mortality prediction based on a current model of outcome prediction is accurate in obstetric patients. **RESULTS:** The Simplified Acute Physiologic Score overestimated mortality in all patients (19 predicted deaths, eight observed) but accurately predicted mortality in patients admitted to the intensive care unit for medical reasons (seven predicted, five observed). The Simplified Acute Physiologic Score did not predict mortality in patients admitted for obstetric indications or postpartum hemorrhage. Median SAPS II scores were significantly higher in those patients who died, compared with survivors. For all groups, SAPS II scores were correlated with intensive care unit length of stay but not hospital length of stay. **CONCLUSION:** The Simplified Acute Physiologic Score accurately predicts hospital mortality in obstetric patients admitted to the intensive care unit for medical reasons but not for indications related to pregnancy and delivery. An alternate model that predicts outcomes in obstetric patients admitted for obstetric indications should be developed. | 1+<br>2+<br>3+<br>4+<br>5+<br>6+/-<br>7+<br>8+<br>9+/-<br>10-<br>Score:+ | 3 |
| Cheng, C. & Raman, S. (2002) | 13 | Singapore | 43 obstetric admissions to the surgical ICU | A retrospective tertiary centre based review of all obstetric admissions to the Surgical Intensive Care Unit of the Singapore General Hospital. Admission records were used to identify all patients admitted to the SICU from 1994 to 1999, either pregnant or in the immediate | Retrospective tertiary centre based analysis of obstetric admissions to the surgical ICU | **OBJECTIVE:** This study was performed in order to determine the obstetric complications occurring in a tertiary hospital in Singapore and review the outcome of the patients who were admitted to the intensive care unit. **RESULTS**: There were 43 obstetric admissions during this period, with 38 deliveries. This represents 0.32% of the deliveries in this hospital during the study period. | 1+/-<br>2+/-<br>3+<br>4+/-<br>5?<br>6?<br>7?<br>8+ | 3 |

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| | | | | puerperium (1 week). Information regarding reason for admission, duration of stay, associated complications, type of delivery, type of aesthetic and patient outcome were retrieved. | | The median duration of stay was three days (range 1–21). Haemorrhage and pregnancy-induced hypertension accounted for the majority of obstetric complications. Anaesthesia may have contributed to the admission of eight patients. Eight patients had more than one admission diagnosis. There were two deaths and one case of major morbidity (hypoxic encephalopathy) in this series. Prolonged ventilation and/or inotropic support were generally not required. **CONCLUSION:** In conclusion, approximately 3 per 1000 maternities require intensive care in this institution. The majority are discharged after a short stay with good outcome. | 9+/-<br>10-<br>Score: - | |
| Demirkiran, O., Dikmen, Y., Utku, T. & Urkmez, S. (2003) | 14 | Turkey | 125 obstetric patients admitted to the ICU | A retrospective tertiary centre based analysis of the records from obstetric patients who were admitted to the ICU for more than 24 hours, between 1995 and 2000. Following data was obtained: maternal age, gestational age, mode of delivery, presence of coexisting medical problems, duration of ICU stay, ICU admission diagnosis, specific intensive care interventions (mechanical ventilation, continuous veno-venous hemofiltration, central venous catheterization, arterial cannulation), ICU outcome and maternal mortality. APACHE II was used to measure severity of illness. | Retrospective tertiary centre based analysis of obstetric admissions to the multi-disciplinary ICU | **OBJECTIVE:** We aimed to determine the morbidity and mortality among obstetric patients admitted to the intensive care unit **RESULTS**: Obstetric patients (n=125) represented 2.64% of all intensive care unit admissions and 0.89% of all deliveries during the five-year period. The overall mortality of those admitted to the intensive care unit was 10.4%. Maternal age and gestation of newborns were similar in survivors and non-survivors. There were significant differences in length of stay and APACHE II score between survivors and non-survivors (P < 0,05). The commonest cause of intensive care unit admission was preeclampsia/eclampsia (73.6%) followed by post-partum hemorrhage (11.2%). **CONCLUSION**: Intensive care specialists should be familiar with these complications of pregnancy and should work closely with obstetricians. | 1+/-<br>2+/-<br>3+<br>4?<br>5+/-<br>6?<br>7+/-<br>8+<br>9+/-<br>10?<br>Score: +/- | 3 |
| Karnad, D., Lapsia, V., Krishnan, A., Salvi, V. (2004) | 15 | India | 453 women admitted to the multidisciplinary ICU during pregnancy and 6 weeks postpartum | A retrospective tertiary centre based analysis of the records of all patients admitted to the medico-neuro ICU of the King Edward Memorial Hospital, between 1997 and 2001. Age, previous obstetric history, weeks of gestation, pre-existing medical disorders and other medical or obstetric disorders developing during | Retrospective tertiary centre based analysis of obstetric admissions to the medical-neuro ICU | **OBJECTIVES:** Obstetric patients form a significant proportion of intensive care unit admissions in countries like India, where maternal mortality is high (440 per 100,000 deliveries). We studied the diseases requiring intensive care and prognostic factors in obstetric patients. **RESULTS**: Four hundred fifty-three obstetric patients, mean gestational age 31 wks) were admitted (548 intensive care unit admissions per 100,000 deliveries), | 1+/-<br>2+<br>3+<br>4+/-<br>5nvt<br>6?<br>7+<br>8+<br>9+/- | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | pregnancy were noted. Acute disorders leading to ICU admission were classified into medical and obstetric.<br>Outcome variables studied were maternal and fetal mortality rate and length of ICU stay | | 138 with single organ failure and 152 with multiple organ failure. Ninety-eight women died (mortality rate 21.6%). Mortality was comparable in antepartum (n =216) and postpartum (n =247) admissions but increased with increasing number of organs affected. There were 236 fetal deaths (52%), of which 104 occurred before hospital admission. Median APACHE II score was 16 (interquartile range, 10–24), and standardized mortality ratio (observed deaths/predicted deaths) was 0.78. Compared with pregnant patients admitted with obstetric disorders (n =313), those with medical diseases (n=140) had significantly lower APACHE II scores (median 14 vs. 17) but higher observed mortality rate (28.6% vs. 18.5%; odds ratio, 1.76; 95% confidence interval, 1.08 –2.87) and standardized mortality ratio (1.09 vs. 0.66). On multivariate analysis, increased mortality rate was associated with acute cardiovascular (odds ratio, 5.8), nervous system (odds ratio, 4.73) and respiratory (odds ratio, 12.9) failure, disseminated intravascular coagulation (odds ratio, 2.4), viral hepatitis (odds ratio, 5.8), intracranial hemorrhage (odds ratio, 5.4), absence of prenatal care (odds ratio, 1.94), and >24 hrs interval between onset of acute symptoms and intensive care unit admission (odds ratio, 2.3).<br>**CONCLUSIONS**: Multiple organ failure is common in obstetric patients; mortality rate increases with increasing organ failure. APACHE II scores overpredict mortality rate. Standardized mortality ratio is lower in obstetric disorders than in medical disorders. Lack of prenatal care and delay in intensive care unit referral adversely affect outcome and are easily preventable. | 10?<br>Score:+/- | |
| Mirghani, H., Hamed, M. & Weerasinghe, D. (2004) | 16 | United Arab Emirates | 60 obstetric patients admitted to the ICU | A retrospective tertiary centre based review of records and ICU sheets of all obstetric patients admitted to the ICU at the Al-Ain teaching hospital, between 1997 and 2002.<br>Data extracted included demographic data, diagnosis and reason for | Retrospective tertiary centre based analysis of obstetric admissions to the ICU | **OBJECTIVE:** this study aimed to identify indications, course and outcome of pregnancy-related admissions to the intensive care unit at Al-Ain hospital.<br>**RESULTS:** A total of 60 patients were admitted during the six years. The frequency of admission was 2.6 per 1000 deliveries and obstetric patients represented 2.4% of all ICU admissions. Admission was planned in 11 | 1+/-<br>2+<br>3+<br>4+/-<br>5?<br>6?<br>7+/- | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | admission, duration of stay in ICU, type of and indication for surgery, whether admission was planned or emergency, history of medical problems, gestational age, complications during pregnancy, mode of delivery and pregnancy outcome.<br>In this retrospective survey they aimed to identify indications, course and outcome of pregnancy-related admissions to the intensive care unit at Al-Ain hospital. | | patients (18%) and unplanned in 49 (82%). The mean (_SD) duration of stay in ICU was 1.6_1.5 days. The leading indications for admission were haemorrhage (28.4%) and preeclampsia/eclampsia (25%). Of the 60 admissions, 47 (78.4%) followed surgery. The mean APACHE II score was 5.0_3.0. Twenty-two patients (37%) had blood transfusions, and only two (3.3%) required ventilation. Of the 60 patients only 28 (46.7%) were deemed to have severe illness necessitating intensive care; the remaining 32 patients were suitable for high dependency care. The<br>mean APACHE II score and duration of stay were significantly higher in these patients. There were two deaths, representing 3.3% of obstetric intensive care unit admissions.<br>**CONCLUSIONS**: Our findings highlight the need for establishing a high dependency unit to avoid unnecessary admission to the intensive care unit and to ensure proper management. | 8+<br>9+/-<br>10?<br>Score:<br>+/- | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Selo-Ojeme, D., Omosaiye, M., Battacharjee, P. & Kadir, R. (2005) | 17 | UK | 33 obstetric ICU admissions | A tertiary based retrospective case control study of the hospital computer records of all obstetric admissions to the ICU at the Royal Free Hospital London over a 10 year period (1993 to 2003). For this study, admissions from 14 weeks' gestation up to 6 weeks postpartum were included. The women who delivered just before and after the indexed case were chosen as controls. The data collected included demographic data, pre-existing medical or surgical conditions, obstetric history, indications for, as well as the outcome of ICU admission. The duration of stay in the ICU, use of mechanical ventilation, and central and arterial monitoring were also noted.<br>The objective was to review all obstetric admissions to the intensive care unit (ICU) at the Royal Free Hospital, London, UK, and to identify the risk factors for obstetric admissions to the ICU | Retrospective tertiary based case control study of the obstetric ICU admissions | **OBJECTIVE** The objective was to review all obstetric admissions to the intensive care unit (ICU) at the Royal Free Hospital, London, UK, and to identify the risk factors for obstetric admissions to the ICU.<br>**RESULTS**: Thirty-three obstetric patients were admitted to the ICU, representing 0.11% of all deliveries. The ICU utilization rate was 0.81%. Eighty percent of the admissions were postpartum. The main indications for admission were hypertensive disorders (39.4%), and obstetric haemorrhage (36.4%). There was no difference between cases and controls in, age, parity, smoking and employment status. Compared with controls, women admitted to the ICU were significantly more likely to be black (P<0.05), have a shorter mean duration of pregnancy (36.6 vs. 39.2 weeks; P=0.006), delivered by emergency caesarean section (P<0.001), and have higher mean blood loss at delivery (1,173 vs. 296 ml; P<0.001). The risk factors for obstetric ICU admission were black race (odds ratio [OR] =2.8, 95% confidence interval [CI] 1.05–6.28), emergency caesarean section (OR=14.9, 95% CI 5.38–41.45) and primary postpartum haemorrhage (OR=5.4, 95% CI 1.79–4.35).<br>**CONCLUSION:** Women of black race, those delivered by emergency caesarean section and those with primary postpartum haemorrhage are more likely to be admitted to the ICU. | 1+<br>2+<br>3+<br>4+/-<br>5?<br>6?<br>7+/-<br>8+<br>9+/-<br>10?<br>Score:<br>+/- | 3 |

Levels of evidence
1a: Systematic review and meta-analysis of RCT´s
1b:Minimum 1 RCT
2a: Minimum 1 NRCT with a good design
2b: Minimum 1 other type of quasi-experimental research with a good design
3: Non-experimental descriptive research with a good design: comparative research, correlation studies, case-series
4: Reports of expertgroups, expert opinions, clinical experience of respected authorities

# APPENDIX CHAPTER 4

## ANNEX 1 : ORIGIN OF DATA

To realize this study, the Agence Intermutualiste (AIM) disposed of two types of data:

- Hospital bills of patients who were admitted to a maternity ward between 01/01/2003 and 31/12/2004; data on health care expenses between 01/01/2003 and 31/12/2005 were also provided.
- Invoices prescribed drugs, (Pharmanet database) from the selected patients from 01/01/2003 to 31/12/2005. Drugs concerned are those which are reimbursed by the social security scheme for salaried workers (self-employed excluded), prescribed to non hospitalized patients at the doctor's office (GP or any other specialty)

## ANNEX 2 : DATABASE CONSTRUCTION

The selection of provided health care (deliveries and miscarriages) was based on the following codes.

**Table 1 :Deliveries**

| Code nomencl. | Type of delivery | Care provider | Place of delivery | Moment of delivery |
|---|---|---|---|---|
| 422225 | vaginal delivery | midwife | Hospital stay | not specified |
| 422656 | vaginal delivery | midwife | Home* | weekday |
| 422671 | vaginal delivery | midwife | Day care | weekday |
| 423651 | vaginal delivery | midwife | Home* | WE or holiday |
| 423673 | vaginal delivery | midwife | Day care | WE or holiday |
| 423010 | vaginal delivery | medical doctor | Ambulatory** | not specified |
| 423021 | vaginal delivery | medical doctor | Hospital stay | not specified |
| 424012 | vaginal delivery | gynaecologist | Ambulatory** | not specified |
| 424023 | vaginal delivery | gynaecologist | Hospital stay | not specified |
| 424071 | with embryotomy | gynaecologist | Ambulatory** | not specified |
| 424082 | with embryotomy | gynaecologist | Hospital stay | not specified |
| 424093 | c-section | gynaecologist | Ambulatory** | not specified |
| 424104 | c-section | gynaecologist | Hospital stay | not specified |

* Home of the patients

** Home or day care

**Table 2 : Miscarriages**

| Code nomenclat. | Label | Place |
|---|---|---|
| 422516 | Follow up and care after miscarriage, from the 1st day following the miscarriage, per day with a maximum of 3 days | ambulatory |
| 422553 | Follow up and care after miscarriage provided the day of the miscarriage, weekday | ambulatory |
| 423555 | Follow up and care after miscarriage provided the day of the miscarriage, weekend or holiday | ambulatory |
| 424115 | Obstetrical intervention for miscarriage between 4 and 6 months provided the women had been a medical follow up during the 3rd month of pregnancy | ambulatory |
| 424126 | | Hospital stay |

# ANNEX 3 : MERGE OF AIM-IMA AND RCM-MKG DATABASES

**Table 3 : MKG/RCM : received files**

| Name of the RCM-file | 2003 | | 2004 | | Sum |
|---|---|---|---|---|---|
| | Class. Hospit. | Day Hosp. | Class. Hospit. | Day Hosp. | |
| File Patient : | 282.983 | | 304.035 | | |
| File Hospital stays : | 282.983 | 22.071 | 304.035 | 28.922 | |
| File Extra Stays : | 282.983 | 22.071 | 304.035 | 28.922 | |
| File Stay ./. Specialism : | 304.134 | 22.926 | 356.273 | 32.013 | 703.316 |
| File Stay ./. Bedindex : | 298.401 | 22.362 | 321.352 | 29.609 | 661.499 |
| File Stay ./. Care unit : | 353.744 | 23.304 | 396.699 | 32.204 | 792.992 |
| File Diagnose : | 797.271 | 45.432 | 895.235 | 68.251 | 1.772.110 |
| File ICD9 procedures : | 542.251 | 31.975 | 582.789 | 45.280 | 1.180.393 |
| File INAMI procedures : | 1.816.702 | 95.087 | 196.074 | 134.632 | 3.930.927 |
| File Newborn babies : | 119.369 | 944 | 120.819 | 779 | 239.583 |

**Table 4: Merging-preparation of MKG/RCM data**

| | 2003 | | 2004 | |
|---|---|---|---|---|
| | Class. Hospit. | Day Hosp. | Class. Hospit. | Day Hosp. |
| **1.1 Creation of a basic databank merging RCM data in *PATVERBIJF, STAYHOSP*** | 282.983 | 282.983 | 304.035 | 304.035 |
| **1.2 Neutralisations** | | | | |
| 1ste neutralisation : only classical hospitalisations | - 215 | - 279.499 | - 206 | - 298.096 |
| 2de neutralisation : only records with IDnumbers | - 90.788 | - 354 | - 106.496 | - 772 |
| | **191.980** | **3.130** | **197.333** | **5.167** |
| **1.3 Segmentation in 3 databanks (=denominator of pct linked records)** | | | | |
| *Records with age=0 --> Babies* | 59.700 | 1.177 | 59.119 | 474 |
| *Others records --> "Mothers"* | 132.280 | 1.953 | 138.215 | 4.693 |
| *Dubbles records of "mothers"* | 17.123 | 9 | 18.253 | 18 |

***Remark :***

Among the MKG/RCM hospital stays, many patients are admitted and discharged during the same month and week The majority of these stays appeared to be stays from the newborns or other children.

We created 3 new databases based on the age of the admitted patient:

- Newborns: when the age is zero, the patient was considered to be a newborn
- Mothers: the other stays were those of the mothers
- Doubles: stays with double records were kept in a separate database.

***Merging of data***

The first cycle of merging was based on IMA/AIM administrative data and health care invoices.

For some MKG/RCM data, one hospital admission corresponds up to 6 numbers of patients' identification. A merge was attempted for each ID.

The merging procedure was repeated on all three MKG/RCM databases, (newborns, mothers, and doubles). The merge of the doubles was done in order to differentiate between mothers and newborns because they have the same IMA/AIM ID if the baby was not admitted directly after the birth.

The first merge was realised on the exact match of the admission and discharge dates. However, these dates did not always correspond exactly.

A second merging attempt was made allowing for a difference of one day between the IMA/AIM and RCM-MKG dates.

**Table 5: Second merge**

| | 2003 | | 2004 | |
|---|---|---|---|---|
| | Class. Hospit. | Day Hosp. | Class. Hospit. | Day Hosp. |
| **1.4 Linking with IMA stays** | | | | |
| 1st link : "mothers" | 126.235 | 1.761 | 132.111 | 4.357 |
| | *95,4%* | *90,2%* | *95,6%* | *92,8%* |
| 2d link : babies | 49.348 | 1.077 | 49.244 | 429 |
| | *82,7%* | *91,5%* | *83,3%* | *90,5%* |
| 3d link : dubbles | 16.329 | 9 | 17.486 | 18 |
| | *95,4%* | *100,0%* | *95,8%* | *100,0%* |
| **1.5 Join of 3 databanks** | **175.672** | **2.842** | **181.466** | **4.799** |
| | ***92%*** | ***91%*** | ***92%*** | ***93%*** |
| 1.6 Rest of RCM unlinked stays | 16440 | 302 | 16033 | 388 |
| *Difference with source data )* | *132* | *14* | *166* | *20* |

# ANNEX 4 : SUMMARY

- Identification of newborns without ID

The goal of this manipulation was to find the ID of the non-merged newborns due to lack of a merging number at the first attempt.

**Table 6: Identification of newborns**

| | 2003 | | 2004 | |
|---|---|---|---|---|
| | Class. Hospit. | Day Hosp. | Class. Hospit. | Day Hosp. |
| Startfiles = files after first neutralisation | 282.768 | 3.484 | 303.829 | 5.939 |
| 2.1 Identification of babies (IDnumber=. and 0<=age<=1) | 80.042 | 227 | 86.390 | 240 |
| 2.2 Sum | | | | **166.899** |
| 2.3 Neutralisation of dubbles | | | | -467 |
| 2.4 Linking with "linked" mothers | | | | **130.584** |
| No "linked" mothers | | | | 35.848 |

**Table 7 : Construction of the databases**

| | | | | |
|---|---|---|---|---|
| **3.1 Join general databanks (cfr 1.5)** | | | | |
| (class hosp 2003 + day hosp 2003 + class hosp 2004 + | RCM-IMA | 364.779 | | |
| **3.2 Neutralisation of appeared dubbles** | | | | |
| 1. during the join (due to created var "opname_MKG" that | | | | |
| different was in classical hosp. and day hosp.) | RCM-IMA | 357.144 | | |
| 2. due to the join between RCM and IMA data | RCM-IMA | **356.900** | | |
| **3.3 Identification of 2 groups :** | | ***MOTHERS*** | ***BABIES*** | ***Rest*** |
| *Criteria* | RCM-IMA | *11<=age<=50* | *0<=age<=1* | *2=<age<=10 & age>51* |
| | | 244.339 | 111.319 | 1.242 |
| **3.4 Neutralisation of incoherent or missing values** | | | | |
| *sex* | RCM-IMA | -375 | -1.192 | *no defined sex* |
| *more than 2 deliveries per annum (n=8 women)* | RCM-IMA | *-12* | | |
| *not included in IMA population* | RCM-IMA | -5 | | |
| | | **243.947** | **110.127** | |
| **3.5** | RCM-IMA | | **+130.584** | **Addition of babies without ID (cfr 2.4)** |
| | RCM-IMA | | **240.711** | |

**Table 8 : Unmerged data**

| | | 2003 | | 2004 | |
|---|---|---|---|---|---|
| | | Class. Hospit. | Day Hosp. | Class. Hospit. | Day Hosp. |
| 4.1 Unlinked RCM data | RCM | 16.440 | 302 | 16.033 | 388 |
| 4.2 Sum | RCM | | | | 33.163 |
| 4.3 Neutralisation of dubbles | RCM | | | | -3 |
| | | | | | **33.160** |
| **4.4 Segmentation in 3 databanks** | | | | | |
| *11<=age<=50 --> Mothers* | RCM | | | | **11.035** |
| *0<=age<=1 --> Babies* | RCM | | | | **21.752** |
| *2=<age<=10 & age>51 --> Rest* | RCM | | | | 373 |

# ANNEX 5: ANALYSIS OF UNMERGED STAYS

## Unmerged stays of mothers

The analysis of women with some missing data (unmerged MKG/RCM stays) was carried out separately. Such cases represented only (3.9) % of the total dataset.

## Number of stays

4,622 MKG/RCM records of women could not be merged with IMA data, because of lack of IMA ID, lack of concordance between the dates of in-patient stays in the two datasets.

There were 113,845 merged in-patients stays, then the 4,622 unmerged stays represents 3.9% of the total number of stays. If we consider the in-patient stays for delivery only, there were 97.718 merged stays for delivery and 4,656 unmerged (2.6%). Here under, we limit the descriptive statistics to women who delivered to avoid duplicates (a same woman can appear in the dataset for several health episode without the possibility of linking those episodes).

## Characteristics of these stays

### *Maternal Age*

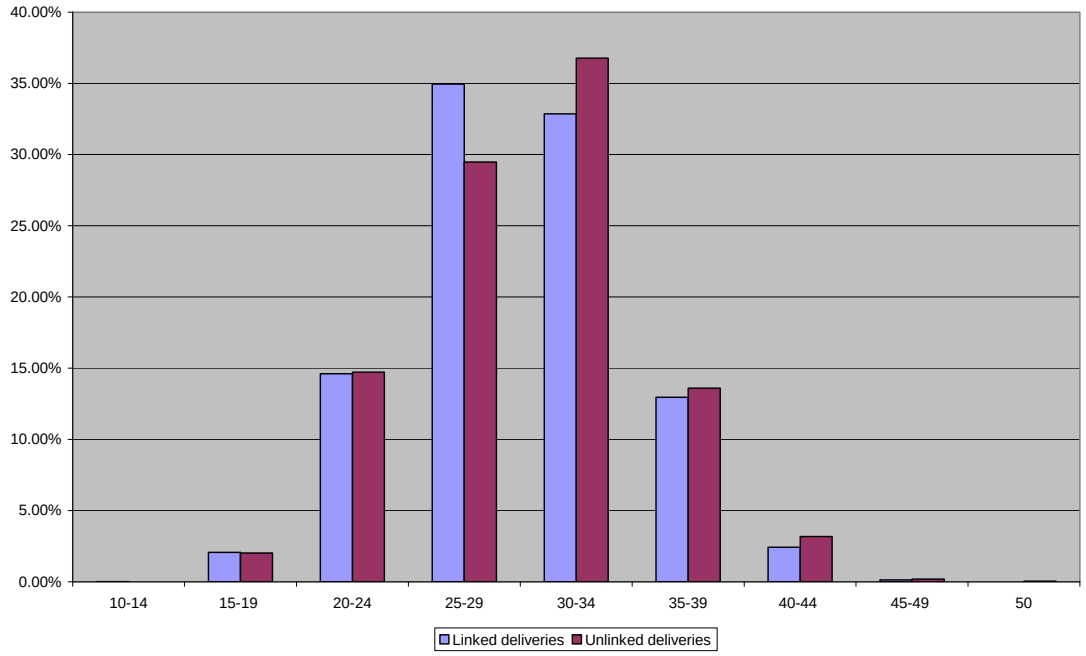
The mean age of women with unmerged stays is 29.8 years (median N= 30)

The mean age of women with merged stays is 29.4 years (median N= 29)

The age distribution graph of the 2 groups is shown in figure X.

The figure X shows that distributions differ, unmerged deliveries include more older women and less women between 25-29 years old (29.5 % against 35,0% in the merged stays).

**Figure 1: Age distribution of admitted women (unmerged and merged stays)**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *Socio - economic characteristics*

For the unmerged stays, these characteristics are not available.

### *Geographic distribution*

Table X shows that the geographical distribution of the stay of deliveries between regions and provinces differs between the merged and unmerged data.
In Brussels, the proportion of deliveries with unmerged stays is lower than the proportion of deliveries with merged stays, while in Antwerpen the proportion of unmerged stays seems quite high. At present, we do not have clear explanation for that finding. Exploratory investigations revealed that an hospital located in this province had none of his 798 merged. However, even after removal of that hospital, the proportion of unmerged stays in Antwerpen remained high.
Another high proportion of unmerged stays is found in the Luxembourg province (10.4% of the overall unmerged stays against 2.2% of the overall merged stays). Is this high proportion explained by the proximity of the border with Luxembourg (country) ?
The higher proportion of unknown place of residence among the unmerged stays is explained by the fact that the place of residence for these stays is established only by means of MKG/RCM data, without the possibility of using IMA/AIM data for substituting the missing data .

**Table 9: Geographic distribution of deliveries according to INS code of residence (unmerged and merged stays)**

| All deliveries | | Unlinked deliveries | | Linked deliveries | | |
|---|---|---|---|---|---|---|
| **Region** | **Province** | Number of stays | Proportion | Number of stays | Proportion | **Total number of deliveries** |
| **Région Bruxelles-Capitale** | | **220** | **8.22%** | 12,412 | **12.70%** | 12,632 |
| **Vlaams gewest** | Antwerpen | 710 | 26.53% | 15,370 | 15.73% | 16,080 |
| | Vlaams Brabant | 257 | 9.60% | 9,066 | 9.28% | 9,323 |
| | West Vlaanderen | 112 | 4.19% | 9,712 | 9.94% | 9,824 |
| | Oost Vlaanderen | 164 | 6.13% | 12,235 | 12.52% | 12,399 |
| | Limburg | 172 | 6.43% | 7,002 | 7.17% | 7,174 |
| | ***Total*** | **1,415** | **52.88%** | 53,385 | **54.63%** | 54,800 |
| **Région Wallonne** | Brabant Wallon | 44 | 1.64% | 2,512 | 2.57% | 2,556 |
| | Hainaut | 157 | 5.87% | 12,845 | 13.14% | 13,002 |
| | Liège | 208 | 7.77% | 9,699 | 9.93% | 9,907 |
| | Luxembourg | 366 | 13.68% | 2,129 | 2.18% | 2,495 |
| | Namur | 46 | 1.72% | 4,352 | 4.45% | 4,398 |
| | ***Total*** | **821** | **30.68%** | 31,537 | **32.27%** | 32,358 |
| *Unknown* | | *220* | *8.22%* | *384* | *0.39%* | 604 |
| **Belgium** | | **2,676** | **100.00%** | **97,718** | **100.00%** | **100,394** |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *Mode of deliveries*

Based on the APR-DRG [jjj] attributed to the in-patient (N = 4,622 stays), 2.094 pregnancies ended in a vaginal delivery, 582 (21.7 %) in a caesarean section, 76 in a miscarriage (<22 weeks[kkk]) and 1.870 with other APR-DRG.

Then among these 4,622 unmerged stays only 59.6% (2,656) are stays of delivery.

The proportion of c-section among unmerged stays (21.7%) is higher than the proportion of 18.6% observed for the merged stays.

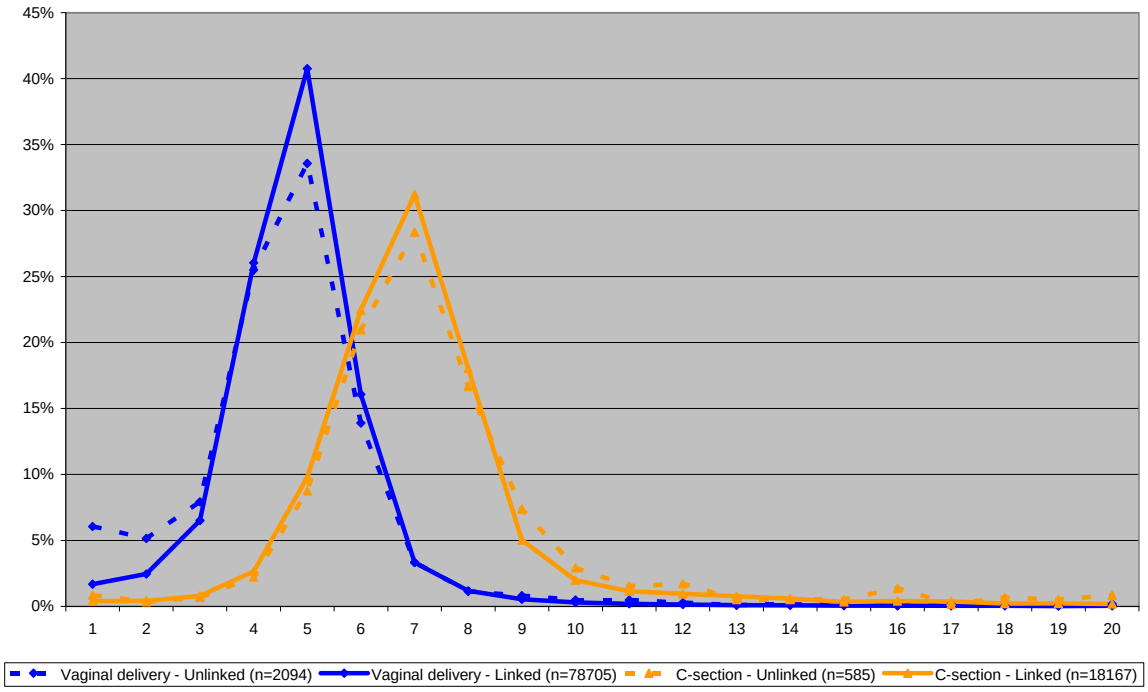
[jjj] Stays are not merged with IMA data and then nomenclature codes are not available.
[kkk] See methodology database building

### *Duration of hospitalisation for delivery*

For the unmerged stays, the mean length of stay for a vaginal delivery is 4.8 days (P10= 2 days; P50=5 days; P90= 6 days). The mean LoS for a caesarean delivery is 8.2 days (P10= 5 days; P50= 7 days; P90=11 days).

These LoS differ slightly from those computed for the merged stays as shown in graph XX. For the unmerged stays, the higher number of stays with low LoS is also translated into a P10 = 2 lower than P10 = 3 for the merged stays. The higher number of stays with longer LoS for the c-section is described by a difference in P90 = 11 days for the unmerged stays and P90 = 9 days for the merged stays.

**Figure 2: Length of stay by mode of delivery (merged and unmerged stays)**




Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *Ante-and postpartum hospitalisations*

This information is not available for unmerged stays; the link between different stays of the same women in different institution can not be done without IMA/AIM information.

## *Ten most frequent ICD-9-CM codes by mode of delivery*

As mentioned in the methodology section, each woman has only one main diagnosis per specialty, but can have more than one secondary diagnosis.
Among unmerged stays, 55.26% have more than one secondary diagnosis against 48.9% for the merged stays.
The detailed frequencies of these codes are presented in the tables underneath.
These tables give an overview of the coded pathologies.

**Table10: 10 most frequent ICD-9-CM codes Vaginal delivery (N=2.094) - Main diagnosis - Specialty 1[III]**

| Naming of icd9 | icd9 | Number | Proportion | Linked data |
|---|---|---|---|---|
| Delivery in a completely normal case | 650 | 520 | 24.83% | 22.82% |
| First-degree perineal laceration during delivery | 66401 | 184 | 8.79% | 6.20% |
| Early onset of delivery | 64421 | 131 | 6.26% | 2.54% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 86 | 4.11% | 5.16% |
| Other & unspecified cord entanglement, without mention of compression, complicating | 66331 | 67 | 3.20% | 2.50% |
| Cord around neck, with compression, complicating labor & delivery | 66311 | 38 | 1.81% | 2.07% |
| Forceps or vacuum extractor delivery without mention of indication | 66951 | 38 | 1.81% | 2.19% |
| Second-degree perineal laceration during delivery | 66411 | 36 | 1.72% | 2.25% |
| Fetal distress | 65631 | 34 | 1.62% | 2.00% |
| Infections of genitourinary tract in pregnancy | 64661 | 28 | 1.34% | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

In diagnostic 1 for vaginal delivery in unmerged stays, Table ?? shows that some differences exist between the proportion of ICD-9 coded in unmerged and merged stays, but most difference are small and ICD-9 being largely unspecific, the clinical signification is not straightforward.

**Table 11: 10 most frequent ICD-9-CM codes Vaginal delivery (N=2.094) - Secondary diagnoses – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion | Linked data |
|---|---|---|---|---|
| First-degree perineal laceration during delivery | 66401 | 96 | 4.58% | 4.18% |
| Acute myocardial infarction of inferolateral wall | 4102 | 88 | 4.20% | 4.05% |
| Other & unspecified cord entanglement, without mention of compression, complicating | 66331 | 60 | 2.87% | 2.94% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 57 | 2.72% | 2.76% |
| Tobacco use disorder | 3051 | 52 | 2.48% | 2.53% |
| Early onset of delivery | 64421 | 48 | 2.29% | |
| Other current conditions classifiable elsewhere | 64891 | 41 | 1.96% | 1.94% |
| Infections of genitourinary tract in pregnancy | 64661 | 40 | 1.91% | |
| Vaginitis and vulvovaginitis, unspecified | 61610 | 39 | 1.86% | |
| Anemia | 64822 | 38 | 1.81% | 2.65% |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

[III] Information from the doctor who manages the medical file (specialist nr 1)

**Table 12: 10 most frequent ICD-9-CM codes C-section (N=582) - Main diagnosis – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion | Linked data |
|---|---|---|---|---|
| Breech presentation without mention of version | 65221 | 59 | 10.14% | 10.12% |
| Generally contracted pelvis | 65311 | 41 | 7.04% | |
| Uterine scar from previous surgery complicating pregnancy, childbirth, or the | 65421 | 39 | 6.70% | 10.89% |
| Obstruction caused by malposition of fetus at onset of labor | 66001 | 30 | 5.15% | 6.55% |
| Early onset of delivery | 64421 | 29 | 4.98% | 2.30% |
| Obstruction by bony pelvis | 66011 | 26 | 4.47% | 5.91% |
| Mild or unspecified pre-eclampsia | 64241 | 20 | 3.44% | |
| Fetal distress | 65631 | 20 | 3.44% | 5.03% |
| Cesarean delivery, without mention of indication | 66971 | 19 | 3.26% | 4.93% |
| Twin pregnancy | 65101 | 14 | 2.41% | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

**Table13: 10 most frequent ICD-9-CM codes C-section (N=582) - Secondary diagnosis – Specialty 1**

| Naming of icd9 | icd9 | Number | Proportion | Linked data |
|---|---|---|---|---|
| Early onset of delivery | 64421 | 77 | 13.23% | 7.17% |
| Uterine scar from previous surgery complicating pregnancy, childbirth, or the | 65421 | 58 | 9.97% | 12.26% |
| Breech presentation without mention of version | 65221 | 49 | 8.42% | 8.68% |
| Fetal distress | 65631 | 36 | 6.19% | 5.27% |
| Prolonged pregnancy, unspecified as to episode of care | 64511 | 25 | 4.30% | 3.89% |
| Poor fetal growth | 65651 | 25 | 4.30% | |
| Fetopelvic disproportion | 65341 | 24 | 4.12% | 5.65% |
| Anemia | 64821 | 21 | 3.61% | |
| Tobacco use disorder | 3051 | 20 | 3.44% | |
| Anemia | 64891 | 19 | 3.26% | |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

### *Transfers*

This information is not available for unmerged stays. The transfers for the merged stays have been computed from information form MKG/RCM and IMA/AIM data.

### *Maternal mortality*

Among the 4.622 unmerged stays, 2 women died during the in-patient stay.

The first women was 28 years old, she had an APR-DRG 564 (Abortion without dilatation, curettage or hysterotomy)

The second women aged 43 had an APR-DRG 540 (c-section delivery).

This rate of 2 maternal deaths for 4.622 stays (2.656 deliveries) is very high.

### *Type of maternities*

Among the unmerged stays, 21.8% (1,008) are in-patients stays in maternities with MIC-services. 27.8% of the merged stays occurred in maternities with MIC.

Table !! shows the repartition of unmerged stays among maternities with MIC-services.

**Table 14: Repartition of unmerged stays among maternities with MIC-services**

| Hospitals | ID Hospital | Nbre of women | Nber of unmerged | Proportion of unmerged |
|---|---|---|---|---|
| UZ Gent | 670 | 821 | 70 | 8.5 |
| U.I.A | 300 | 821 | 61 | 7.4 |
| UCL | 403 | 1267 | 67 | 5.3 |
| ZOL | 371 | 1733 | 88 | 5.1 |
| KUL | 322 | 2031 | 86 | 4.2 |
| Erasme | 406 | 1509 | 61 | 4.0 |
| CHU St Pierre | 76 | 1728 | 65 | 3.8 |
| CH La Citadelle | 412 | 1929 | 72 | 3.7 |
| CH St Vincent et Ste Elisabeth | 158 | 3368 | 117 | 3.5 |
| Edith Cavell | 332 | 2248 | 72 | 3.2 |
| AZ St Jan | 49 | 1004 | 32 | 3.2 |
| VUB | 143 | 1573 | 43 | 2.7 |
| CH Notre Dame / Reine Fabiola | 27 | 1684 | 43 | 2.6 |
| AZ Middelheim | 9 | 1241 | 31 | 2.5 |
| CHU Brugmann + hôpital des enfants | 77 | 1437 | 35 | 2.4 |
| CHU Tivoli | 96 | 1099 | 26 | 2.4 |
| AZ St Augustinus | 99 | 2498 | 39 | 1.6 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

For the non MIC maternities, the number of unmerged stays varies from 2 to 80 with the following exceptions: Algemene ziekenhuis St Maarten (ID 26) that has 798 (100%) of his stays unmerged; Clinique du Sud Luxembourg (ID 246) that has 293 unmerged stays; Gezondheidzorg centrum Oostkust (ID 393) 107 unmerged stays; Ziekenhuis Oost-Limburg (ID 371) 88 stays.

*Classification of women with the indications list*

The methodology used to classify the women with merged stays into the intermediate care, 'grey zone' or standard care group could not be exactly reproduced with unmerged stays.

Indeed, with unmerged stays, information about former in-patient stays, ambulatory drugs are lacking. As explained in the methodology of the list building, to refine some ICD-9-codes the LoS before delivery was taken into account; to refine other ICD-9 for asthma, long term use of oral corticoids was taken into account.

The indication list with only ICD-9 codes classified 2,786 stays (60.3%) in standard care, 1,372 (29.7% in 'grey zone' and 464 (10.0%) in Intermediate care.

Compared to the merged stay database, the proportion of women in 'Standard care group' is higher in unmerged stays (60.3% versus 55.9%) and in 'Intermediate care' (10.0% versus 9.6%). The difference in 'Intermediate care' is very slight.
The proportion of women in Grey zone is lower (29.7% versus 33.7%).

When we select only the in-patients stays for deliveries, the proportion of intermediate care stays is 9.4% for unlinked stays versus 9.6% for linked stays.

# UNMERGED STAYS OF NEWBORN BABIES

## Number of stays

Between 01/10/2003 and 30/09/2004, a total of 21,646 MKG-RCM records of neonates could not be merged with the data of their mother. This high proportion (18.0%) of unlinked stays is explained by the structure of the data.

For most of these neonates, there is no separate bill issued. The only way to link the stay of the newborn is through his mother. The MKG-RCM number of the mother should be registered on the MKG-RCM record of her baby.

Nevertheless, among the non merged newborn stays, 68% do not possess the MKG-RCM number of the mother.
In more than 97% of these unmerged stays, the IMA identification number of the mother is missing, in 1% the IMA ID of the newborn is missing, and in 37% both ID are missing.

## Characteristics of these stays

The specific information about the location of the birth indicates that 13.9% (N= 3,004) of the neonates with an unmerged file were transferred from another hospital and 101 (0.5%) neonates were transferred from ambulatory care, while these figures were much lower for the merged stays (0.02% (N= 18) and 0.03% (N = 33), respectively). So, most of the babies transfers resulted in unmerged files. The transfers and readmission in other hospitals can not be followed up because an individual IMA/AIM ID is issued for the baby after his transfer, hampering linkage with information of the first stay (where maternal IMA/AIM ID was used). This also hampers computation of an accurate transfer rate.

Table X shows the absolute figures and the differences in proportion between characteristics of newborn babies from merged and unmerged stays.

The in-patient mortality, the proportion of multiple pregnancies, the proportion of low birth weight babies, the proportion of premature babies, the proportion of babies staying in NIC-services are higher among unmerged stays[mmm].

The fact that the transferred newborns are included in the unmerged stays most probably explained the difference observed between the characteristics of the newborn from merged and unmerged in-patient stays.

[mmm] All differences between merged and unmerged measured by chi-square tests are statistically significant but effect size measured by Cramer's V or the phi coefficient were close to 0 indicating a weak relationship between the 2 factors.

The analyse of the 3.004 babies born in another hospital showed that 79.1% of them were admitted in a NIC department; 33.6% had a low birth weight; 37.5% were premature; 8.7% were issued from twin pregnancies; 3.5 died during the in-patient stay.

**Table 15: General data merged and unmerged stays newborns**

| | Merged stays | | Unmerged stays | |
|---|---|---|---|---|
| Status | N | Proportion | N | Proportion |
| born alive | 97,617 | 99.4 | 21,387 | 98.8 |
| Still born | 433 | 0.4 | 94 | 0.4 |
| Died during hospital stay | 181 | 0.2 | 147 | 0.7 |
| Type of pregnancy | N | Proportion | N | Proportion |
| single | 94,490 | 96.2 | 19,825 | 91.6 |
| twins | 3,220 | 3.3 | 872 | 4.0 |
| multiple (more than 2) | 76 | 0.1 | 24 | 0.1 |
| missing data | 21 | 0.0 | 831 | 3.8 |
| Birth weight | N | Proportion | N | Proportion |
| 500 - 999 : Extreme low birth weight ELBW | 444 | 0.5 | 126 | 0.6 |
| 1000 - 1499 : Very low birth weight VLBW | 630 | 0.6 | 336 | 1.6 |
| 1500 - 2499 : Low birth weight LBW | 6,104 | 6.2 | 2,007 | 9.3 |
| 2500 - 3999 : Normal birth weight NBW | 83,748 | 85.3 | 17,516 | 80.9 |
| >=4000 : High birth weight HBW | 7,235 | 7.4 | 1,463 | 6.8 |
| Missing information | 79 | 0.1 | 198 | 0.9 |
| Gestational age | N | Proportion | N | Proportion |
| 22-28 : Extreme prematurity | 563 | 0.6 | 184 | 0.9 |
| 29-32 : Very preterm | 995 | 1.0 | 569 | 2.6 |
| 33-36 : Preterm delivery | 6,558 | 6.7 | 2,110 | 9.8 |
| 37-42 : Term delivery | 90,099 | 91.7 | 18,530 | 85.6 |
| >=42 : Prolonged pregnancy | 9 | 0.0 | 4 | 0.0 |
| missing information | 16 | 0.0 | 249 | 1.2 |
| **Apgar score at 1 min** | N | Proportion | N | Proportion |

| | | | | |
|---|---|---|---|---|
| 0-3 | 2,156 | 2.2 | 810 | 3.7 |
| 4-6 | 5,538 | 5.6 | 1,454 | 6.7 |
| 7-10 | 90,535 | 92.2 | 18,940 | 87.5 |
| **Apgar score at 5 min** | N | Proportion | N | Proportion |
| 0-3 | 741 | 0.8 | 329 | 1.5 |
| 4-6 | 1,194 | 1.2 | 489 | 2.3 |
| 7-10 | 96,291 | 98.0 | 20,379 | 94.2 |
| **Stay in a Nic department** | N | Proportion | N | Proportion |
| No | 94,066 | 95.8 | 19,098 | 88.2 |
| Yes | 4,174 | 4.3 | 2,548 | 11.8 |
| **Stay in a N* department** | N | Proportion | N | Proportion |
| No | 81,172 | 82.6 | 17,788 | 82.2 |
| Yes | 17,068 | 17.4 | 3,858 | 17.8 |
| **All** | 98,240 | 100.0 | 21,646 | 100.0 |

Source: Merged IMA and MKG/RCM Data 01/10/2003 – 30/09/2004

## KEY MESSAGES

- **Unmerged stays represented only (3.9) % of the total dataset. The proportion of unmerged files varies by province.**
- **Differences are negligible between merged and unmerged stay as far as maternal characteristics are concerned.**
- **Globally, the differences between merged and unmerged stays were also small as regards newborn parameters. However, 13.9 % (n=3004) of babies with an unmerged file had been transfered from another hospital. So, most of the babies transfers resulted in unmerged files.These 3004 babies were significantly different from other babies with or without a merged file: 79.1% babies were admitted in a NIC department ; 33.6% had a low birth weight; 37.5% were premature; 8.7% were issued from twin pregnancies; 3.5 died during the in-patient stay.**

# UNMERGED STAYS IN MIC-SERVICES

**Table 16: Unmerged stays in MIC-services**

| Delivery stays - Intermediare care | | | Unlinked delivery stays | Linked delivery stays | | |
|---|---|---|---|---|---|---|
| ERK | Maternities with MIC beds | Number of MIC beds | Number of unlinked IC delivery stays | Number of linked IC delivery stays | Total | IC deliveries/MIC bed |
| 158 | CH St Vincent et Ste Elisabeth | 16 | 10 | 536 | 546 | 34.1 |
| 322 | KUL | 20 | 5 | 331 | 336 | 16.8 |
| 412 | CH La Citadelle | 8 | 8 | 271 | 279 | 34.9 |
| 99 | AZ St Augustinus | 8 | 3 | 269 | 272 | 34.0 |
| 143 | VUB | 8 | 6 | 257 | 263 | 32.9 |
| 332 | Edith Cavell | 8 | 7 | 251 | 258 | 32.3 |
| 371 | ZOL | 8 | 8 | 241 | 249 | 31.1 |
| 77 | CHU Brugmann + hôpital des enfants | 9 | 7 | 233 | 240 | 26.7 |
| 403 | UCL | 16 | 8 | 227 | 235 | 14.7 |
| 76 | CHU St Pierre | 15 | 4 | 220 | 224 | 14.9 |
| 96 | CHU Tivoli | 8 | 3 | 190 | 193 | 24.1 |
| 27 | CH Notre Dame / Reine Fabiola | 8 | 1 | 174 | 175 | 21.9 |
| 300 | U.I.A | 8 | 16 | 154 | 170 | 21.3 |
| 406 | Erasme | 8 | 4 | 155 | 159 | 19.9 |
| 670 | UZ Gent | 8 | 6 | 137 | 143 | 17.9 |
| 49 | AZ St Jan | 8 | 4 | 85 | 89 | 11.1 |
| 9 | AZ Middelheim | 8 | 2 | 77 | 79 | 9.9 |
| | **Total** | **172** | 102 | 3808 | 3910 | 22.7 |

# APPENDIX CHAPTER 5

## ANNEX 1 : LIST OF INDICATIONS MIC-ADMISSION UZGENT APRIL 2007

**MIC – INDICATIES 04/2007**

**1. LIJST VAN PATHOLOGIEËN WELKE DIENEN TE WORDEN OPGENOMEN OP EEN MIC-AFDELING :**

***a. Niet-zwangerschapsgerelateerde pathologie***

(1) Endocrinologische aandoeningen :

- schildklierpathologie met positieve schildklierantistoffen
- elke diabetes waarvoor insulinetherapie
- elke afwijking door endocrinoloog als hoogrisico benoemd

(2) Nefrologische aandoeningen

- nierinsufficiëntie met creatinine >1.5 mg/dl
- transplantnier
- elke afwijking door nefroloog als hoogrisico benoemd

(3) Cardiovasculaire aandoeningen

- maligne essentiële hypertensie (met weerslag op andere organen)
- pulmonale hypertensie (vb. Eisenmenger syndroom)
- cardiomyopathieën (alle types)
- pathologie van grote en/of intracraniële vaten
- risicopatiënten voor aneurysma aortae : - Marfan – Ehlers-Danlos
  - bicuspiede aortaklep
  - coarcatio aortae
- kleplijden : - symptomatische MKstenose (NYHA II > IV)
  - ernstige AoKstenose (Ao jet ≥ 4m/s) met of zonder symptomen
  - AoK- of MKregurgitatie (NYHA III>IV)
  - ieder kleplijden resulterend in - ernstige LVdysfunctie (EF<40%)
    - pulmonale hypertensie
  - M Marfan met of zonder aortaklepinsufficiëntie
  - kunstklep waarvoor anticoagulantia
- elke afwijking door cardioloog als hoogrisico benoemd

(4) Infectieuze aandoeningen (onafhankelijk van de zwangerschapsduur)

- actieve TBC
- HIV

- Varicella
- acute hepatitis
- acute pancreatitis
- pyelonefritis
- pneumonie
- (vermoeden van) appendicitis
- elke ernstige infectie en/of sepsis

(5) Pulmonale aandoeningen

- respiratoire insufficiëntie

(normaalwaarden $PaO_2$ 75-100 mmHg – $PaCO_2$ 35-45mmHg – $SaO_2$ 94-100mmHg)

- astma bronchiale : opstoot of patiente onder perorale onderhoudstherapie

(6) Auto-immuunziekten

- antifosfolipiden syndroom
- SLE
- ernstige M Crohn / colitis ulcerosa

(7) Bindweefselaandoeningen

- M Marfan
- M Ehlers-Danlos

(8) Skeletale aandoeningen

- osteogenesis imperfecta

(9) Neuromusculaire aandoeningen

- myasthenia gravis
- M Steinert
- Amyotrofe Laterale Sclerose
- multiple sclerose
- hemi-/para-/tetraplegie
- spina bifida

(10) Hematologische aandoeningen

- homozygote hemoglobinopathieën
- stollingsafwijkingen : - TTP
  - ITP
  - f X (von Willebrandt)
  - Hemofilie A-B
  - M Werlhof
- aandoeningen met verhoogd tromboserisico - antifosfolipidensyndroom

- proteine C deficiente
- proteine S deficientie
- f V Leiden mutatie
- antitrombine III deficientie
- protrombine genmutatie

(11) Actieve oncologische aandoeningen

(12) Socio-economische problematiek
- alcohol-/drugabusus
- mishandeling
- Female Genital Mutilation type III (infibulatie)

(13) Rechtstreeks buiktrauma vanaf 24w

(14) Psychiatrische aandoeningen in het ante- of postpartum waarvoor opname is vereist

***b.Zwangerschapsgerelateerde pathologie***

- (vermoeden van) ernstige foetale afwijking waarbij vroege neonatale behandeling aangewezen is
- zwangerschapsinterruptie wegens zware foetale pathologie
- opname en/of partus bij mors in utero
- hyperemesis gravidarum waarbij - daling van lichaamsgewicht ≥ 5%
  en/of - elektrolytstoornissen
  en/of - ketonurie ≥ +++
  en/of - andere complicaties
- PPROM < 34 weken
- dreigende vroeggeboorte < 34 weken (cervixveranderingen en/of nood aan tocolyse/longrijping)
- IUGR (EFW < P5) al of niet met dopplerafwijkingen thv a umbilicalis en/of ACM en/of gestoorde veneuze dopplers, onafhankelijk van de zwangerschapsduur
- actieve rhesus immunisatie, onafhankelijk van de zwangerschapsduur
- meerlingen ≥ 3
- monochoriale tweelingzwangerschappen met TTTS en/of dopplerveranderingen en/of groeidiscordantie >10% en/of IUGR, onafhankelijk van de zwangerschapsduur
- matige of ernstige zwangerschaps-geïnduceerde hypertensie / preëclampsie / HELLP, onafhankelijk van de zwangerschapsduur
- trombo-embolieën tijdens zwangerschap (onafhankelijk van zwangerschapsduur) of postpartum :
  - DVT
  - longembolie
- antepartum hemorragie >24 weken
- ernstige complicaties ontstaan tijdens of aansluitend de bevalling / expulsie of in het postpartum

- hemorragie >1000ml, al dan niet na placentaire retentie
- sfincterruptuur graad IV
- infecties waarvoor parenterale AB-toediening is vereist
- gecompliceerde SC/kunstverlossing

- elke kraamvrouw met opname van de baby op NICU, onafhankelijk van de plaats van bevalling

3. Bij verstrijken van bovengenoemde termijn of wanneer er geen bedreiging meer is voor materneel/foetaal welzijn, wordt patiente terugverwezen naar de verwijzende gynaecoloog.

**2. ANDERE PATHOLOGIEËN**

Pathologie die besproken wordt op de multidisciplinaire staffvergadering obstetrie – neonatologie. Het staat de verwijzer vrij een patiente door te verwijzen naar een MIC-arts, ook indien de pathologie niet strikt is opgenomen in de lijst. Ook kan elke gynaecoloog/verwijzer een delicaat dossier voorstellen op de staff vergadering om zo advies in te winnen omtrent zwangerschap en/of bevalling.

Iedere klinische opname van een dergelijke patiente is een MIC-opname.

*01/05/2007 Dr . K. Roelens – Dr. E. Roets – Prof. Dr. M. Temmerman (*Bronnen :KB 01/10/1996 - sturingsgroep Verloskunde UZ Leuven – AZ St Augustinus)

# ANNEX 2 : THEORETICAL MODEL, NOT PREGNANCY RELATED PATHOLOGY

| **Standard care (low-risk)** | **Grey Zone**<br>[Recommended intermediate care<br>(GRADE 2C, weak recommendation)] | **Maternal Intermediate Care**<br>[Indispensable intermediate care<br>(GRADE 1C, strong recommendation)] |
|---|---|---|
| **Endocrinologic disorders**<br>• Every disorder labelled as low-risk by an endocrinologist but not specified as a disorder requiring a level of intermediate care | **Endocrinologic disorders:**<br>• Thyroid pathology with or without positive thyroid antibodies<br>• Diabetes patient (not during labour and delivery) with optimal glycemic control, in consultation with a diabetologist,<br>• All diabetes patients without insuline therapy (diet) during labour and delivery | **Endocrinologic disorders:**<br>• Thyreotoxicosis[nnn]<br>• Severe hypothyroïdism<br>• Diabetes patient (not during labour and delivery) with suboptimal glycemic control, in consultation with diabetologist<br>• All diabetes patients under insuline therapy, during labour and delivery<br>• Every disorder labelled as high-risk by an endocrinologist but not specified as a disorder requiring a level standard care |
| • **Nephrologic disorders** [2]<br>• Every disorder labelled as low-risk by an nephrologists but not specified as a disorder requiring a level of intermediate care | **Nephrologic disorders**<br>• Renal insufficiency: proteinuria ≤ 3g/24h<br>• Pyelonephritis | **Nephrologic disorders**<br>• Kidney transplant<br>• Every disorder labelled as high-risk (e.g. lupus nephropathy, membranous glomerulonephritis, scleroderma) by a nephrologists[3] but not specified as a disorder requiring a level of standard care<br>• proteinuria > 3g/24h<br>• Severe nephrologic infections (except pyelonephritis) |
| **Cardio-vascular disorders**<br>• Normal blood pressure upper limit: 140/90 mmHg<br>• Small left to right shunts such as arterial septal defect, ventral septal defect and patent ductus arteriosus<br>• Repaired lesions with normal cardiac function | **Cardio-vascular disorders**<br>• >140/90 mmHg[ooo], without systemic repercussion and a diagnosis of hypertension before pregnancy (e.g. African population)<br>All disorders[ppp]/procedures[qqq] that require endocarditis prophylaxis**:** | **Cardio-vascular disorders**[rrr]<br>• >140/90 mmHg[sss], with systemic repercussion and a diagnosis of hypertension before pregnancy<br>• Pathology of the major and/or intracranial vessels<br>• Uncorrected cyanotic congenital heart disease<br>• Large left to right shunts |

nnn Lyndal, R. et al. (2005). Outcomes of pregnancy complicated by thyroid disease. The Australian and New Zealand Journal of Obstetrics and Gynaecology 45 , 239–242.

ooo Finnish Medical Society Duodecim (2006). *Systemic diseases in pregnancy*. Retrieved Mai 15, 2007 from Cebam, National guideline clearinghouse : www.guideline.gov.

| | | |
|---|---|---|
| • Mild to moderate malformations of pulmonary or tricuspid valve<br>• NYHA class I and II[2]<br>• Every disorder labelled as low-risk by a cardiologist but not specified as a disorder requiring a level of intermediate care | • Bicuspid aortic valve (no stenosis)<br>• Diagnostic cardiac catheterisation<br>• Transoesophageal echocardiography<br>• Balloon valvuloplasty/balloon dilatation of coarctation of aorta | • Coarctation of the aorta (uncorrected, uncomplicated and complicated)<br>• Artificial valve<br>• Implantation of cardiac pacemakers/defibrillators<br>• Cardiac surgical operations<br>• Implantation of occlusive devices, eg ductal occluders, septal occluders<br>• PTCA/PCI/stent implantation<br>• Acquired valvular heart diseases<br>• Mitral valve prolapse with valvular regurgitation or severe valve thickening<br>• Homograft or bioprosthetic valves<br>• Aortic or mitral stenosis (particulary NYHA functional class III and IV)<br>• Severe pulmonic stenosis<br>• Surgically constructed systemic or pulmonary conduits<br>• Left ventricular dysfunction (moderate to severe)<br>• Previous left ventricular dysfunction now resolved (such as peripartum cardiomyopathy)<br>• Previous myocardial infarction<br>• Pulmonary hypertension<br>• Marfan syndrome with aortic root or valve involvement<br>• Cardiomyopathy<br>• Eisenmenger's syndrome[2]<br>• Hart transplant<br>• Cardio-vascular infections<br>• Every disorder labelled as high-risk by a cardiologist (e.g. cardiac arrhythmia) but not specified as a disorder requiring a level of standard care |

ppp Horstkotte, D. et al (2004). *Guidelines on prevention, diagnosis and treatment of infective endocarditis. The task force on infective endocarditis of the European Society of Cardiology.* September, 5th , 2007 from Cebam, National guideline clearinghouse : www.guideline.gov

qqq Ramsdale, D. & Turner-Stokes, L. (2004). *Prophylaxis and treatment of infective endocarditis in adults: concise guidelines.* September, 5th , 2007 from Cebam, Royal college of physicians (UK): www.rcplondon.ac.uk.

rrr Arafah, J. & McCurtry, S. (2006). Cardiac disease in pregnancy. *Crit. Care Nurs Q*, 29, 32-52.

sss Finnish Medical Society Duodecim (2006). *Systemic diseases in pregnancy*. Retrieved Mai 15, 2007 from Cebam, National guideline clearinghouse : www.guideline.gov.

| | | |
|---|---|---|
| **Thrombotic disorders**<br>• Thrombophilia needing no thromboprophylaxis[ttt]<br>• Every disorder labelled as low-risk by a haematologist but not specified as a disorder requiring a level of intermediate care | **Thrombotic disorders**<br>• Any form of thrombophilia which requires thromboprophylaxis for maternal reasons | **Thrombotic disorders**[2]<br>• Antiphospholipid syndrome<br>• Any form of thrombophilia which requires thromboprophylaxis [uuu]<br>• History of (deep vein) thrombosis or pulmonary embolism associated with ATIII-/ protein C-/ protein S-deficiency [2]<br>• Every disorder labelled as high-risk by a haematologist but not specified as a disorder requiring a level of standard care |
| **Infectious disorders**<br>(independent from gestational age)<br>• Every disorder labelled as low-risk by an infectiologist but not specified as a disorder requiring a level of intermediate care<br>• No severe infection or sepsis | **Infectious disorders**<br>(independent from gestational age) | **Infectious disorders**<br>(independent from gestational age)<br><u>Care for maternal reasons:</u><br>• Active TBC<br>• Malaria<br>• Gonorrhoea<br>• Varicella<br>• Herpes<br>• Sepsis<br><u>Care for foetal reasons:</u><br>• Toxoplasmosis (with suspected or confirmed fetal anomalies)<br>• CMV (with maternal clinical symptoms and or fetal anomalies)<br>• Epstein Bahr Virus<br>• Syphilis<br>• HIV<br>• Parvovirus<br>• Listeria (with clinical symptoms)<br>• Rubella<br>• Every infection labelled as high-risk by a infectiologist but not specified as a disorder requiring a level of |

ttt RCOG. (2004). Thromboprophylaxis during pregnancy, labour and after vaginal delivery, guideline nr 37. Retrieved on June 20, 2007 from cebam, http://www.rcog.org.uk/resources/Public/pdf/Thromboprophylaxis_no037.pdf.

uuu RCOG. (2004). Thromboprophylaxis during pregnancy, labour and after vaginal delivery, guideline nr 37. Retrieved on June 20, 2007 from cebam, http://www.rcog.org.uk/resources/Public/pdf/Thromboprophylaxis_no037.pdf.

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|---|---|---|
| | | standard care |
| **Pulmonary disorders**<br>• Normal ventilatory function : PaO2 >80 mmHg, PaCO2 between 30-35 mmHg, SaO2 > 97%[vvv]<br>• Mild Asthma[www] [Subjects were considered to have **mild** asthma if they had all of the following: (1) symptoms (cough, dyspnea, or wheezing) in the prior 6 months; (2) symptoms on fewer than 8 days during 4 weeks not attributable to upper respiratory tract infections; (3) FEV1 of 80% or greater predicted; and (4) were not taking daily asthma medications. ]<br>• Every disorder labelled as low-risk by an pneumologist but not specified as a disorder requiring a level of intermediate care | **Pulmonary disorders**<br>Moderate asthma: Subjects were considered to have **moderate** asthma if they had any of the following: (1) symptoms on 8 or more days during 4 weeks not attributable to upper respiratory tract infections; (2) FEV1 60% to 80% predicted; or (3) requirement for at least 1 daily asthma medication other than oral corticosteroids for at least 4 weeks, ie, daily inhaled ☐-agonist (at least 2 puffs per day), theophylline (at least 1 dose per day), inhaled ipratropium (at least 4 puffs per day), or at least 2 puffs per day of inhaled cromolyn, nedocromil, or inhaled steroids | **Pulmonary disorders**<br>• Abnormal respiratory values: PaO2 < 80 mmHg, PaCO2 <25 and > 40 mmHg, SaO2 < 97%<br>• Severe asthma. Subjects were considered to have **severe** asthma if either (1) FEV1 was less than 60% predicted or (2) they required regular (daily or every other day) oral corticosteroids for at least 4 weeks<br>• Pulmonary (arterial) hypertension: in rest >25 mmHg, during exercise > 30 mmHg([xxx])<br>• Pulmonary transplant<br>• Severe pulmonary infections (incl. complicated pneumonia)<br>• Every disorder labelled as high-risk by a pneumologist but not specified as a disorder requiring a level of standard care |
| **Autoimmune disorders**<br>• Rheumatoid arthritis[2] without medical treatment<br>• Inflammatory bowel disease, without antecedents of surgery and corticoid therapy [yyy] and/or immunosuppressive agents<br>• Every disorder labelled as low-risk by an immunologist/gastroenterologist but not specified as a disorder requiring a level of intermediate care | **Autoimmune disorders**<br>• Rheumatoid arthritis with medical treatment | **Autoimmune disorders**<br>• Anti phospholipid syndrome<br>• Systemic lupus erythematosus (with clinical symptoms)<br>• Inflammatory bowel disease[zzz] (Crohn / colitis ulcerosa)[aaaa] with history of surgery, corticoid therapy and/or immunosuppressive agents<br>• Every disorder labelled as high-risk by a immunologist/gastroenterologist but not specified as a disorder requiring a level of standard care |

vvv Personal communication with dr. Brouckaert (pneumologist UZGent, August 06, 2007)

www Schatz et al. (2003). Asthma morbidity during pregnancy can be predicted by severity classification. *J Allergy Clin Immuno, 112,* 283-288.
[National Asthma Education Program Report of the Working Group on asthma and pregnancy. *Management of asthma during pregnancy*. Bethesda (MD): National Heart, Lung, and blood institute; 199393-3279A.]

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yyy Personal communication with prof Dr. Devos (gastro-enterologist UZGent, July, 28th 2007)

zzz Carter, M., Jobo, A. & Travis, S. (2004). *Guidelines for the management of inflammatory bowel disease in adults*. Retrieved on June, 20, 2007 from the British society of Gastroenterology: http://www.bsg.org.uk/pdf_word_docs/ibd.pdf

aaaa Vienna Classification" and recent "Montreal modification" (2005.) Retrieved June 12, 2007, from Cebam, tripdatabase: http://www.merck.com/mmpe/sec02/ch018/ch018b.html).
Inflammatory bowel disease[aaaa] (Crohn / colitis ulcerosa). Crohn's disease into three principal patterns: (1) primarily inflammatory, which after several years commonly evolves into either (2) primarily stenotic or obstructing or (3) primarily penetrating or fistulizing.

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| **Connective tissues disorders**<br>• Every disorder labelled as low-risk by an connective tissue specialist but not specified as a disorder requiring a level of intermediate care | **Connective tissues disorders** | **Connective tissues disorders**<br>• Marfan's disease (Gent nosology[bbbbccccdddd])<br>• Ehlers-Danlos' disease (type I – XI[eeee])<br>• Every disorder labelled as high-risk by a connective tissue specialist but not specified as a disorder requiring a level of standard care |
| **Skeletal disorders**<br>• Osteogenesis imperfecta[ffff] type I<br>• Every disorder labelled as low-risk by an orthopaedist but not specified as a disorder requiring a level of intermediate care | **Skeletal disorders** | **Skeletal disorders**<br>• Osteogenesis imperfecta: type II-VII<br>• Every disorder labelled as high-risk by a orthopaedist but not specified as a disorder requiring a level of standard care |
| **Neuromuscular disorders**<br>• Every disorder labelled as low-risk by an neurologist but not specified as a disorder requiring a level of intermediate care | **Neuromuscular disorders**<br>• Well equilibrated epileptic patient (or no active medical treatment) | **Neuromuscular disorders**<br>• Epileptic patient[gggg] (with active medical treatment)<br>• Myasthenia gravis (class I – IVb)<br>• Steinert's disease<br>• Amyotrophic lateral sclerosis<br>• Hemi-/para-/tetraplegy<br>• Spina bifida<br>• Multiple sclerosis[hhhh]<br>• Severe neuromuscular infections<br>• Every disorder labelled as high-risk by a neurologist but not specified as a disorder requiring a level of standard care |

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eeee Ceccolini, E. (2006). *Ehler-Danlos syndrome*. Retrieved June 5, 2007 from cebam, emedecine : http://www.emedicine.com/derm/topic696.htm.

ffff Rauch, F. & Glorieux, F.H. (2004). Osteogenesis Imperfecta. Lancet. 363(9418):1377-85.
**I Mild non-deforming**: Normal height or mild short stature; blue sclera; no dentinogenesis imperfecta.; **II Perinatal lethal**: Multiple rib and long-bone fractures at birth; pronounced deformities; broad long bones; low density of skull bones on radiographs; dark sclera; **III Severely deforming:** Very short; triangular face; severe scoliosis; greyish sclera; **IV Moderately deforming:** Moderately short; mild to moderate scoliosis; greyish or white sclera; dentinogenesis imperfecta; **V Moderately deforming:** Mild to moderate short stature; dislocation of radial head; mineralised interosseous membrane; hyperplastic callus; white sclera; no dentinogenesis imperfecta; **VI Moderately to severely:** Moderately short; scoliosis; accumulation of osteoid in bone tissue, fish-scale pattern of deforming bone lamellation; white sclera; no dentinogenesis imperfecta; **VII Moderately deforming:** Mild short stature; short humeri and femora; coxa vara; white sclera; no dentinogenesis imperfecta

gggg National collaborating centre for women's and children's health. *Antenatal care routine care for the healthy pregnant woman*, *Clinical guideline 23*. Retrieved June 18, 2007 from cebam, rcog: http://www.rcog.org.uk/resources/Public/pdf/Antenatal_Care.pdf.

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|---|---|---|
| **Haematological disorders**<br>• Heterozygous haemoglobinopathy (carriers)<br>• Anaemia not requiring a blood transfusion<br>• Every disorder labelled as low-risk by an haematologist but not specified as a disorder requiring a level of intermediate care<br>• Thrombophilia needing no thromboprophylaxis[iiii] | **Haematological disorders**<br>• Anaemia requiring a blood transfusion | **Haematological disorders**[jjjj]<br>• Homozygous/double heterozygous haemoglobinopathy<br>• Coagulation disorders: TTP, ITP, von Willebrand, haemophilia A-B, Werlhof<br>• Any thrombophilia needing thrombophylaxis<br>• Every disorder labelled as high-risk by a haematologist but not specified as a disorder requiring a level of standard care |
| **Oncologic disorders**<br>• Every disorder labelled as low-risk by a oncologist but not specified as a disorder requiring a level of intermediate care | **Oncologic disorders**<br>• All previous (>5 years in remission) systemic and/or invasive cancers | **Oncologic disorders**<br>• All current systemic and/or invasive cancers<br>• Every disorder labelled as high-risk by a oncologist but not specified as a disorder requiring a level of standard care |
| **Socio-economic problems**<br>• No (known/suspicion of) alcohol/drug abuse<br>• No (known/suspicion of) smoking<br>• No (known/suspicion of) signs or history of violence | **Socio-economical problems**<br>• Pregnancy without antenatal follow-up | **Socio-economical problems**<br>• Severe alcohol (>5 units a day) abuse with obstetrical and/or fetal implications<br>• Severe (hard) drug abuse with obstetrical and/or fetal implications<br>• Severe smoking, 1 pack a day during pregnancy[kkkk]<br>• Abuse/violence with obstetrical and/or fetal complications |
| **Trauma**<br>• Every disorder labelled as low-risk by a traumatology specialist but not specified as a disorder requiring a level of intermediate care | **Trauma** | **Trauma**<br>• Severe trauma<br>• Every disorder labelled as high-risk by a traumatology specialist but not specified as a disorder requiring a level of standard care |

hhhh NHS (2003). *Multiple Sclerosis, management of ms in primary and secondary care, clinical guideline 8*. Retrieved on June 20, 2007, from NICE: http://www.nice.org.uk/pdf/CG008guidance.pdf

iiii RCOG. (2004). *Thrombophylaxis during pregnancy, labour and after vaginal delivery, guideline nr 37*. Retrieved on June 20, 2007 from cebam, http://www.rcog.org.uk/resources/Public/pdf/Thromboprophylaxis_no037.pdf.

jjjj National collaborating centre for women's and children's health. *Antenatal care routine care for the healthy pregnant woman, Clinical guideline 23*. Retrieved June 18, 2007 from cebam, rcog: http://www.rcog.org.uk/resources/Public/pdf/Antenatal_Care.pdf.

kkkk Lodewyckx K, Peeters G, Spitz B, et al. KCE reports 6A. (2004). Nationale richtlijn prenatale zorg. Een basis voor een klinisch pad voor de opvolging van zwangerschappen. Brussel: KCE.

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| **Psychiatric disorders**<br>• Every disorder labelled as low-risk by a oncologist but not specified as a disorder requiring a level of intermediate care<br>• No previous or current psychiatric disorders | **Psychiatric disorders**<br>• Women taking medication, for example benzodiazepines, neuroleptica, anti-depressives (SSRI's), … | **Psychiatric disorders**[llll]<br>• Suicidal symptoms<br>• Severe anorexia and bulimia nervosa[mmmm]<br>• Psychotic symptoms<br>• Substance dependency[nnnn]<br>• Postpartum psychosis<br>• Mania (always hospitalisation in function of context: MIC, psychiatry, mother-child ward…)<br>• Phobic disorders if co-morbidity (substance, depression, …)<br>• Severe psychiatric disorders for which admission is/was required before pregnancy or during a previous pregnancy, delivery of puerperium [2]<br>• Every disorder labelled as high-risk by a psychiatrist but not specified as a disorder requiring a level of standard care |
| **Uro-genital tract disorders**<br>• Every disorder labelled as low-risk by a uro-genital specialist but not specified as a disorder requiring a level of intermediate care<br><br>Female genital mutilation type I & II | **Uro-genital tract disorders**<br>• Complicated uro-genital disorders<br>• Severe uro-genital infections (e.g. PID[oooo])<br>• Female genital mutilation type III (infibulation) | **Uro-genital tract disorders**[pppp] [qqqq]<br>• Every disorder labelled as high-risk by a uro-genital specialist but not specified as a disorder requiring a level of standard care |

llll Personal communication with dr. Heylen and dr Vanden Abeele (psychiatrists UZGent, July 28 and August 8 2007)

mmmm (Tiller & Treasure, 1998 Morgan, Lacey & Sedwick, 1999; Franco e.a., 2001 Waugh & Bullik, 1999 Stein, Woolley, 1996; Russel, Treasure & Eisler, 1998; Stein, Woolley & McPherson, 1999; Timimi & Robinson, 1996; Franzen & Gerlinghoff, 1997; Franzen & Florin, 1995).

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oooo Elective services, HFA (2001). *National referral guidelines gynaecology*. Retrieved from cebam, New Zealand guidelines group on June 26, 2007.

pppp Seuntjens, L. et al (2006). *Zwangerschapsbegeleiding.* Retrieved on June 19, 2007 from cebam, Domus Medica, www.wvvh.be

qqqq Lodewyckx K, Peeters G, Spitz B, et al. KCE reports 6A. (2004). *Nationale richtlijn prenatale zorg. Een basis voor een klinisch pad voor de opvolging van zwangerschappen.* Brussel: KCE.

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| **Gastrointestinal disorders**<br>• Every disorder labelled as low-risk by a gastrointestinal specialist but not specified as a disorder requiring a level of intermediate care | **Gastrointestinal disorders**<br>• BMI, 35 or more (at first contact) or underweight (BMI less than 18[rrrr])<br>• Gastric bypass<br>• Cholestasis ≤ 40 mg/l | **Gastrointestinal disorders**<br>• Other chirurgical interventions with malabsorption<br>• Stomach/duodenal ulcer<br>• Cholestatis >40 mg/l<br>• Disturbed liver functioning<br>• Stoma<br>• Severe acute abdominal pain , not pregnancy related (e.g. appendicitis)<br>• Acute/chronic pancreatitis<br>• Other severe gastro-intestinal infections<br>• Every disorder labelled as high-risk by a gastrointestinal specialist but not specified as a disorder requiring a level of standard care |

A level of intensive care is required when a life threatening situation is diagnosed and when the patient needs the following support: mechanical ventilation and/or multiple organ support and/ or invasive monitoring and/or artificial life support.

[rrrr] National collaborating centre for women's and children's health. *Antenatal care routine care for the healthy pregnant woman*, *Clinical guideline 23*. Retrieved June 18, 2007 from cebam, rcog: http://www.rcog.org.uk/resources/Public/pdf/Antenatal_Care.pdf.

# ANNEX 3: THEORETIC MODEL, PREGNANCY RELATED PATHOLOGY

| Standard care (low-risk) | Recommended intermediate care (GRADE 2C, weak recommendation) | Indispensable intermediate care (GRADE 1C, strong recommendation) |
|---|---|---|
| **Miscarriage/abortion**<br>• Termination of pregnancy ≤ 14 weeks | **Miscarriage/abortion** | **Miscarriage/abortion**<br>• Termination of pregnancy for fetal pathology > 14 weeks |
| **Intra uterine death** | **Intra uterine death** | **Intra uterine death**<br>• > 20 weeks |
| **PPROM**<br>• ≥32 weeks | **PPROM** | **PPROM**<br>• < 32 weeks |
| **Preterm labour**<br>• ≥ 32 weeks | **Preterm labour** | **Preterm labour**<br>• <32 weeks |
| **IUGR**<br>• Estimated fetal weight by ultrasound > P5 and normal Doppler values | **IUGR**<br>• Estimated fetal weight by ultrasound < P5 and normal Doppler values | **IUGR**<br>• Estimated fetal weight by ultrasound < P5 with abnormal Doppler on the arteria umbilicalis and/or ACM and/or abnormal venous Doppler, independent from gestational age |
| **Immunisation** | **Immunisation** | **Immunisation**<br>• Active rhesus immunisation, independent from gestational age<br>• Any symptomatic allo-immunisation |

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| **Multiple pregnancies**<br>• Strictly normal diamniotic, dichorionic twin pregnancy<br>• Diamniotic twin pregnancy with concordant growth and normal dopplers | **Multiple pregnancies** | **Multiple pregnancies**<br>• Mono- and dichorionic twin pregnancy with discordant growth and/or abnormal doppler values<br>• Multiple pregnancy (3 baby's and more) |
| **Hypertension**<br>(Independent from gestational age)<br>• Moderate hypertension | **Hypertension**<br>(Independent from gestational age)<br>• Moderate pre-eclampsia[ssss] | **Hypertension**<br>(Independent from gestational age)<br>• Severe and/or complicated hypertension<br>• Severe and/or complicated (pre)-eclampsia<br>• HELLP |
| **Gestational diabetes** | **Gestational diabetes**<br>• **Without insuline therapy (diet) (cf. endocrinologic disorders)** | **Gestational diabetes**<br>• **With insuline therapy (cf. endocrinologic disorders)** |
| **Thromboembolism**<br>• Superficial venal thrombosis | | **Thromboembolism**<br>• DVT<br>• Lung embolism<br>• Arterial thrombosis |
| **Haemorrhage** | **Haemorrhage** | **Haemorrhage**<br>• Complicated antepartum haemorrhage (> 500ml) (ACOG, 2006)<br>• Complicated delivery/expulsion/postpartum (> 1000ml) |
| **Miscellaneous**<br>• Sphincter rupture < level IV<br>• Cerclage<br>• History of uncomplicated caesarean sections<br>• History of uncomplicated artificial delivery<br>• BMI under 35 (at first contact) or underweight (BMI more than 18)[tttt] | **Miscellaneous**<br>• Hyperemesis gravidarum<br>• Vaginal delivery after caesarean section<br>• Baby admission on NICU<br>• < 16 and > 40 years[uuuu]<br>• History of perinatal loss (incl. 2nd and 3rd trimester)<br>• Baby for adoption | **Miscellaneous**<br>• Sphincter rupture level IV<br>• Previous or current uterus rupture<br>• Current or previous complicated caesarean section<br>• Current or previous complicated artificial delivery<br>• History of recurrent perinatal loss (incl. 2nd and 3rd trimester)<br>• Placenta praevia, placenta accreta and percreta |

ssss ACOG (2002). Clinical management guidelines for obstetrician-gynaecologists, nr 33, Diagnosis and management of preeclampia and eclampsia. Retrieved on Mai 28, 2007 from: www.agog.com.

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# ANNEX 4: THEORETICAL MODEL, FOETAL PATHOLOGY

- Prenatally assessed severe fetal malformation (acute and/or chronic) which requires subspecialist diagnostics and treatment in the first hours/days
- Chromosomal abnormality affecting fetus
- Hereditary disease in family possibly affecting fetus
- Suspected damage to fetus due to viral disease in the mother (Rubella)
- Suspected damage to fetus due to other disease in the mother (alcohol addiction, listeriosis, toxoplasmosis)
- Suspected damage from drugs/ radiation/ environmental toxins/ IUD
- Allo immunisation (e.g. rhesus, iso)
- Fetal cardiac arrhythmia
- Fetal distress (fetal metabolic acidaemia, meconium staining, fetal bradycardia, fetal tachycardia)
- Decreased fetal movements
- Threatening preterm birth: gestational age < 32 full weeks, or estimated birth weight < 1.500g
- Severe (<P5) and early (early third trimester or earlier) IUGR
- Excessive fetal growth >P95
- Multiple pregnancies (≤ 33 weeks)
- Fetomaternal haemorrhage (leakage of fetal blood into maternal circulation)
- Abnormal placenta
- Polyhydramnios
- Hydrops foetalis
- Oligohydramnios
- PPROM
- Infection of the amniontic cavity (amnionitis, chorioamnionitis, membranitis, placentitis)
- Every disorder labelled as high-risk by a neonatologist requiring a level of intermediate for the mother

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10. Le coût des prothèses dentaires. D/2005/10.273/04.
11. Dépistage du cancer du sein. D/2005/10.273/06.
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28. Recommandations provisoires pour les évaluations pharmacoéconomiques en Belgique. D2006/10.273/11.
29. Recommandations nationales Collège d'oncologie : A. cadre général pour un manuel d'oncologie B. base scientifique pour itinéraires cliniques de diagnostic et traitement, cancer colorectal et cancer du testicule. D2006/10.273/13.
30. Inventaire des bases de données de soins de santé. D2006/10.273/15.
31. Health Technology Assessment : l'antigène prostatique spécifique (PSA) dans le dépistage du cancer de la prostate. D2006/10.273/18.
32. Feedback: évaluation de l'impact et des barrières à l'implémentation - Rapport de recherche: partie II. D2006/10.273/20.
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34. Trastuzumab pour les stades précoces du cancer du sein. D2006/10.273/24.

35. Etude relative aux coûts potentiels liés à une éventuelle modification des règles du droit de la responsabilité médicale – Phase III : affinement des estimations. D2006/10.273/27.
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45. HTA Dépistage du Cancer Colorectal : état des lieux scientifique et impact budgétaire pour la Belgique. D/2006/10.273/54.
46. Health Technology Assessment. Polysomnographie et monitoring à domicile des nourrissons en prévention de la mort subite. D/2006/10.273/60.
47. L'utilisation des médicaments dans les maisons de repos et les maisons de repos et de soins Belges. D/2006/10.273/62
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49. Médicaments antiviraux en cas de grippe saisonnière et pandémique. Revue de littérature et recommandations de bonne pratique. D/2006/10.273/66.
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73. Financement du programme de soins pour le patient gériatrique dans l'hôpital classique : Définition et évaluation du patient gériatrique, fonction de liaison et évaluation d'un instrument pour un financement approprié. D/2008/10.273/12
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