Indicateurs de qualité cliniques

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Federaal Kenniscentrum voor de gezondheidszorg
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PREFACE

La qualité est en vogue dans les soins de santé! Du moins peut-on le croire, au vu des innombrables discussions, réunions et autres initiatives prises par diverses autorités, par les mutuelles, par les hôpitaux et les dispensateurs de soins. Des mots tels que "accréditation des hôpitaux","cercles de qualité", "feedback" ou "promotion de la qualité" n'ont probablement jamais été utilisés de manière aussi fréquente que durant ces derniers mois.

La Belgique est renommée pour ses soins de santé d'excellente qualité. Pourtant, au niveau des soins de santé en Belgique, il n'est question ni de mesure systématique de la qualité, ni d'un système global de qualité qui y serait lié. Cette lacune met en lumière une faille importante de notre système de soins.

Cependant, mesurer la qualité des soins est loin d'être simple. La qualité comme telle peut-elle être *in fine* mesurée ? Il existe souvent une confusion avec la satisfaction du patient, essentielle également mais qui n'est qu'une composante de la qualité des soins.

Ce rapport se concentre sur la qualité des soins dans le secteur hospitalier aigu. Cette restriction fut un choix pragmatique puisque cette étude avait également pour objectif d'explorer si les bases de données existantes, telles les données RCM/RFM des hôpitaux, constituaient une bonne base de départ pour la mesure des indicateurs de qualité. La réponse à cette question est particulièrement bien illustrée dans la phase exploratoire de ce projet. Ses résultats incitent à la prudence quant à une interprétation trop simpliste des données enregistrées. Nous adressons nos sincères remerciements aux experts et hôpitaux qui se sont impliqués dans ce processus de validation de données.

Les projets à venir du KCE devront tenir compte des tendances actuelles dans le secteur hospitalier: les soins évoluent vers une prise en charge ambulatoire plus fréquente et une importance croissante du secteur de la revalidation. Dans ce même cadre, il faut mentionner un projet du KCE qui commence actuellement et concerne spécifiquement le domaine de la qualité des soins en médecine générale.

Il n'entre pas dans les missions du KCE de se prononcer au sujet de qui doit mesurer la qualité et quelles seraient les utilisations potentielles des résultats: ces décisions relèvent d'une discussion politique. Le fait est qu'un système de qualité global doit être initié. Le KCE espère fournir grâce à ce rapport une base d'information utile pour les différentes parties concernées par la mesure de la qualité. Ces dernières années, de nombreux pays ont acquis une expérience certaine dans le domaine de la qualité des soins. Ne réinventons pas l'eau chaude: inspirons-nous de cette expérience pour mettre sur pied en Belgique un système d'amélioration de la qualité performant.

Jean-Pierre CLOSON	Dirk RAMAEKERS
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Executive summary

Le défi de tout système de soins de santé consiste à offrir des soins de qualité de manière efficace, tant en valeur absolue qu'en rapport avec les moyens mis en œuvre ("effective and efficient"). Les indicateurs de qualité permettent de suivre et de mesurer cette qualité des soins mais contrairement à de nombreux autres pays, la Belgique n'a que peu d'expérience dans le développement et l'utilisation d'indicateurs de qualité au niveau politique.

Le principal objectif de ce rapport est de fournir un cadre conceptuel relatif au développement et à l'utilisation d'indicateurs de qualité cliniques au niveau politique, en se basant sur une revue critique de la littérature. Le rapport se limite à la qualité des soins dans les hôpitaux aigus mais les conclusions peuvent servir de fondement à des initiatives similaires dans d'autres cadres et pour d'autres types d'indicateurs de qualité.

Un second objectif de ce rapport est d'évaluer l'utilisation potentielle des bases de données du résumé clinique minimum et du résumé financier minimum (RCM/RFM) pour la mesure en Belgique des indicateurs de qualité cliniques basés sur des données probantes.

Revue de littérature: définition, développement et utilisation des indicateurs de qualité cliniques

Méthodologie

Une recherche détaillée dans la littérature indexée et non indexée a été effectuée, en utilisant plusieurs banques de données électroniques et les sites internet d'organisations et d'initiatives nationales et internationales. Cette recherche a trouvé 57 articles indexés et 28 rapports non indexés.

Résultats

Plusieurs définitions de qualité des soins ont été identifiées mais ce sont les définitions de Donabedian et de l'Institute of Medicine (IOM) qui sont les plus souvent citées. Donabedian définit le 'soin de haute qualité' comme un soin censé améliorer le bien-être du patient, en tenant compte des avantages et des inconvénients inhérents à chaque processus de soins. L'IOM définit la qualité des soins comme étant la mesure dans laquelle le soin aux individus et à l'ensemble de la population augmente la probabilité d'obtenir les résultats souhaités et ce, selon l'état actuel de la science. L'IOM propose également six dimensions de la qualité des soins : sécurité, "effectiveness" (définie comme la provision de services basés sur la connaissance scientifique, à tous ceux qui peuvent en bénéficier, en s'abstenant de fournir des services à ceux qui ne sont pas susceptibles d'en profiter), "efficiency" (en évitant le gaspillage, y compris celui du matériel, des réserves, des idées et de l'énergie), orientation en fonction du patient, équité et ce, en temps opportun.

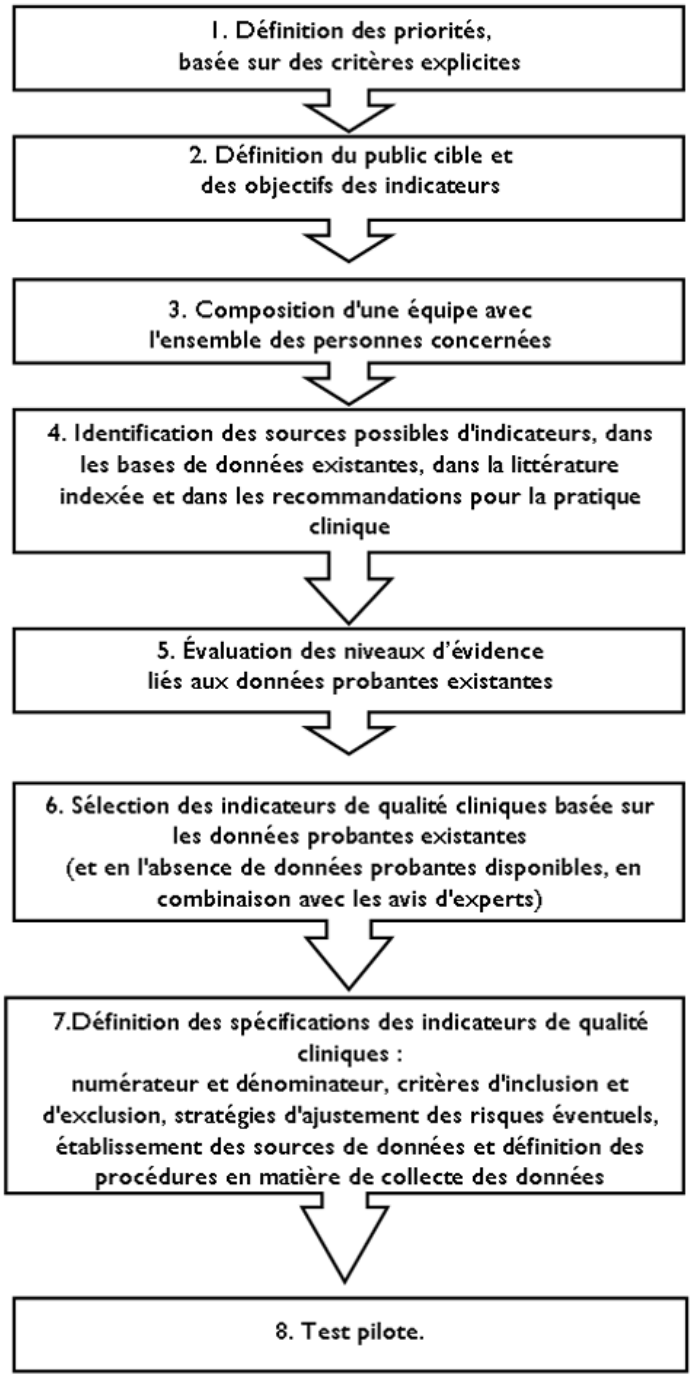
Les indicateurs de qualité mesurent un aspect spécifique des soins. Aucune définition opérationnelle des indicateurs de qualité cliniques n'a été retrouvée dans la littérature et la distinction entre indicateurs de qualité et indicateurs de qualité cliniques s'avère délicate, surtout en raison de l'absence de définition correcte des soins cliniques.

Différents types d'indicateurs de qualité cliniques peuvent être distingués : indicateurs de processus versus indicateurs de résultats, indicateurs désirables versus indicateurs non désirables, indicateurs génériques versus indicateurs spécifiques de maladies, etc. Tant les indicateurs de processus que les indicateurs de résultats ont des avantages et des inconvénients. Les indicateurs de processus constituent la meilleure manière de mesurer les soins cliniques prodigués mais ils n'ont pas toujours un lien direct avec les résultats au niveau du patient. Les indicateurs de résultats, par contre, ne sont pas toujours le reflet

précis de la qualité des soins, étant donné qu'ils peuvent être influencés par plusieurs facteurs.

De bons indicateurs de qualité cliniques doivent être valides, fiables, sensibles et spécifiques (= caractéristiques techniques liées à la mesure). En outre, leur mesure doit être réalisable, les résultats doivent être faciles à interpréter et l'indicateur doit comporter un potentiel pour une amélioration (= caractéristiques liées à l'utilisation de l'indicateur).

Les systèmes d'indicateurs de qualité cliniques sont des initiatives au sein desquelles les données relatives aux indicateurs de qualité cliniques sont collectées de manière systématique et sont analysées en vue d'un feedback aux personnes concernées. Lors du développement de sets d'indicateurs de qualité cliniques, plusieurs étapes seront suivies :



Lors du choix des sources de données appropriées, il convient de tenir compte de leurs avantages et inconvénients respectifs. Les bases de données administratives et les dossiers médicaux ont l'avantage d'inclure des informations immédiatement disponibles mais ces données sont bien souvent peu spécifiques et peu détaillées. Les données collectées de manière prospective, par contre, sont plus spécifiques mais plus onéreuses et non immédiatement disponibles. À côté de ces avantages et inconvénients, il convient également de tenir compte de la manipulation éventuelle des données ('gaming'), des biais liés à un enregistrement de données exagérées ou sous-évaluées, de l'«ascertainment bias» et de l'erreur d'échantillonnage. L'interprétation et la présentation des données comportent également des problèmes, comme la régression vers la moyenne ("regression to the mean") et l'utilisation de «league tables».

Mesurer la qualité au moyen d'indicateurs de qualité peut avoir plusieurs objectifs, allant d'une évaluation neutre de la qualité ou de son amélioration jusqu'au soutien de décisions politiques. L'utilisation potentielle des indicateurs de qualité au niveau politique comprend le soutien de la politique de qualité, l'évaluation de la politique de santé, la justification cette politique et le financement.

Proposition de cadre conceptuel dans le contexte belge pour le développement et l'utilisation d'indicateurs de qualité cliniques au niveau politique

La revue de littérature et les expériences de deux initiatives internationales récentes (Performance Assessment Tool for quality improvement in Hospitals (PATH) et Health Care Quality Indicator project) ont servi de base pour élaborer un cadre conceptuel relatif au développement et à l'utilisation des indicateurs de qualité cliniques. Ce cadre met l'accent sur deux dimensions de qualité: "effectiveness" et "efficiency". Quatre étapes sont proposées :

1. Définition d'une politique de qualité au niveau de la politique nationale de santé

Le système de santé belge a besoin en priorité d'une politique de santé comportant des objectifs de santé clairs. Une politique de qualité aide à atteindre ces objectifs de santé en veillant à la qualité des soins. La qualité des soins est définie par les caractéristiques généralement acceptées pour de bons soins : sécurité, "effectiveness", "efficiency", orientation en fonction du patient, équité, soins dispensés de manière continue, intégrée et en temps opportun. Le terme "justifié" ("appropriate") n'est pas utilisé afin d'éviter la confusion par exemple avec l'utilisation du case mix comme substitut pour des soins justifiés dans le cadre du financement hospitalier. Ce terme « appropriate » est couvert par les caractéristiques "effectiveness " et "efficiency".

La qualité des soins est entre autres déterminée par le développement d'un système d'indicateurs de qualité dont les objectifs et la coordination de la collecte de données sont clairement décrits dans la politique de qualité.

2. Établissement des priorités

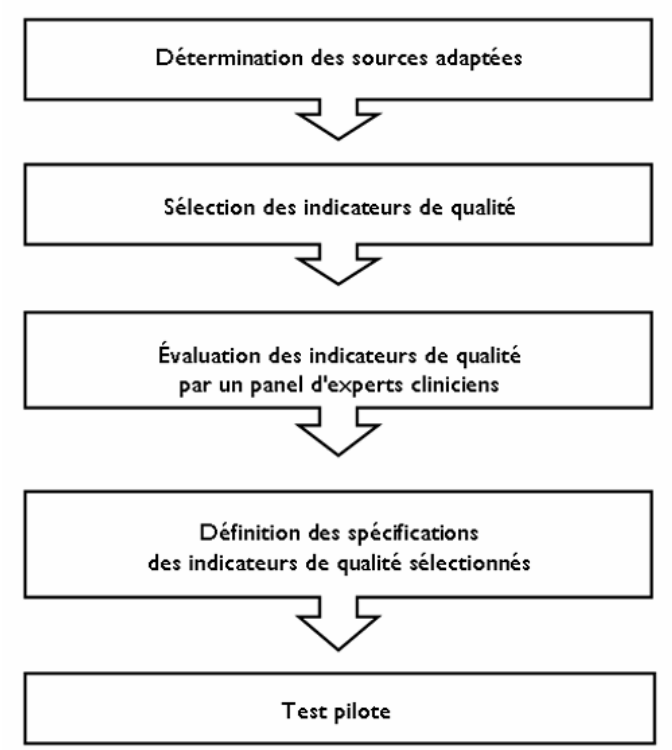
Les priorités seront établies en tenant compte des objectifs de santé de la politique de santé et de critères explicites décrits dans la littérature: impact de l'affection sur la santé publique, existence de données probantes, potentiel pour une amélioration et possibilité de contrôle par les prestataires de soins. Déterminer des priorités implique également la définition du domaine que concerne le système d'indicateurs de qualité, à savoir un domaine générique ou spécifique à une affection.

Pour ce rapport, la priorité était l'activité clinique dans les hôpitaux aigus, définie comme étant les interventions médico-techniques en milieu hospitalier (processus) axées sur

l'amélioration, la stabilisation ou le ralentissement de l'aggravation de la condition du patient (résultat).

3. Développement d'un set d'indicateurs de qualité

Pour le développement d'un set d'indicateurs de qualité, plusieurs étapes essentielles sont suivies, telles que décrites dans les grandes lignes dans la revue de littérature ci-dessus :



4. Diffusion et mise en œuvre ("implementation") du système d'indicateurs de qualité

Cette étape implique la justification et l'explication du système d'indicateurs de qualité, de ses objectifs et de sa relation avec la politique de santé et de qualité; la définition de limites relatives à l'utilisation du système; le soutien logistique pour les utilisateurs ainsi que l'évaluation et la mise à jour du système à intervalles réguliers.

Indicateurs de santé et de qualité disponibles en Belgique

Différentes initiatives belges pour la mesure des indicateurs de santé et de qualité ont été identifiées, avec des objectifs variés et à des niveaux politiques différents. Certaines initiatives se chevauchent, ce qui entraîne un double travail pour les prestataires de soins devant communiquer les mêmes informations pour des initiatives différentes poursuivant des objectifs différents. En outre, les données sont bien souvent difficiles à comparer et la prudence est de mise lors de leur interprétation.

Parallèlement à ces initiatives, différentes banques de données ont été identifiées, lesquelles peuvent être potentiellement utilisées pour la mesure des indicateurs de qualité. Chacune présente des avantages et des inconvénients. Certaines d'entre elles sont génériques (RCM, RFM…), d'autres sont spécifiques pour certaines maladies (Registre national du cancer, Centre d'étude d'épidémiologie périnatale…). Ces données de santé ne sont toutefois pas intégrées dans un système national d'information relatif à la santé (cf. rapport KCE 30B: Inventaire des bases de données de soins de santé)

Évaluation des bases de données RCM et RFM pour la mesure des indicateurs de qualité cliniques en Belgique

Le but de cette étude exploratoire consistait en l'analyse de l'exhaustivité et de l'utilité des bases de données RCM et RFM pour la mesure des indicateurs de qualité cliniques.

Méthodologie

Pour cette étude, quatre affections ont été sélectionnées : accidents vasculaires cérébraux, soins périnataux, soins aux personnes âgées et prothèse totale de hanche. Pour ces affections, des indicateurs de qualité ont été recherchés dans les sets d'indicateurs existants, les recommandations pour la pratique clinique et la littérature. Les indicateurs ont ensuite été sélectionnés suivant des critères successifs: lien avec l'activité clinique, applicabilité dans un contexte hospitalier aigu, données probantes existantes et pertinence clinique ainsi que faisabilité de la mesure, notamment sur la base de discussions avec des experts cliniques. Le set final d'indicateurs a été utilisé pour évaluer les bases de données RCM et RFM. Les données RCM et RFM de quatre hôpitaux ont été confrontées aux données sources des hôpitaux individuels pour en contrôler la qualité.

Résultats

Le nombre d'indicateurs initialement trouvés (n = 511) variait sensiblement en fonction de l'affection, allant de 16 indicateurs pour la prothèse totale de hanche à 231 indicateurs pour les soins aux personnes âgées. La majeure partie de ces indicateurs était constituée par des indicateurs de processus. Les recommandations pour la pratique clinique semblaient être une source intéressante d'indicateurs tandis que Medline n'a fourni que peu d'indicateurs supplémentaires. Seuls 44 % des indicateurs de qualité cliniques semblaient étayés par des données probantes (niveau 1a ou 1b). Lors des concertations avec les experts, certains indicateurs ont été reformulés afin de permettre leur mesure. Durant ces réunions, les experts ont exclu 21 indicateurs originellement sélectionnés en raison de leur pertinence clinique limitée. Ils en ont inclus plusieurs, non basés sur des données probantes, en raison de leur pertinence clinique. Après l'évaluation de la faisabilité de la mesure des indicateurs, un set final de 30 indicateurs de qualité cliniques a été composé. La principale raison justifiant la 'non faisabilité' d'un indicateur était le manque d'informations cliniques dans les bases de données RCM et RFM (comme les antécédents médicaux). De même, le manque d'information sur les médicaments non remboursés ou sur le moment d'administration était un problème important.

Pour plusieurs des 30 indicateurs finalement sélectionnés, une grande dispersion de résultats a été trouvée au niveau des hôpitaux. Cela s'explique en partie par différents case-mix dans les hôpitaux mais aussi par des données manquantes dans les bases de données RCM et RFM. D'une manière générale, les données RCM et RFM correspondaient bien aux données individuelles des hôpitaux. Certaines différences peuvent être expliquées par des incidences peu élevées.

Conclusions et recommandations

Ce rapport offre un cadre pour le développement d'indicateurs de qualité (cliniques) dans le contexte belge. Il contient en premier lieu une quantité importante d'informations de nature méthodologique et la description de l'expérience d'autres pays en matière d'indicateurs de qualité.

Une première recommandation claire et condition sine qua non à l'attention du monde politique est la nécessité d'une vision claire relative au développement d'une stratégie pour une politique de qualité dans les soins de santé. Le manque actuel de coordination entre les différentes institutions et autorités a comme principale conséquence qu'un système de qualité généralisé est inexistant pour les patients des hôpitaux belges. Une lacune complémentaire est le manque d'information au niveau international au sujet de la qualité des soins de santé belges.

Sans aucun doute, des hôpitaux individuels ou groupes d'hôpitaux ont pris un certain nombre d'initiatives louables dans le domaine de la mesure de la qualité. Ces hôpitaux qui actuellement travaillent déjà avec un système de qualité sont probablement les hôpitaux qui en ont le moins besoin. Un cadre conceptuel global applicable à tous les hôpitaux manque cependant encore.

Dans une étape ultérieure, en accord avec les personnes concernées, les décideurs pourront identifier les domaines prioritaires en se basant sur des objectifs explicites en matière de santé.

Lors du développement de systèmes d'indicateurs de qualité, les recommandations suivantes doivent être prises en considération :

1. Les objectifs et l'utilisation de tout système d'indicateurs de qualité doivent au préalable être clairement énoncés et explicités. D'un point de vue politique, les indicateurs de qualité peuvent être utilisés de différentes manières (comme le démontre la revue de littérature internationale), allant d'un feedback de type volontaire pour les prestataires de soins à la publication des résultats et à leur couplage à un financement. Pour chacune de ces options est requise – en accord avec une politique de qualité – une évaluation objective des conséquences sur la qualité des soins (et sur les objectifs de santé). Les expériences à l'étranger montrent en effet que certains systèmes initialement bien intentionnés peuvent conduire à des effets pervers tels que la sélection des patients basée sur leurs risques.

2. La mise en place réussie d'un système d'indicateurs de qualité nécessite absolument une base de données valide et exhaustive. A ce propos, il faut insister sur la nécessité d'une simplification administrative tout en évitant des enregistrements doubles. Une méthode d'enregistrement et une méthodologie standardisées sont conseillées pour permettre une comparaison entre les hôpitaux et un « peer review » au niveau national et au niveau régional. Pour être utile, un système d'indicateurs de qualité doit fournir un feed-back en temps opportun aux utilisateurs (au niveau politique et au niveau des organisations et professionnels de la santé).

3. L'existence de données probantes de qualité revêt une importance particulière pour le développement d'indicateurs de qualité cliniques. L'implication de manière transparente d'experts cliniciens est une nécessité et apporte une plus-value dans la sélection et la formulation des indicateurs de qualité cliniques.

4. Il existe en Belgique un nombre de bases de données incluant les données de tous les hôpitaux telles que les données longitudinales des mutualités et les bases de données RCM/RFM (combinaison de codes ICD et de codes de nomenclature incluant les médicaments, de l'INAMI et du Ministère Fédéral de la Santé Publique). Ces bases de données peuvent s'avérer utiles pour le développement d'indicateurs de qualité cliniques. Ce projet contenait une étude exploratoire relative à la faisabilité de mesurer des indicateurs de qualité à partir des bases de données administratives RCM/RFM. Cette base de données semble utilisable pour un certain nombre d'indicateurs, comme le démontre la phase exploratoire de ce projet. Plusieurs lacunes ont été mises en évidence:

- La possibilité d'un enregistrement de données sur- ou sous-estimées ainsi que le manque de validation primaire constituent une menace pour la fiabilité des bases de données RCM/RFM et pour leur utilité dans la mesure des indicateurs de qualité cliniques.
- En raison d'un manque d'informations importantes dans les bases de données RCM/RFM (comme certaines données cliniques, des précisions temporelles et des informations sur les médicaments non remboursables), de nombreux indicateurs de qualité cliniques potentiellement pertinents ne peuvent être mesurés avec ces seules bases de données et aucune alternative n'existe actuellement.
- Le délai de couplage des données RCM/RFM constitue un réel obstacle. En outre, la procédure administrative permettant l'accès à ces données doit être simplifiée.

La mise en place d'un système d'indicateurs de qualité nécessite dès lors plusieurs étapes élémentaires de validation, allant de la validation primaire des données enregistrées à une validation sur le terrain des indicateurs de qualité dérivés, au moins dans quelques hôpitaux. Ce rapport démontre que ces étapes sont réalisables dans le contexte belge. Elles vont requérir de nombreux efforts, tant sur le plan de l'expertise que sur le plan des ressources. Elles sont cependant cruciales pour mettre en place un système de qualité crédible de niveau professionnel.

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1 INTRODUCTION

The challenge of a health care system is to provide health care services effectively and efficiently whilst maintaining and even improving the quality of care. One way to measure and monitor this quality of health care is the development and use of quality indicators. For this reason, many national governments and/or health agencies developed their own indicator set for different purposes [1-4].

Belgium has only limited experience in the development and use of quality indicators for policy decisions and support. Belgian researchers developed expertise in the field of quality indicators through the participation in the international QIP project [5], the development of a specific set of quality indicators for hospitals [6] and the recent multidimensional feedback for hospitals developed by the Ministry of Health, Food chain safety and Environment [7]. However, in Belgium there is currently no integrated policy to determine priority areas, development methods and the use of these quality tools to monitor health care quality. On the health care policy level a general definition of quality indicators and clinical quality indicators in particular is lacking and the objectives underlying the measurement of quality have not been elaborated. These objectives are a necessary condition to identify priority areas, in which indicators sets have to be developed, planned and implemented. Finally, there is the difficulty to involve all stakeholders in a common culture of quality improvement, especially in a health care sector that is not very much in favour of interference on the provision of care by policy measures.

The main objective of this research project is to develop a conceptual framework about clinical quality indicators specifically, based on a critical analysis of the existing literature on quality indicators in health care. However, a semantic discussion on performance indicators is beyond the scope of this project. This project focuses on clinical quality indicators in acute hospitals but the conceptual framework will potentially serve as a basis for other projects using clinical quality indicators (general practice, rehabilitation) and other types of quality indicators.

A second objective of the project is to explore the usability of the Minimal Clinical Data (MCD) and Minimal Financial Data (MFD) databases to measure evidence-based clinical quality indicators in Belgium. This exploration will focus on a limited number of conditions, using selected clinical quality indicators.

The first chapter of this report describes the literature search on the definition, development and use of clinical quality indicators. The second chapter proposes a conceptual framework for the use of quality indicators in the Belgian health care system. The third chapter describes the existing databases and data sources in Belgium potentially useful for the development and measurement of clinical quality indicators. Finally, the explorative study of the usefulness of the MCD and MFD databases for the measurement of evidence-based clinical quality indicators will be presented.

2 LITERATURE REVIEW

2.1 METHODOLOGY

2.1.1 Indexed literature search

Articles were searched using Ovid Medline, Cinahl, British Nursing Index, DARE database, the Cochrane database of systematic reviews and ACP Journal Club. The reference list of the selected articles was also screened for additional relevant articles. Although performance indicators were not the subject of this review, the search terms 'performance indicator' and 'performance outcome' were used to ensure a broad search, since from the experience of the authors performance indicators and (clinical) quality indicators are often confused.

In Medline, Cinahl and British Nursing Index the following search strategy was used:

#1 *quality indicators, health care/

#2 clinical indicator.mp

#3 performance outcome.mp

#4 performance indicator.mp

#5 quality indicator.mp

#6 quality measure.mp

#7 clinical outcome.mp

#8 outcome measure.mp

#9 quality indicators, health care/

#10 #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9

#11 outcome assessment (health care)/

#12 process assessment (health care)/

#13 outcome and process assessment (health care)/

#14 total quality management/

#15 quality assurance, health care/

#16 health care quality, access, and evaluation/

#17 benchmarking/

#18 #11 or #12 or #13 or #14 or #15 or #16 or #17

#19 #10 and #18

#20 #1 or #19

In the DARE database, the Cochrane database of systematic reviews and ACP Journal Club the following search terms were used: clinical indicator, performance outcome, performance indicator, quality indicator, quality measure, clinical outcome, outcome measure.

The search was limited to articles written in English, French or Dutch. Since our first objective was to develop a conceptual framework – delineating clinical indicators within the broader context of quality indicators –, only articles containing empirical evidence or a theoretical discussion on generic issues in the use of quality indicators or clinical indicators were selected. Some articles about clinical indicator use in general practice were included (despite the fact that the scope of this research project are acute hospitals), because they contained interesting theories about the development of clinical indicators, potentially applicable in a hospital setting. Disease- and condition-specific papers without general import were not included for developing the conceptual

framework, but were used as an example where appropriate. Also articles describing the reliability and validity testing of specific quality indicators were excluded because of a lack of theoretical discussion.

2.1.2 Non-indexed literature search

The search for non indexed literature focused on the United States, Australia, the United Kingdom and The Netherlands. These four countries have defined policies at the national level for the development and the use of quality indicators with the ultimate purpose to improve the quality of the health care system. The appendix 1 provides an overview of the main indicator sets of these countries (completed with important indicator sets from other countries).

- Australia: the Australian Council on Healthcare Standards (ACHS) developed a set of indicators of clinical care used for comparisons between participating organisations [8]. The National Health Performance Committee (NHPC) publishes annual reports for the Ministry of Health [9]. These indicators provide an overview of the performance of the Australian Health system (health status, determinants of health, health system performance and health inequalities).
- In the United States the Institute of Medicine (IOM) issued reports on delivery, use and quality of health services [10]. The Agency for Healthcare Research and Quality (AHRQ) developed tools for program managers and researchers at the national or local level [11]. AHRQ quality indicators use hospital administrative data in three areas, i.e. patient safety indicators, prevention quality indicators and inpatient quality indicators. Many other agencies are involved in the measurement of the performance of health care organizations mainly for accreditation purposes.
- In the United Kingdom the National Health Service (NHS) uses performance and clinical indicators to obtain information about the Hospital Trusts and Health Authorities [12]. Recently, a unique set of clinical quality indicators has also been developed to measure the quality in family practice [13].
- In the Netherlands two important indicators projects were carried out for general practice and for specialist settings respectively. The "Werkgroep onderzoek kwaliteit" (WOK) developed clinical indicators which are currently included in the accreditation instrument for general practices [14]. The Dutch Quality Institute for Health Care (CBO) also developed clinical indicators based on guidelines for specialists [15].

More recently, some other European countries developed quality policies incorporating the development and use of clinical indicators. These indicator sets are usually based on the experiences described above, but their use differs according to the health care system. Interesting documents relate to France, Germany and Scandinavian countries [16, 17].

The OECD Quality Indicators project recently developed international quality indicators defined as "measures of health outcome or health improvement attributable to medical care". Five reports focus on different areas i.e., cardiac care, diabetic care, prevention and primary care, mental care and patient safety [18] (see appendix 1). In 2006 (after this literature search), the OECD published a report on a conceptual framework, mainly based on the work of technical experts from the Netherlands [19]. The scope of this framework is broader than the scope of the present report, and aims at international comparison.

Information on clinical indicators in Belgium was gathered concerning general practitioners' initiatives, "colleges" of specialists and Flemish hospitals [6]. The Federal government was also contacted to provide information on current initiatives.

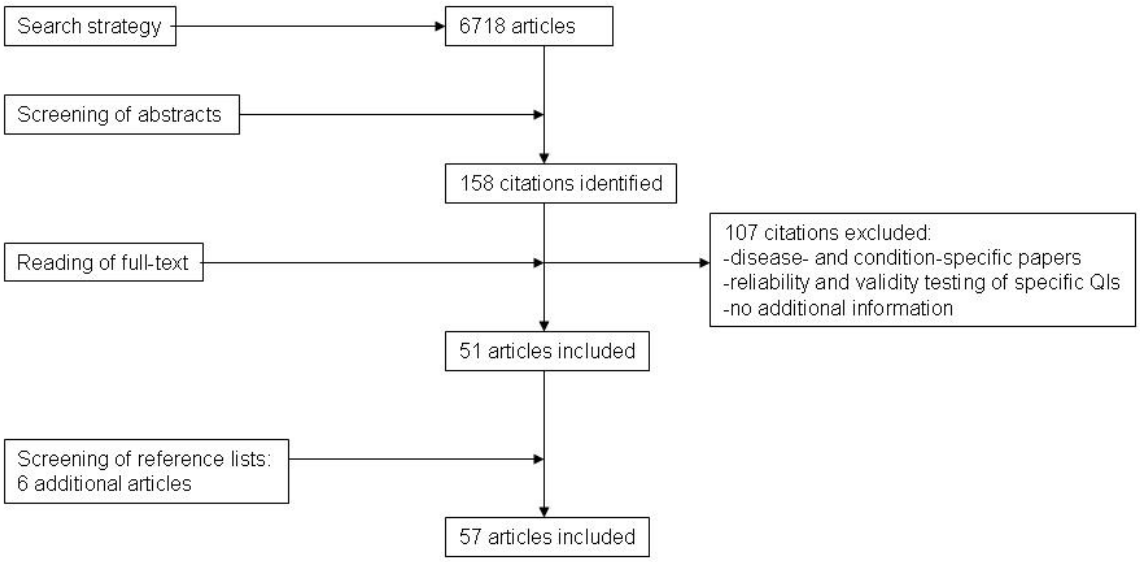
Furthermore, the websites of important Belgian health care organizations and institutes were searched for relevant information.

2.1.3 Selection of the articles

The search strategy delivered 6718 articles (Medline 4227 articles, Cinahl 179 articles, British Nursing Index 0 articles, CDSR 1520 articles, ACP 375 articles, DARE 417 articles) (figure 1). Two researchers (GV, JV) independently selected the articles on the basis of the abstracts. They finally selected commonly 158 abstracts focusing on the development and use of quality indicators. Specific articles were selected addressing methods and issues relevant for the development of the conceptual framework. Eventually, based on the full-text of these papers, 51 articles were included. The screening of the reference lists of these articles provided another 6 articles for inclusion.

The search in the non-indexed literature yielded 28 articles, reports or websites.

Figure 1. Results of literature search in the indexed literature.



2.2 RESULTS OF THE LITERATURE SEARCH

The terms "quality", "quality indicators" and "clinical quality indicators" are widely used. However, the definitions and underlying concepts differ between the authors and between the systems that use quality tools. The first part of this chapter describes the definition and underlying concepts of quality of health care, quality indicators, clinical quality indicators, and clinical indicator systems. Methodological aspects of quality and clinical quality indicators will be discussed in detail. The development and use of quality clinical indicators will be further analyzed together with the potential benefits and problems linked to their use.

2.2.1 Quality of health care, quality indicators and clinical quality indicators

The literature search provided a vast amount of descriptive and/or theoretical articles. However, no definite and generally accepted answers/definitions were identified. Because of the pure qualitative nature of the topic, mainly based on expert opinion, assessing the validity of the articles was difficult, making an objective selection of the soundest definitions hard.

2.2.1.1 Quality of health care: definition and dimensions

Definition

Many definitions of quality of health care exist in the literature but few are widely accepted and repeatedly cited. Donabedian, a pioneer in the theory and management of quality of health care, defined care of high quality as "that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts" [20]. He identified three closely interrelated components of quality, i.e. the quality of technical care, the goodness of interpersonal relationship and the goodness of amenities. The first component is related to the effectiveness of care, defined as the "ability to achieve the greatest improvement in health that science, technology and skills can now offer" [21]. According to Donabedian, quality of health care can be measured by observing its structure (organizational factors), processes (clinical care and inter-personal care) or outcomes (consequences of care) [20].

In 1990, the IOM defined quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" [22]. The terms used in this definition deserve further attention [10]:

- *'Health services'* refers to a wide range of settings of care (primary care, secondary and tertiary lines), a wide range of health professionals (physicians, nurses and paramedical workers) and many services affecting health.

'individuals and populations': this aspect was further detailed by Campbell et al. by distinguishing quality of care for individual patients and for populations [23]. Campbell et al. consider quality of care as a concept having most meaning when related to individual users: "their ability to access effective care with the aim of maximizing health benefit in relation to need". On the other hand, quality of care at the societal level is "the ability to access effective care on an efficient and equitable basis for the optimization of health benefit/well-being for the whole population".

The consistency with *'current professional knowledge'* emphasizes the need for health care professionals to update their knowledge to maximize the likelihood of optimal outcomes for patients. Quality measurement is linked to the current scientific knowledge which expands rapidly.

The *'likelihood of desired health outcomes'* means that the practitioner has to take into account the values and preferences of the individual. Moreover the term *'likelihood'* underlines that quality of care cannot be simply reduced to desired health outcomes.

The cited definitions of 'quality of health care' share the assumption that a care of high quality *improves* (Donabedian and Campbell use 'maximize', the IOM uses 'increase') the patients' *outcomes* ('welfare' or 'health outcomes' or 'health benefit') [20, 22, 23]. Donabedian and the IOM added the connotation that high quality care has to reflect the current professional knowledge [20, 22].

Dimensions

In 2001, the IOM identified 'six aims for improvement': safety, effectiveness, patient-centeredness, timeliness, efficiency and equity [24]. A description of these dimensions is provided in table 1. Other authors suggested components of quality similar to the IOM dimensions. For example, accessibility is covered by the IOM dimensions equity and

timeliness. Relevance and legitimacy are part of patient-centeredness. Optimality is similar to efficiency. Efficacy is a part of effectiveness. Acceptability is related to patient-centeredness. Only continuity and comprehensiveness – both complementary and important dimensions – are not fully covered by the IOM dimensions.

The quality domains described by Campbell overlap those stated by the IOM [24]. For individual patients, Campbell et al. proposed two main domains of quality, i.e. access and effectiveness (clinical and inter-personal care) [23]. The IOM dimensions "timeliness" and "patient-centeredness" correspond to "access" for individuals, "effectiveness" can be covered by the IOM dimensions "effectiveness" and "patient-centeredness" (inter-personal care). Furthermore, Campbell et al. place the care for individual patients in the context of health care for populations with equity and efficiency as important notions. "Equity" is considered by Campbell et al. as a sub-component of accessibility relevant to structure and process (the extent to which all individuals in a population access the care they need). This notion of access emphasizes also the timely use of the services (another IOM dimension) [23]. "Efficiency" relates to the cost-effectiveness and allocation of health care resources to the population [23].

Considering the fact that the definitions and dimensions of quality of health care are opinion-based, the works of Donabedian and of the IOM will be used as stepping stones for the conceptual framework, as they are the most frequently cited, widely accepted, generic and for this last reason, also applicable to acute hospital settings.

Table 1. Quality of care: dimensions.

Health care quality dimensions	
IOM dimensions [24]	**Definitions**
Safety	Avoiding injuries to patients from the care that is intended to help them.
Effectiveness	Providing services based on scientific knowledge to all who could benefit, and refraining from providing services to those not likely to benefit.
Patient-centeredness	Providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions.
Timeliness	Reducing waits and sometimes harmful delays for both those who receive and those who give care.
Efficiency	Avoiding waste, including waste of equipment, supplies, ideas, and energy.
Equity	Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.
Dimensions proposed by other authors	**Definitions**
Accessibility	The services are accessible in terms of distance, time and social barriers [25-27].
Continuity	Delivery of care by the same healthcare provider throughout the course of care (when appropriate), and appropriate and timely referral and communication between providers [25, 27].
Efficacy	The ability of care, at its best, to improve health [28, 27].
Optimality	The most advantageous balancing of costs and benefits [28].
Acceptability	Conformity to patient preferences regarding accessibility, the patients-practitioner relation, the amenities, the effects of care, and the cost of care [28, 26].
Legitimacy	Conformity to social preferences [28].
Comprehensiveness	A range of services and care broad enough to meet all common needs as they occur [25].
Relevance	The services are appropriate to the needs of its users [26].

Key points:

- **Many definitions of quality of health care coexist, with the definitions by Donabedian and the Institute of Medicine being the two most often cited. Donabedian defines a care of high quality as "that kind of care which is expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts". The Institute of Medicine defines the quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge".**
- **The IOM proposed 6 key dimensions of quality of health care: safety, effectiveness, patient-centeredness, timeliness, efficiency and equity. These dimensions encompass the components of other models.**

2.2.1.2 Quality indicators and clinical quality indicators: definitions and underlying concepts

The terms 'quality indicator' and 'quality measure' are frequently used as synonyms. Many definitions of the term "quality indicator" have been proposed in the literature. Table 2 provides an overview of these definitions, however without taking into account the accompanying commentary of the authors. A common part of these definitions is that indicators are **measurable elements of health care**.

Many definitions of clinical (quality) indicators are being applicable to quality indicators and vice versa. Few workable definitions were found delineating clinical quality indicators within the broader group of quality indicators (table 2). A major shortcoming of the definitions of clinical quality indicators is their lack of a description of 'clinical'. For the development of the conceptual framework, special attention will be paid to develop a description of this concept 'clinical'.

The concepts underlying the term "clinical quality indicator" more often stress the relationship between the care provided (process) and the outcome of care [22, 29, 30, 15, 31, 8]. Some authors also mention the ability of clinical quality indicators to measure the appropriateness of care (i.e. the degree to which a care provider delivers the right care to the right patient) [22, 15, 32].

As stated in the introduction, the scope of this project is clinical quality indicators and not performance indicators. Quality indicators and clinical quality indicators should be clearly distinguished from performance indicators, in that quality indicators infer a judgment about the quality of care, whereas performance indicators monitor care without necessarily measuring the quality (figure 2) [33].

Table 2. Definitions and underlying concepts of quality and clinical quality indicators

Author	Term used	Description
ANAES[1 16]	Indicator	A variable which describes an element of a situation or its evolution from a quantitative point of view. Its interest comes from its ability to support decisions and to highlight choices (for deciders, managers and health professionals).
Campbell [33]	Quality indicator	A measurable element of practice performance for which there is evidence or consensus that it can be used to assess the quality, and hence change the quality, of care provided. An indicator indicates potential problems that might need addressing.
CBO[2 15]	Indicator	A measurable element of health care delivery that gives an indication of its quality.
COWG[3 34]	Indicator	A measure that provides a picture about a specific aspect of health/health care (including clinical outcomes) at a particular time.
Hofer [35]	Indicator	Should reflect the delivery of processes of care that are causally associated with an outcome of interest. An indicator is a measurement of some point in an underlying process-outcome continuum.
Jencks [36]	Quality indicator	Must indicate whether the care provided increases the likelihood of desired outcomes and is consistent with current professional knowledge.
NQMC[4 32]	Quality measure	A mechanism that enables the user to quantify the quality of a selected aspect of care by comparing it to a criterion.
ACHS[5 8]	Clinical indicator	A metric or measure which screens for a particular event. They are designed to indicate potential problems that might need addressing. They are used to assess, compare and determine the potential to improve care. They are tools to assist in assessing whether or not a standard in patient care is being met.
AZQ[6 37]	Clinical performance measure	Measures attributes of health care aspects to be assessed within the scope of quality improvement activities.
Ballard [31]	Clinical indicator	Evaluates the relationship of specific processes of care and/or their patient health states outcomes.
Barnsley [29]	Clinical outcome indicator	A measurable element in the outcome of care, the values of which suggest one or more dimensions of quality of care that are theoretically amenable to change by the provider.
CBO [15]	Clinical performance indicator	Gives an indication on the degree to which the health services provided are tailored to the patient's condition and achieve the desired objective (health outcome and patient satisfaction).
Collopy [30]	Clinical indicator	A measure of the clinical management and/or outcome of care.

Author	Term used	Description
IOM[7, 22]	Clinical indicator	Can refer to adverse events or to measures of process recorded routinely by clinical care and ancillary departments. They can also refer to objective and measurable elements of acceptable practice that are applied consistently to the review of care by external reviewers. Finally, they can refer to appropriateness protocols (based on adherence to condition- or procedure-specific standards) or to positive or negative health status outcomes.
JCAHO[8, 38]	Clinical indicator	A quantitative measure that can be used as a guide to monitor and evaluate the quality of important patient care and support service activities. It is a screen that directs attention to specific performance issues that should be the subject of more intense review.
NQMC [32]	Clinical performance measure	A mechanism for assessing the degree to which a provider competently and safely delivers clinical services that are appropriate for the patient in the optimal time period.

[1] Agence Nationale d'Accreditation et d'Evaluation en Santé; [2] Dutch Quality Institute for Health Care; [3] Clinical Outcomes Working Group; [4] National Quality Measures Clearinghouse; [5] Australian Council on Healthcare Standards; [6] Artztliche Zentrum fur Qualitat in der Medizin; [7] Institute of Medicine; [8] Joint Commission on Accreditation of Healthcare Organizations

2.2.1.3 The use of quality indicators and clinical quality indicators

Where most definitions of quality indicators and clinical quality indicators agree on the measurement aspect, the authors' opinions differ when describing the potential use of this measurement (table 3). Various authors state that quality indicators indicate potential problems that might need further attention [38, 33, 8]. Quality indicators are also frequently defined as tools for quality assurance and/or improvement [33, 15, 34, 32]. Other authors stress the link between measurement and decision support [16]. Finally, some authors stress the link between processes and desired outcomes [36, 35, 34].

Table 3. Use of quality measurement with quality or clinical quality indicators.

Condition/use	Quality indicator	Clinical quality indicator
Quality assessment	Campbell [33], CBO [15], COWG [34], NQMC [32]	AZQ [37], Barnsley [29], JCAHO [38]
Quality improvement	Campbell [33]	ACHS [8], AZQ [37], Barnsley [29]
Indicates potential problems that need further attention and solution	Campbell [33]	ACHS [8], JCAHO [38]
Supported by evidence/consensus	Campbell [33], Jencks [36]	IOM [22]
Link process – outcome	COWG [34], Hofer [35], Jencks [36]	ACHS [8], Ballard [31], Barnsley [29], CBO [15], Collopy [30], IOM [22]
Assesses appropriateness		CBO [15], IOM [22], NQMC [32]
Comparison with criterion/standard	NQMC [32]	ACHS [8], IOM [22]
Decision support and highlight choices	ANAES [16]	

Key points

- **The definitions of quality indicators agree on the fact that they measure a specific aspect of care.**
- **No workable definition of "clinical" quality indicator has been found in the literature. The descriptions of clinical quality indicators are not very distinctive from the descriptions of quality indicators, be it that the first group puts more emphasis on the relation between process and outcome of care.**
- **The use of the quality measurement varies from a neutral quality assessment over a mean for quality improvement and identification of potential problems, to tools for decision support.**

2.2.2 Classification of clinical quality indicators

Classifications have been proposed to identify subtypes of clinical quality indicators [38, 39] (table 4). A frequently used classification of quality indicators is Donabedian's classification in structure, process and outcomes indicators. He stated that quality of health care can be measured by observing its structure (organizational factors), processes (clinical care and inter-personal care) or outcomes (consequences of care) [20]. However, since structure is rather a condition for than a part of clinical care, only the distinction between process and outcome indicators is applicable to clinical quality indicators. The pros and contras of their respective use will be detailed in the next paragraph. Clinical quality indicators can also be differentiated by the seriousness and frequency of the event and the degree to which it can be avoided (sentinel vs. rate-based indicators). Depending on the scope of the indicator, generic and disease-specific indicators can be distinguished. Furthermore, an indicator may measure a result of care that is either desirable or undesirable. Indicators can also be classified according to the type of care (preventive vs. acute vs. chronic care), function (screening, diagnosis, treatment, follow up) and modality (history, physical examination, laboratory/radiology study, medication, other interventions). Finally, depending on the result of the measurement, an indicator can be dichotomous, continuous, a rate or a score on a scale [40].

Table 4. Classifications of clinical quality indicators with examples provided (in italic) [38, 40, 39].

Type of indicator	Description
Process indicator	Measures a care activity done for a patient. Proportion of patients with a diagnosis of stroke receiving aspirin within 48h after admission (the process is 'the administration of aspirin within 48h after admission for stroke')
Outcome indicator	Measures what happens to a patient after something is done to the patient. Proportion of patients expiring within 180d after diagnosis of stroke (the outcome is 'death')
Generic indicator	Measures aspects of care that are relevant to most patients. Inpatient mortality (concerns all hospitalized patients)
Disease-specific indicator	Measures particular aspects of care related to specific diseases. Proportion of patients diagnosed with stroke expiring during hospitalization (concerns only hospitalized stroke patients)
Desirable indicator	Measures a result of care that is desirable. Proportion of patients discharged to prior home situation within 56d after admission for stroke ('discharge to prior home situation' is desirable)
Undesirable indicator	Measures a result of care that is undesirable. Proportion of patients expiring within 180days after diagnosis of stroke ('death' is undesirable)
Dichotomous indicator	Expressed as proportions, with a given numerator and denominator. Proportion of patients expiring within 180d after diagnosis of stroke (numerator is 'number of patients with a diagnosis of stroke, expiring within 180d after diagnosis, denominator is 'total number of patients with a diagnosis of stroke)
Continuous indicator	Expressed as means for the relevant population. Minutes to thrombolytic therapy for patients presenting with stroke
Rate	Defined as a proportion within a given time frame. Proportion of patients presenting with stroke undergoing CT scan within 24h after admission
Score on scale	Individual questionnaire items are summarized into a single score. Score on the Barthel Index on admission for stroke

Key point

- **Various classifications are proposed to categorize clinical quality indicators. The most common classification refers to the aspect of care considered, i.e. process and outcome. Other classifications refer to the desirable or undesirable nature of the events, to the generic versus disease-specific focus, to the occurrence of the event registered (sentinel versus rated based) and to the type of results (continuous, dichotomous, rate or score on scale).**

2.2.3 Pros and contras of process and outcome indicators

Structural indicators alone are not sufficient for measuring the clinical quality of care. The relation between structural and process indicators is indeed weak and only poorly understood [21, 41, 42].

Both process and outcome indicators have advantages and disadvantages (table 5) [43, 44]. The major advantage of process indicators is that they relate directly to what providers are doing. They are highly sensitive to differences in the quality of clinical care. They also allow a data collection while the clinical process is on the way and need a short observation time (a small sample size is needed as all patients experience the process). Finally, process indicators are straightforward to interpret and they generally do not need complicated statistics. However, process indicators have drawbacks. They require a strong definition of the eligible patients and they need to be updated according to advances in diagnosis and treatment. Furthermore, the feasibility of process indicators may be overestimated. When one wants to study a process in detail, the data collection may be extensive and time consuming (for example for surgery processes). Above all, process indicators are only a part of the explanatory variables that determine the patient outcomes.

On the other hand, outcome measures are often generic and can be compared across several conditions and processes. They reflect a global overview of all aspects of the health care process and not only the measurable ones. However, this is their major drawback as well, as risk adjustment is needed to filter the influence of confounding factors, such as the natural history of the disease or patient's characteristics.

Table 5. Pros and contras of process and outcome indicators [43, 44].

	Process indicators	**Outcome indicators**
Relevance		
Updating and maintenance of indicators	Require updating and maintenance according to advances in treatment	Require some updating, though generally less often than process measures
Specificity/sensitivity		
Risk adjustment	Generally require no use of extensive risk adjustment models, though require a good definition of eligible patients	Risk adjustment is difficult; need different models for each outcome
Feasibility		
Ease of specification and identification of population at risk	Difficult to specify population eligible for a process	Easy to define population for which to measure an outcome
Time needed for measurement	Takes less time to accumulate, smaller sample and less observation time	Larger sample and long period of observation needed
Size of population	Smaller sample size needed	Due to need for risk adjustment a larger sample size is needed
Need for additional follow-up tracking of patients for later data collection	Data collection can be done when clinical process is occurring	Requires follow-up for measurement of short- and long-term outcomes at time when routine data collection not occurring
Use of routinely collected data	Potential for abstraction from data already recorded for clinical and administrative use	Often requires collection of data elements that are not being recorded for clinical or billing purposes
Validity		
What patients care about	Often inaccessible to patients who often do not understand the significance of a specific component of care	Generic outcomes of survival, health and well-being are what patients care about
What providers care about	Relates directly to what the provider is doing	Many outcome measures are influenced by other things besides what providers do
Interpretability		
Need for advanced statistical consultation	Generally not needed	Needed to create risk adjustment models and to evaluate them when analyzing data
Creation of valid summary measures	Difficult to summarize process measures in a valid way as they are rarely comprehensive	Many important outcome measures are global and generic and can be compared across conditions and processes
Interpretability of feedback for quality improvement	Provides clear and interpretable feedback for quality improvement about what providers are actually doing; easy to benchmark	Most measures cannot be used to give feedback to providers about how to improve what they are doing, since an outcome is rarely a consequence of a particular process as such

Key point

- **Process and outcome indicators have both advantages and drawbacks. Process indicators are the best measure of the clinical care provided by the clinician. However, they do not always have a direct link with the patients' outcomes, the major focus for all stakeholders involved. On the other hand, outcome indicators do not precisely reflect the quality of clinical care as they depend on many other influencing variables.**

2.2.4 Methodological aspects of quality and clinical quality indicators

Many authors have listed key characteristics that each indicator should ideally present (table 6). These can be divided in two groups, i.e. measurement-related technical aspects and aspects related to the development of indicators in connection with their use.

Table 6: Essential characteristics of quality and clinical quality indicators.

Measurement-related technical aspects: Relevance: the topic area and aspect of health is of significant clinical importance. Validity: an indicator should measure what it is intended to measure. Reliability: an indicator should obtain the same result a high proportion of the time when repeatedly applied to the same population/organisation/practitioners. Specificity: an indicator should detect few false positives. Sensitivity: an indicator should detect few false negatives. Aspects related to the development of indicators in connection with their use: Feasibility: an indicator should use currently available data or data that could be easily collected. Potential for improvement: the results of an indicator can be operationalized into actions or interventions that are under control of the user, leading to improvements that are known to be feasible. Interpretability: the results of an indicator should be comprehensible for the user. Adjustability: an indicator should be formulated in such way that it measures the quality of specific aspects of care of comparable units.

2.2.4.1 Measurement-related technical aspects

- Relevance: the topic area and aspect of health that the indicator addresses are of significant clinical importance [45, 15, 32]. An indicator that does not concern many patients is unable to measure the quality of care and to identify potential problems [35].
- Validity: an indicator should measure what it is intended to measure [46, 39]. Validity can be evaluated in a variety of ways, and this validity testing should be documented [32]:
- face validity: subjective assessment by experts of whether an indicator accurately represents the content it is intended to assess [46, 45];
- criterion validity: objective assessment of the ability of the indicator to predict a score on any other indicator considered as the evaluation criterion [45];
- construct validity: assessment of whether the correlations between the indicator of interest and other indicators are of the right magnitude and in the right direction [45];

- content validity: the indicator should be based on solid evidence [33]. The evidence supporting the measure is explicitly stated [32];
- predictive validity: the indicator should have the capacity for predicting quality of care outcomes [33].
- Reliability: an indicator should produce a similar result when repeatedly applied to the same population/organisation/practitioners [46, 45]. Three common categories of reliability assessment exist: internal consistency (variation among items that should provide similar results), inter-rater reliability (variation among different evaluators) and test-retest reliability (variation when the same person repeats the measure at two different time points). This reliability testing should be documented [32].
- Specificity: the indicator should yield few false positive results and should only react to those cases where true variability exists in quality of care (see above) [39]. Each indicator should have explicit and detailed specifications for the numerator and denominator in order to be specific [15, 39, 32].
- Sensitivity: the indicator should yield few false negatives results and should be able to measure even slight quality differences [39]. Both specificity and sensitivity are very much related to the aspect 'discrimination', proposed by the Artztliche Zentrum fur Qualitat in der medizin (AZQ) as an additional suitable characteristic for quality indicators [47].

2.2.4.2 *Aspects related to the development of indicators in connection with their use*

- Feasibility: data availability is often a determining factor for the measurement [33, 48]. The data source used to measure the indicator should be available, accessible and timely [32]. Optimally, a quality indicator should use currently available data or data that could be easily collected with a minimum of expense and personnel time [35].
- Potential for improvement: the results of the measurement have to result in actions that are under control of the user, leading to improvements that are known to be feasible [35, 49]. An indicator that is acceptable to both those being assessed and those undertaking the assessment is more likely of being used to facilitate quality improvement [50]. Quality indicators should also be enough sensitive to detect these improvements in quality of care [51].
- Interpretability: the numeric values of the indicator should be comprehensible for the user [32]. Assessments of interpretability include statistical analysis (statistical significance), calibration of measures (clinical significance) and effective presentation of information [45].
- Adjustability: indicators should be defined in such a way that they measure the quality of specific aspects of care of comparable units (regions, organizations, providers of care). If there is only limited comparability, all possible confounders should be identified and statistically adjusted (see risk-adjustment below) [47]. The AZQ added 'adjustability' as an additional feature of clinical quality indicators, mainly within the context of benchmarking of health care providers [47]. Other authors mentioning this feature were not found.

The literature offers no definitive overview of the essential features of clinical quality indicators. It is clear however, that specific technical requirements first have to be fulfilled before looking at other characteristics as interpretability or adjustability, which infer the testing of the quality indicator on the field.

Key point

- **Good (clinical) quality indicators present measurement-related technical characteristics as relevance, validity, reliability, sensibility and specificity. Moreover, characteristics in connection with their use are also important to facilitate the utilization on the field, i.e. a feasible data collection and an easy interpretation by the stakeholders involved. Finally, good (clinical) quality indicators should bear a potential for improvement.**

2.2.5 Clinical indicator systems

Indicator systems are initiatives where data on quality indicators are collected, summarized and used for feedback to stakeholders [36, 52, 5, 3, 53, 4]. Indicators systems can be theoretically divided into four possible types, based on the source of control (internal/external) and on the nature of the resultant action (positive: supportive and formative; or negative: punitive) [54]. The Quality Indicator Project (QIP), one of the largest and longest-running indicator systems, is an example of an internal system, with a formative objective, aiming at continuous quality improvement [5]. In contrast, the National Health Service (NHS) public sector developed an indicator program for external accountability, with positive and negative consequences for the providers [12].

A potential benefit of indicator systems is their potential to gain insight into practice, discussed and interpreted by clinicians and managers in the light of the local context and with the aim of continuously improving the quality of clinical care.

However, indicator systems carry some inherent problems [48]. Firstly, they carry the risk of displacing informal strategies of quality assurance, hereby generating suspicion and fear and undermining the conditions of trust required for quality improvement. Also, indicator systems are incapable of explaining why particular results are obtained. Moreover, many technical problems arise from significant problems with their validity, reliability and comparability [48].

2.2.6 Development and/or selection of clinical quality indicators

2.2.6.1 Priority setting

The identification of the key clinical areas requiring a quality measurement is needed first, before developing clinical quality indicators. The indicators should be developed in areas where the data suggest that there is poor quality of care in general, or variations of quality among organizations/professionals indicating a need for improvement [45, 15, 32]. McGlynn proposed four criteria for selecting meaningful assessment clinical areas [45]:

- *impact* of the condition on health: a health-care problem or a disease/procedure is considered to have a high impact if it has a high volume (high prevalence and incidence, high utilization rate), contributes significantly to morbidity/mortality and is costly to treat;
- *level of evidence* of the link between the measured processes and outcomes of care: clinical indicators supported by strong evidence can be used with more confidence to inform choices. The process-outcome link is crucial for both process and outcome indicators. A process indicator can be used with confidence if the measure aspects of improved processes leading to better outcomes. Vice-versa outcome indicators are useful when the link back to process demonstrates that the type of clinical interventions influences the outcome;
- *potential for improvement* in quality of care: the diseases should be selected where there is evidence that the quality of care is variable or substandard with a substantial potential for improvement;

- *controllability* by health plan and/or providers: the health plan or provider being assessed should have control over the performance in the evaluated area.

Most authors largely follow these four criteria [29, 40, 55-57]. For example, based on these criteria, six conditions (stroke, hip fracture, schizophrenia, acute gastrointestinal surgery, heart failure, and lung cancer) were selected to develop clinical quality indicators for the Danish National Indicator Project (DNIP) [3].

2.2.6.2 Development methods

Various authors describe the stages for developing, testing and implementing clinical quality indicators [29, 45, 58, 40, 33, 59, 15, 56].

Definition of the audience and purpose of the indicator

Only a few authors address this first important step [29, 40, 56]. The uses (quality improvement, regulation, purchasing, selection of providers) and the users (clinicians, administrators, purchasers, regulators, patients) of the indicator are important to define, since they will dictate the focus on particular clinical areas and elements of care [40, 60]. Different uses and users also determine the unit of analysis (patient, individual clinician, clinical unit, hospital, nation) [40]. Blumenthal stressed the need for different approaches to the measurement of quality, depending on the different perspectives and definitions of quality of care [61]. For example, managers tend to be more interested in efficiency and outcomes, whereas patients are more focused on structure and communication skills of the providers [13]. Patients' and consumers' views play an increasing role in the assessment of the quality of health care services. Moreover health care plans, organizations and purchasers put emphasis on the organizational performance and on the extent to which health care meet the needs of a group [61]. The DNIP clinical indicators for example were developed to document and improve the quality of care in Denmark [3]. In this particular case the users are the clinical units, the government and the patients. The purposes are quality improvement, quality documentation and selection of providers respectively. The unit of analysis is the clinical unit [3].

Organisation of the measurement team

All key stakeholders need to be involved in the development of the clinical quality indicator. The team should include representatives of the users, the unit of analysis and the administrators whose resources will be used [40]. The multidisciplinarity of the team is also an important issue [56]. Sometimes, quality of care researchers and patients representatives can be included [40, 56]. In the Danish National Indicator Project for example, the government (the Ministry of Health, the counties), the health care providers (physicians, nurses, physiotherapists, occupational therapists) and clinical epidemiological experts were involved [3].

Identification of the potential sources of indicators

A large amount of indicator sets is available, usually developed by governments, health agencies or professional organizations [2, 12, 3]. The first appendix presents the main sets and databases of clinical quality indicators that are used worldwide. The objectives, the description of the sets and the methodology of development are summarized as well as the potential interest for the Belgian health care system.

Most of these indicator sets were developed using a combination of literature searches and consensus techniques. However, a description of the literature search is only rarely provided in detail. These indicator sets are usually found by an internet search, although some of them are published in peer-reviewed literature [62-64].

Rigorously developed clinical practice guidelines are another useful source for clinical quality indicators. For example, the Institute for Clinical Systems Improvement (ICSI) and the National Institute for Clinical Excellence (NICE) systematically provide a list of indicators in each published guideline [65, 66]. The New Zealand Guidelines Group sometimes includes a separate chapter ('appendix' or 'audit') with indicators [67]. The

CBO published a set of clinical indicators based on clinical practice guidelines [15]. An important advantage of these indicators is the potential explicit link with recommendations and levels of evidence. Unfortunately most other guidelines developers hardly ever mention the potential clinical quality indicators related to the content of their published guidelines. An illustration of the use of clinical practice guidelines as a source for clinical quality indicators is found in the KCE report about the organisation and quality of care for type 2 diabetes mellitus [68]. The authors extensively searched quality indicators in 104 guidelines and finally selected 29 potentially useful indicators based on the evidence.

Caution is warranted when searching clinical quality indicators using the above mentioned sources. The transfer of clinical quality indicators between countries needs to take into account the variation in professional culture and clinical practice in order to produce a set of valid and applicable quality indicators for the country [69].

Evaluation of the strength of scientific evidence

Providing an overview of the existing evidence allows the team to take into account the strength of evidence when selecting clinical indicators [40, 33]. The stronger the scientific evidence, the higher the (content) validity of the clinical indicator. Important aspects in evaluating the strength of evidence are the type (e.g. randomized controlled trials) and number of studies (multiple studies or meta-analyses vs. single studies) related to the indicator, and the consistency of the findings [45, 40, 56]. In the case of the Danish National Indicator Project for example, a detailed description of the scientific evidence is provided on the website in Danish [3].

No specific level of evidence scale exists for clinical quality indicators. A possible solution is to use the scales developed for grading clinical practice guidelines [70-72]. An example is the scale provided by the Oxford Centre for Evidence-based Medicine distinguishing therapeutic, diagnostic, prognostic and economic studies. It is a very comprehensive but also a complex scale [71]. The scales used by the Scottish Intercollegiate Guideline Network and the US Agency for Healthcare Policy and Research Classification are easier to use, but only applicable to therapeutic activities [70, 72].

Some healthcare activities (e.g. diagnostic) may not be best evaluated using the randomized controlled trial approach and other evidence-grading scales may be more appropriate in these cases. A good example of a scale grading diagnostic activities is the one provided by Fryback and Thornbury [73]. This grading scale provides a hierarchy of diagnostic efficacy, taking into account the technical efficacy, diagnostic accuracy, diagnostic thinking, therapeutic impact, patient outcome, and cost-effectiveness.

Selection of clinical indicators

Indicators should be selected based on the level of evidence. If no or little scientific evidence is available, expert opinion should be combined with the available evidence using consensus techniques [33].

the *RAND appropriateness method* is a formal group judgment process, which systematically and quantitatively combines expert opinion and scientific evidence [33]. First, the condition to be assessed is selected and a systematic review of the available evidence is conducted to generate the preliminary indicators to be rated. Then, the consensus panel is selected and in a first round postal survey the panelists are asked to critically read the accompanying evidence and to rate the indicators. In a face to face meeting, the panel then discusses and re-rates each indicator. Finally, the final ratings are analyzed and the recommended indicators are developed. This technique has been applied widely [74, 62, 75, 69, 76-82]. The RAND appropriateness method is the only one which explicitly combines scientific evidence and expert opinion using active (face-to-face) discussion rounds to reach a consensus.

the *Delphi technique* is a structured interactive technique involving repetitive administration of anonymous questionnaires, usually across two or three postal rounds [33]. First, the research problem is identified and the statements to rate are developed.

Then, an appropriate consensus panel is selected, preferably including members from different disciplines [83]. Anonymous iterative postal rounds are conducted, with a feedback of the results between the rounds and a summary of the results at the end. The Delphi technique has also been used to develop many indicators [50, 84-90].

the *iterated consensus rating procedure* is based on the impact of guideline recommendations on the outcomes of care [33]. The CBO used this technique for developing their set of clinical indicators [15].

the *nominal group technique* is a group decision process [91]. Its result is a list of proposals and statements ranked by the panel according to their relevance.

Of these four techniques, the RAND appropriateness method is the only one that explicitly combines scientific evidence and expert opinion, and uses active (face-to-face) discussion rounds to reach consensus.

Write the indicator specifications

McGlynn proposed six elements for describing the indicator specifications [45]:

- Definition of the indicator: different specifications are needed to define the indicator (see table 4). For dichotomous indicators, a numerator and denominator need to be specified [56]. For continuous indicators, expressed as a mean, all important details (e.g. the specific context or population) should be specified. At this step, the possibility of missing data should already be explored, since an indicator with a high chance of missing data is of low value. Specific problems that can arise in the interpretation of a clinical quality indicator (see below) should be kept in mind when defining the indicator. For example, continuous indicators – expressed as a mean or a median (e.g. mean glycosylated haemoglobin for a diabetic population) – can have large ranges, which are not visible when the indicator is presented as a single value. A solution is to provide the standard deviation, or to use a cut-off value (e.g. number of diabetic patients with a glycosylated haemoglobin of >9%), transforming the indicator into a dichotomous indicator. Another interpretation problem can arise when 'intermediate outcome indicators' (as glycosylated haemoglobin) are used, not necessarily indicating poor care, but rather poor control [92]. Better is to monitor appropriate responses to poor control (e.g. number of diabetic patients with a glycosylated haemoglobin of >9% where insulin therapy is associated), transforming the outcome in a process indicator.
- Identification of the sample and exclusions: explicit inclusion and exclusion criteria should be defined to reduce potential measurement bias [40]. Other considerations are the use of incident vs. prevalent cases, the description of upper and/or lower limits, and whether the selection should be based on confirmed diagnoses or symptoms or signs [45].
- Definition of the risk-adjustment strategy if necessary [45]: risk-adjustment is a statistical process that ideally equalizes the distribution of factors beyond the providers' control, consequently facilitating valid comparisons between provider outcomes [93]. Process indicators require usually less risk-adjustment than do outcome indicators (see above). Risk-adjustment requires the definition and the measurement of many patient characteristics (e.g. age, gender, anatomical, physiological, disease severity …) that are not always part of routine administrative databases or medical records, and therefore difficult and expensive to collect [44]. An overview of possible factors influencing the outcome of care is provided in table 7 [39]. Freeman identified four principal strategies to minimize their impact, i.e., standardization (e.g. for age and gender), cluster analysis (grouping of units sharing similar socio-economic profiles), Data Envelope Analysis (comparison of a units' actual indicator rate against the best possible rate given its confounding

profile) and multiple regression analysis (information from all units is used to predict the indicator rate that a unit should have, given the values of its confounding variables) [48].

Table 7: Patient- and illness-related factors determining the outcome of care [39].

Patient:
Demographic factors (age, sex, height)
Lifestyle factors (smoking, alcohol use, weight, diet, physical exercise)
Psychosocial factors (social status, education)
Compliance
Illness:
Severity
Prognosis
Comorbidity

- Identification of the data sources and data collection procedures: four sources of data exist, each with its benefits and limitations (see also paragraph 2.2.7): administrative databases, medical records, prospectively collected clinical data, and survey data [45, 40].
- Writing of the data extraction or collection specifications: the population at risk and the method for evaluating the patients' exposure to the specific element of the process representing the clinical indicator should be defined explicitly [40]. If necessary, the specifications must indicate the sample size [45]. Also, detailed instructions should be provided on how to collect the necessary information in a consistent manner in order to compare the results fairly (see also paragraph 2.2.7) [45].
- Writing of the specifications for scoring: a protocol for scoring the indicator should be developed (e.g. the proportion of patients experiencing an event, the proportion of patients above a particular threshold) [40]. However, caution is warranted when applying a threshold – based on strong evidence for a specific population (e.g. diabetic patients treated by a general practitioner) – to another population (e.g. diabetic patients treated in a specialized diabetes clinic). The scoring specifications should also include a plan for handling missing data [45, 40].

Pilot testing

Pilot testing can identify possible areas requiring further adjustment, and can generally be performed on a small sample [40]. During this evaluation, the indicators' reliability and validity should also be tested (see also above) [45, 40]. Indicators with an acceptable reliability and validity will also be tested for the interpretability of their results [45].

Key points

- **Priority setting and defining the audience and purpose of the quality indicator are important first stages in the development and/or selection of clinical indicators.**
- **The development and/or selection of clinical indicators should be based on the evidence, when necessary combined with expert opinion using consensus techniques (e.g. RAND appropriateness method).**
- **After writing the indicator specifications, a final important step is the pilot testing of the indicator.**

2.2.7 Data collection and its potential pitfalls

Clinical quality indicators are precious tools for quality improvement. However, the practice often differs from the theory: the data sources and the data collection can raise potential problems.

2.2.7.1 Problems in relation with the data sources

Most of the data collected from administrative databases and medical records are readily available, but often lack specificity and detail (table 8) [94, 95, 40]. On the opposite, prospectively collected clinical data and survey data are more specific, but expensive to obtain and not readily available.

In an attempt to overcome some of these limitations, the ACHS tried to match ICD-9-CM codes to clinical quality indicators [96]. However, despite its potential (mainly because of its universal use), ICD-9-CM coding was also found to have several limitations, such as a high variability of coding practices [96].

Keating et al. demonstrated that administrative and medical record data provide different information about the quality of diabetes care, hereby suggesting that administrative and medical record data should be combined [97]. This was also demonstrated by Scully et al., who found a large discrepancy (or complementarity) between hospital billing and physician billing sources for a sample of the AHRQ Quality and Patient Safety Indicators [98].

Table 8. Advantages and disadvantages of databases [45, 40].

Type of data	Advantage	Disadvantage
Administrative data	Readily available Inexpensive to collect	Lacks specificity and detail
Medical record data	Available More detailed than administrative data; most complete source of information on diagnosis, treatment and outcomes If standardized in an electronic medical record, reduces data collection burden	Expensive to obtain May have insufficient detail Less available in automated form
Prospectively collected clinical data	Most specific; can define exactly what data are required Quality control of data collection	Not readily available Expensive to obtain unless already incorporated into electronic medical record
Survey data	Can collect what is important to patients Collects data not otherwise available	Not readily available Expensive and timely to collect and analyze Valid instrument required, because of the potential for bias

2.2.7.2 Problems in relation with the data collection

The process of data collection should produce valid and reliable data to be used for measuring clinical quality indicators. However, the consequences for the health care provider sometimes flaw the results. Data collected for quality measurement can be manipulated ('gaming'), in order to influence the consequences of their use by external users (as the stakeholders or the patients). The objective may be to avoid punishment or embarrassment [41, 95, 99]. The perspective of an accreditation or extra payment can also

trigger the data manipulation [100]. This is particular true for external and summative indicator systems (see below) or when data are publicly released.

Under- or over reporting of indicators can also be due to unintentional errors, such as wrong coding or insufficient training of administrators [29].

Another threat is a phenomenon called 'ascertainment bias': the staff working in better quality facilities are more likely to discover negative health outcomes than in lower quality facilities, paradoxically leading to worse quality indicator rates [100].

'Sampling error' occurs when data are routinely collected during a fixed reference period, causing many events to be missed because they fall outside this reference period [100]. In our Belgian context, this potentially applies to the use of data from the Nursing Minimum Data Set [101].

2.2.8 Data interpretation and its potential pitfalls

Two frequent pitfalls must be considered when interpreting the results of a clinical quality indicator, i.e. the "regression to the mean" and the misuse of "league tables". The "regression to the mean" occurs whenever a sample is selected from a population and two imperfectly correlated variables are measured [99]. As an example, two consecutive blood pressure measurements are taken on the same person on different occasions: these measurements will have correlation <1 because of the inevitable random measurement error and biological random variation. The less correlated the two variables (or the larger the random error), the larger the effect of regression to the mean. Also, the more extreme the value from the mean, the more room there is to regress to the mean. For example, a hospital having a high score on a quality indicator during one year will probably also have a good score the next year, but probably closer to the average score, without any change in the underlying true value. Understanding the phenomenon is a first step to overcome the problems caused by regression to the mean [102]. Sequential testing to get an average value (e.g. in the clinical setting, taking the average value of several sequential blood pressure measurements tends to reduce the random individual variation) is a solution for some variables.

Indicators are often presented as "league tables" leading to comparisons between providers/organizations [103, 99]. Even if the care in all compared providers/organizations is of low quality, one will be ranked as the best, leading to unnecessary praise. On the other hand, when comparing high-quality providers/organizations, one will be ranked as the worst, leading to unnecessary sanction [48]. A possible solution is the inclusion of confidence intervals, although some issues still remain with that approach, such as which methodology to use to compute the confidence interval and how to deal with multiplicity testing [104]. Marshall et al concluded that any performance indicator should always be associated with a measure of sampling variability. Other solutions include the assessment against a fixed baseline (e.g. a desired score for a quality indicator), the use of funnel plots or the estimation of an underlying trend if there are sufficient data points.

2.2.9 Overview of the benefits and problems in relation with the use of clinical quality indicators

Clinical quality indicators are of great value for health care quality improvement if they are used in the right way. It is important to recognize that they are indicators only, rather than definitive judgments about quality [33]. Table 9 summarizes the benefits and problems linked to the use of clinical quality indicators for improving quality [105, 106, 99]. The main benefit is the emergence of a culture where quality of care is essential. The potential pitfalls when using clinical quality indicators have been detailed in the previous paragraph.

Table 9. Benefits and problems of using clinical quality indicators [105, 106, 34].

Benefits
Create a culture in which quality of care is the centre of attention Focus attention on variations in outcome and/or practice, which may be worthy of further investigation Provide useful clues and evidence about the quality of care or performance Help to identify unacceptable and poor performance and to highlight examples of good practice Stimulate informed debate about quality of care and level of resources Stimulate and motivate change where necessary Help target resources to areas of greatest need Facilitate an objective evaluation of quality improvement initiatives Inform purchasing decisions and planning of service agreements Focus attention on the quality of information in hospitals Can be quicker and cheaper tools for quality assessment than other tools, e.g. peer review Allow comparisons between health care institutions, comparisons with gold standards or follow-up over time
Problems
Scope: Encourage a fragmented approach to an holistic and integrated discipline Assess only easily measurable aspects of care and fail to encompass the more subjective aspects Do not include the patients' views about outcome and/or practice Technical problems (cf. above) Are based on dubious quality data and information that is difficult to access Are difficult to interpret (e.g. apparent differences in care may relate more to random variation, case mix or case severity, rather than real differences in the quality of care) Can be expensive and time consuming to produce (the cost-benefit ratio of measuring quality of care is largely unknown) Can be time consuming in producing the data and acting on the findings Consequences: Encourage a blame culture and discourage internal professional motivation Lead organizations to focus on measured aspects of care to the detriment of other areas and to concentrate on the short term rather than adopting a long-term strategic approach Erode public trust and professional morale if deficiencies in the quality of care are highlighted Encourage massaging or manipulation of data by health professionals or organizations if the results of indicators are published

2.2.10 Use of clinical quality indicators for governmental policy

Clinical quality indicators or indicator systems can be used by a local, regional or national government for different purposes (table 10) [43, 95, 107]:

- Support or guidance by the governments of the quality policy of health care organizations. Indicator-based information allows making more informed decisions and priority settings (see above). The Dutch Prestatie-indicatoren for example are used by the Dutch government to detect areas that need further exploration, in order to adjust the quality policy of health care organizations [108]. Above this, these indicators are used by the health care organizations themselves to stimulate internal quality improvement. In Denmark, indicators and standards for six diseases have been implemented in all clinical units and departments, and participation is mandatory [3]. All clinical units and departments receive their results monthly, and national and regional audit processes are organized to explain the results and to prepare implementation of improvements [3]. The AHRQ quality indicators in the US were also developed to improve the quality of health care on the level of institutions [11].
- Indicator-based information gives governments the opportunity to determine goals within the current health policy, and to evaluate the

adherence to these goals. This can be done by evaluating trends on the organizational level or by benchmarking between organizations.

- A government can make its health policy the subject of indicator-based information, for example by evaluating the outcomes of preventive actions. The OECD indicators for example can provide governments information on their performance on preventive services (like vaccination or screening) in comparison to other countries [18]
- The use of indicators makes governments and health care organizations more accountable, not only to each other (e.g. the PATH project [109]), but also to the public. With indicator-based information, the government can objectively demonstrate that they are making progress in their efforts to improve the health system and that the taxpayers' money is being managed properly. In the Netherlands for example, the government forces health care organizations to make their results on the Dutch Prestatie-indicatoren public [108]. In Denmark, the results of the indicators are published in order to inform the public, and to give patients and relatives the opportunity to make informed choices [3].
- Financing. Indicator-based information can be used to support the recognition, accreditation and/or financing of health care organizations. An example is the NHS, which uses indicator data to reward hospitals [12]. Another example is the Joint Commission which obligates health care organizations to use indicators and indicator systems in order to receive reimbursement for insured patients [27].

Table 10. International examples of indicator use by governments.

Agency, project (country)	Government involved	Purpose
National Indicator Project (Denmark) [3]	Ministry of Health, counties	Quality assurance Accountability
NHPC (Australia) [9]	Ministry of Health	Accountability Financing (local) Quality assurance
Prestatie-indicatoren (Netherlands) [108]	Inspectie voor de Gezondheidszorg (Ministry of Health)	Quality assurance Accountability
NHS (UK) [12]	Department of Health	Accountability Financing
AHRQ (US) [11]	U.S. Department of Health and Human Services	Quality assurance

Key points

Governments can use indicators:

- **to support/steer quality policy**
- **to evaluate current health policy**
- **for accountability**
- **for financing**

3 PROPOSAL FOR A CONCEPTUAL FRAMEWORK IN A BELGIAN CONTEXT

A conceptual framework was elaborated for the development of a set of clinical quality indicators. This framework is a flowchart that integrates the theory and practice. The development of this framework is based on the literature review described in the previous chapter. Moreover, the content of two recent projects was consulted. The first project is the Performance Assessment Tool for quality improvement in Hospitals (PATH project). It was launched by the WHO in 2003 [109] and it will be discussed in detail in chapter 4. The second recent project is the Health Care Quality Indicator (HCQI) project described in a recent OECD report. It was published after the literature search date of this project and therefore it is not included in the literature review [19].

The focus of the current project are the quality of care dimensions 'effectiveness' and 'efficiency', which in fact is a narrower scope than the PATH project (figure 2) [109] and the HCQI project (figure 3) [19].

Figure 2. The PATH theoretical model for hospital performance [109] and focus of current project.

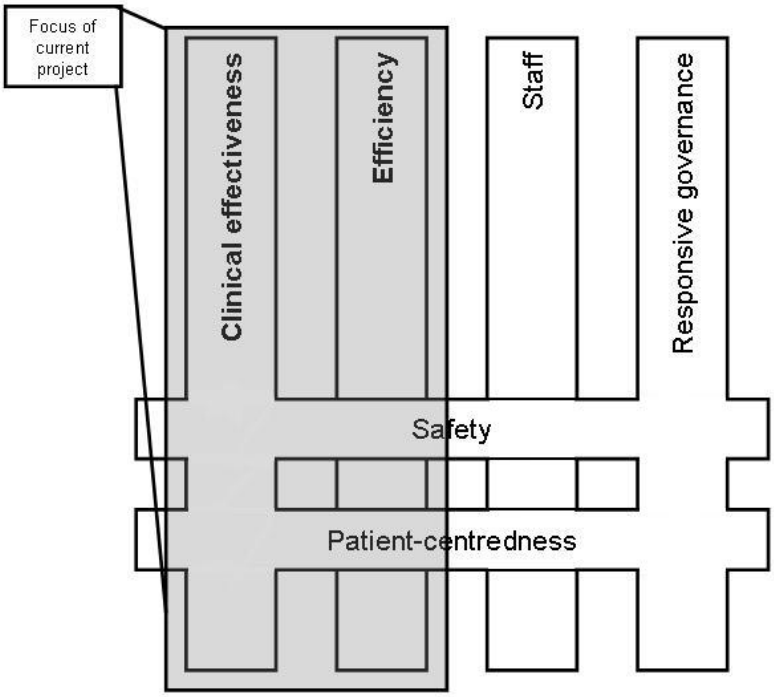
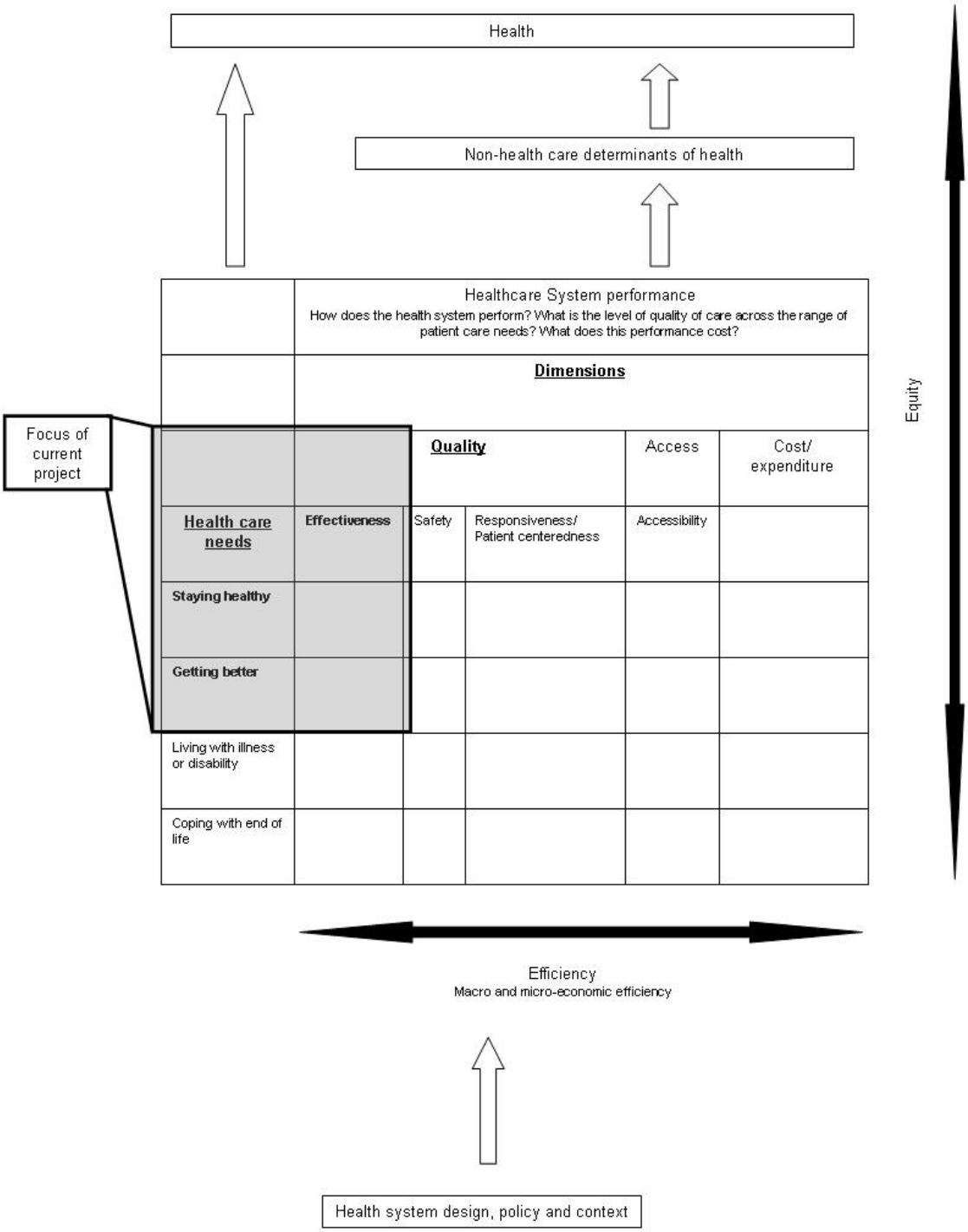


Figure 3. Conceptual framework of the HCQI project [19] and focus of current project.



Four main steps are proposed for the development and use of clinical quality indicators in the Belgian health policy context (figure 4): 1. definition of a quality policy within the national Belgian health policy; 2. priority setting; 3. development of a set of quality indicators using an appropriate methodology and sources; 4. dissemination and implementation of the quality indicators at the policy and health care provider level. Once the quality indicator system is in use, it has to be regularly evaluated and updated. The ultimate goal of the indicator system is an improvement of the quality of health care and an improved health status. This link between the health policy, quality of health care, and health was well described in the OECD report [19].

The described framework focuses on clinical quality indicators, but can in fact be applied to quality indicators in general.

3.1 DEFINITION OF A QUALITY POLICY WITHIN THE NATIONAL HEALTH POLICY

The Belgian health care system needs first to set up a well-defined quality policy within the national health policy. A *national health policy* can be defined as a formal statement by the government that encompasses the necessary strategies to achieve the health objectives as determined by the policy makers and society. Within the national health policy, the *quality policy* helps to achieve these health objectives by assuring the quality of health care. As there is no widespread accepted operational definition of *quality of health care*, the concept 'quality of health care' encompasses here the generally accepted attributes of good care: safe, effective, patient-centered, timely, efficient, equitable, and continuous and integrative (table 11). The last characteristics 'continuous and integrative' – as proposed by the Health Services Research Group and O'Leary et al. [25, 27] – complete the six characteristics defined by the Institute of Medicine (IOM) [24].

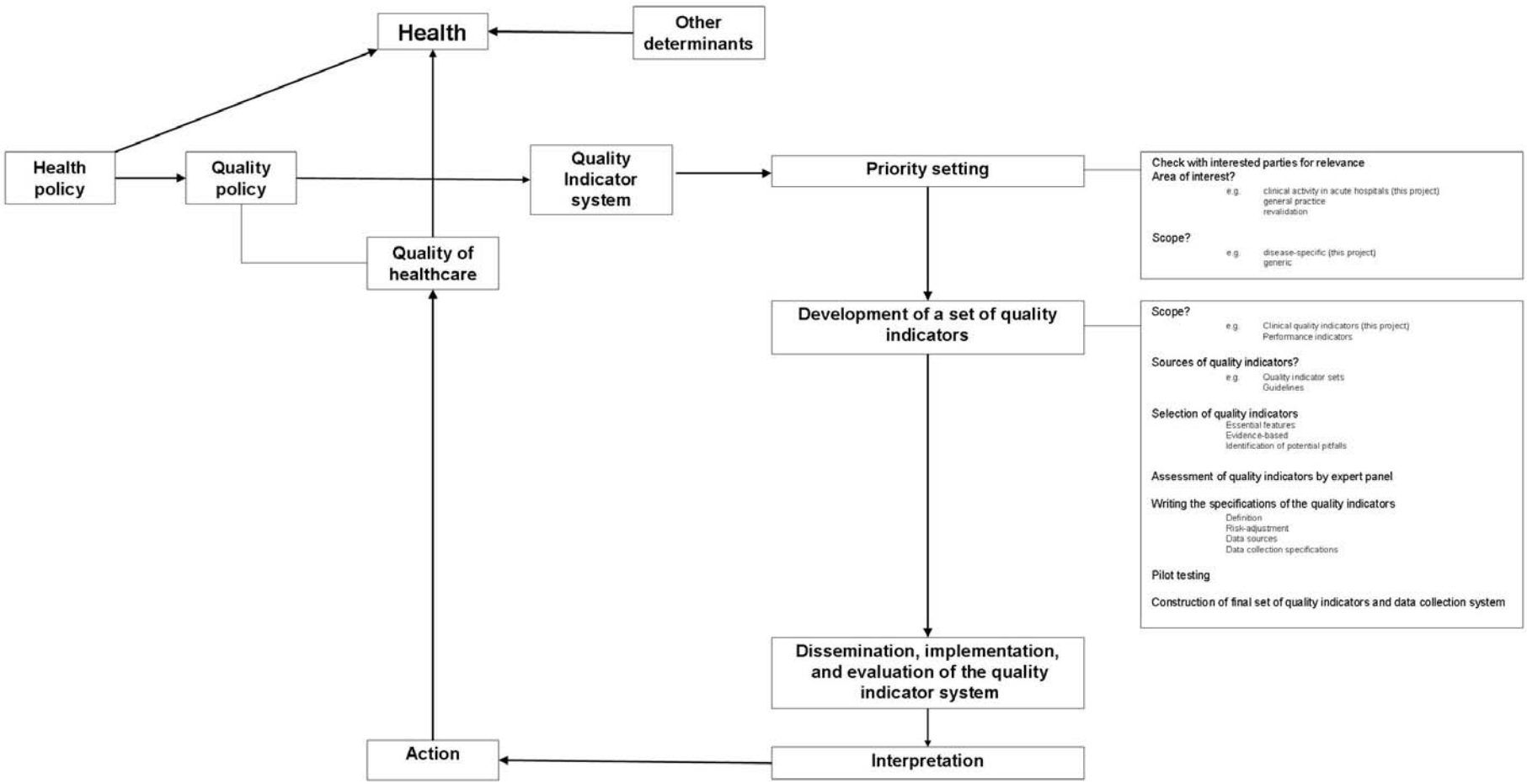
Within the quality policy, a *quality indicator system* is defined as an initiative where data on a set of quality indicators are systematically collected, summarized, and used for feedback to stakeholders. *Quality indicators* are quantitative and thus measurable elements of health care that give an <u>indication</u> of its quality related to at least one of the 7 key characteristics. A quality indicator does not judge the quality of health care, but helps its user to make this judgment. As such, it is an instrument that can be used to support decisions and to highlight choices in order to improve quality.

The objectives of the quality indicator system are described in the quality policy. Possible objectives are the support of internal quality improvement initiatives or the identification of potential problems at the provider level, or external benchmarking, accountability, accreditation, or health policy assessment and orientation at the policy level. A description of the coordination of the data collection will also be provided. Quality indicator systems used for policy reasons obviously are coordinated on the national or regional level. However, the ownership of the data (government, hospitals, and providers), the level of aggregation, and the possible users (government, hospitals, providers, patients) should be defined.

Table 11. Quality of care: dimensions [25, 27, 24].

Dimensions	Definitions
Safety	Avoiding injuries to patients resulting from the care that is intended to help them (e.g. complications, medication errors …).
Effectiveness	Providing services based on scientific knowledge to all who could benefit, and refraining from providing services to those not likely to benefit.
Patient-centeredness	Providing care that is respectful of and responsive to individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions.
Timeliness	Reducing waits and potentially harmful delays for both those who receive and those who give care.
Efficiency	Avoiding waste, including waste of equipment, supplies, ideas and energy.
Equity	Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location and socioeconomic status.
Continuous and integrative	Seamlessly proceeding from diagnosis to after-care, and integrating the contribution off all caregivers involved.

Figure 4. Conceptual flowchart for the development and use of quality indicators for policy reasons in a Belgian context.



3.2 PRIORITY SETTING

The identification of an area of interest requiring a quality measurement can be done based on the four criteria proposed by McGlynn: impact on health, level of evidence, potential for improvement, and controllability [45]. The selection of this area of interest should also take into account the health objectives of the health policy. For the present project the area of interest is the *clinical activity in acute hospitals*, defined as the inpatient medical-technical interventions (processes) aiming at improving, maintaining or slowing down the deterioration of the condition of the patient (outcomes). Other possible areas of interest – though not addressed in this project – are general practice, revalidation, nursing care, non-clinical patient outcomes (e.g. patient satisfaction), logistics … Some of these areas will be addressed in future KCE projects.

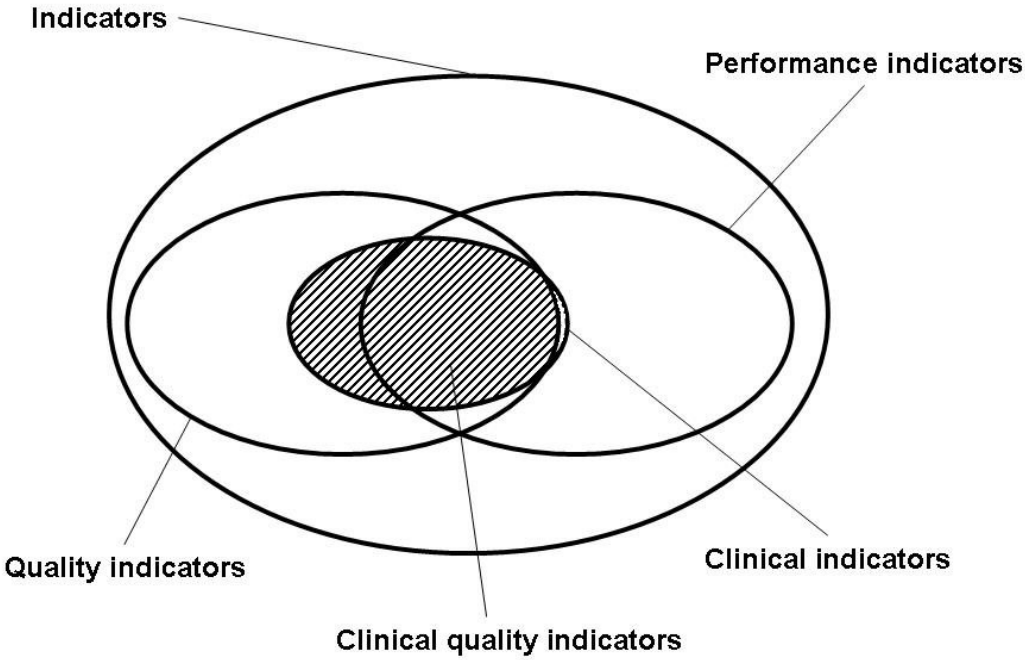
Priority setting also implies the demarcation of the scope of the quality indicator system, i.e. a generic approach (independent of the disease, e.g. patient safety, surgery …) or a disease-specific approach (e.g. stroke, diabetes …). An example of a disease-specific approach is the recent diabetes project of the KCE, where the quality indicators apply to different levels of care, i.e. individual, regional and policy level [68].

The priority area should be checked with interested parties (e.g. authorities, RIZIV/INAMI, public health experts, citizens) for its relevance.

3.3 DEVELOPMENT OF A SET OF QUALITY INDICATORS

Once a priority area is agreed on, a set of quality indicators can be developed. Since the area of interest in this project is the clinical activity in acute hospitals, the four quality indicator sets of the feasibility test (see chapter 5) were limited to *clinical quality indicators* (figure 5). A clinical quality indicator is a quality indicator that gives an indication of the quality of the medical-technical interventions (process indicator) and/or their (desirable and undesirable) outcomes (outcome indicator).

Figure 5. Relationship between clinical quality and other indicators.



The development of a set of clinical quality indicators comprises a number of essential phases:

3.3.1 Search for appropriate sources of clinical quality indicators:

When developing a set of clinical quality indicators, appropriate sources have to be searched. In a Belgian context, existing Belgian quality indicator sets and/or guidelines are preferred. Existing international quality indicator sets and/or guidelines from countries with a similar population and culture are appropriate alternatives. However, these foreign sets and/or guidelines should be carefully checked for their relevance for the Belgian healthcare system (see appendix 1).

3.3.2 Selection of clinical quality indicators:

The selection of the identified clinical quality indicators is based on three main questions:

1. Does the clinical quality indicator have the essential features of a quality indicator?

2. The identification of potential pitfalls linked with the measurement of the clinical quality indicator.

3. Is the clinical quality indicator evidence-based?

1. A clinical quality indicator needs to be relevant, valid, feasible, reliable and bearing a potential for improvement within the context and the organizational level (micro-, meso-, macro-) at which it will be used. These attributes must be appreciated more specifically with

regards to the Belgian healthcare system. Specificity/sensitivity, interpretability, discrimination and adjustability will be used to select quality indicators if a formal pilot testing is already described and the results are available.

2. The use of clinical quality indicators as instruments for quality assurance can induce perverse behavior, e.g. gaming (over- or underreporting of data) and cream-skimming (selection of 'good' patients). Clinical quality indicators can also focus attention on one area, while leading to the negligence of other areas. These unwanted effects of clinical quality indicators should be anticipated.

3. A clinical quality indicator should be evidence based (high content validity), integrating the best research evidence, clinical expertise and patient values. For each possibly relevant clinical quality indicator the best research evidence should be searched, and a level of evidence should be assigned. Preferentially, clinical quality indicators with a high level of evidence are selected. The evidence should be identified in a context that is applicable to and relevant for the Belgian population and the Belgian healthcare system.

In our explorative study specific attention will be given to this aspect (see chapter 5).

3.3.3 Assessment of the quality indicators by an expert panel:

The selected indicators should be evaluated by a group of experts using a formal group judgment process (RAND appropriateness method), which systematically and quantitatively combines expert opinion and scientific evidence. The selection of the experts will be based on their knowledge of the topic and/or quality measurement. During the judgment process, the experts should assess the selected indicators on their relevance, validity (including content validity), feasibility, and potential for improvement.

3.3.4 Writing the specifications of the quality indicators:

Once the clinical quality indicators are identified, selected, and evaluated by an expert panel, the specifications have to be written. This phase implies a number of steps:

Defining the selected clinical quality indicators: the numerator and denominator of the indicators should be unambiguously described. Explicit in- and exclusion criteria of both the numerator and denominator should be provided. The definition of the numerator, the denominator, and the in- and exclusion criteria will also indicate the specifications for scoring the indicator (e.g. proportion of patients, use of a threshold …).

Defining risk-adjustment strategies when necessary and when possible: risk-adjustment is a necessary step for the interpretation of the clinical quality indicator results. It requires the definition and the measurement of possible confounding variables (e.g. age, gender, comorbidities, treatment …).

Identification of available data sources: available data sources should be assessed for their relevance and accessibility. Preferentially, these data sources should contain systematically collected data as it is the case for example for MCD, MFD and Minimal Nursing data (MND) (see chapter 4). The data sources should be checked for their completeness and their validity (which is known to be poor for the MCD, MFD, and MND databases). This step will identify the need for additional specific data collection. Eventually, some clinical quality indicators may have to be modified according to the strengths and limitations of these data sources.

Writing the data collection specifications: in case additional data collection is needed, the data should be collected in a consistent manner in order to compare the results fairly. The method for evaluating the patients' exposure to a process or for evaluating an outcome should be defined explicitly.

3.3.5 Pilot testing

Pilot testing aims at identifying areas that require further adjustment. It can generally be performed on a small sample of cases. During this evaluation, the indicators' attributes (as mentioned above) and the analysis, interpretation, and presentation of the results must be tested. After the necessary adjustments identified during this pilot testing, the final set of clinical quality indicators can be constructed and a data collection system can be created.

3.4 DISSEMINATION AND IMPLEMENTATION OF THE QUALITY INDICATOR SYSTEM

Using an appropriate method for developing clinical quality indicators (as described above) is no guarantee for a successful utilization of the system. A detailed justification and explanation of the clinical quality indicator system, its purposes (see above), and its place in the health and quality policy should be provided to the interested and involved parties. The barriers to use the system should be as low as possible at the provider level, e.g. by using routine data and by minimizing the need for additional data collection. Logistic support should be provided to the providers where needed and if feasible.

Regular evaluation of the system is needed to identify unresolved flaws and to keep the system up-to-date. This evaluation and updating can imply running through the four steps again.

4 AVAILABILITY OF HEALTH AND QUALITY INDICATORS IN BELGIUM

In Belgium, the competences concerning health policy are divided between the different governments. There are six governments, which have the same decision-making power on their own level: the Federal, the Flemish, the French Community, the German-speaking Community, the Walloon Region and the Brussels Capital Region. As a consequence, the provision of health information is scattered. Though many health data are available in Belgium, they are not (yet) integrated into a national health information system.

As well as on governmental as on non-governmental level, various initiatives for developing and measuring quality indicators exist in Belgium for different purposes. On the other hand, databases containing health care information and maintained by the government or by private organizations are available for indicator use.

4.1 BELGIAN INITIATIVES FOR MEASURING HEALTH AND QUALITY INDICATORS

4.1.1 PATH-indicators (Performance Assessment Tool for quality improvement in Hospitals)

4.1.1.1 Aims

In 2003, the World Health Organisation (WHO) Regional Office for Europe launched a project aiming to develop and disseminate a flexible and comprehensive tool for assessment of hospital performance [109]. This project aims at supporting hospitals in assessing their performance, questioning their own results and translating them into actions for improvement, by providing hospitals with tools for performance assessment and by enabling collegial support and networking among participating hospitals. It also pursues the goal of building on the dynamics of national and international comparisons through benchmarking networks. In Belgium, this project was co-coordinated by the Ministry of Health, Food chain safety and Environment.

4.1.1.2 Indicator source

For the indicator selection, a list of 100 hospitals performance indicators was identified through a review of the literature. Indicators were assessed against a series of criteria by an expert panel through a nominal group technique. Indicator selection was based on evidence gathered through the preliminary review of the literature and on a survey carried out in 20 countries. A set of 24 core performance indicators was selected with detailed operational definitions. Eight performance indicators can be identified as being clinical:

- caesarean section delivery
- prophylactic antibiotic use
- mortality
- readmission
- admission after day surgery
- return to higher level of care within 48 hours
- sentinel events
- breastfeeding at discharge

4.1.1.3 Methodology of data collection

The participating hospitals collected their data for the indicators in excel-sheets, which were sent to coordinators for analysis. Each hospital received a feedback report with benchmarking on national and international level.

4.1.1.4 Current status

The PATH pilot project was implemented in 66 hospitals in 8 countries (22 hospitals in Belgium) from March 2004 to November 2005 and the project partners are still evaluating the results. An international meeting was organized in June 2006, where the definitive results and the perspectives of the project were discussed and presented. Next steps in the project will be to refine the indicators by the end of august 2006 and to organize a meeting with the core members in autumn. A web-based interface will be provided for the participating hospitals and a new wave of data collection should be finished by the end of 2006. The group of participating countries will expand with 2 and the project's aim is to evolve to a group of 200 participating hospitals.

4.1.2 Multi-dimensional feedback for the hospitals from the Ministry of Health, Food chain safety and Environment

4.1.2.1 Aims

The application of the PATH project in Belgium showed that a strong demand exists among the hospitals to receive regular feedback from basic administrative data, with a comparison on the national level to define priorities for improvement. Therefore, the federal government engaged itself to provide feedback from their extended databases to the hospitals. This multidimensional feedback contains an analysis of information regarding financial performance, capacity and innovation, clinical performance and risk management, and patient population [7]. It allows hospitals to position themselves to the national average and to determine opportunities for improvement within their organisation. This interpretation of the results has to take account of the case-mix in each institution.

The federal government stresses that this feedback system is not developed to serve as an external evaluation instrument and is not meant to compose a "hit parade" of hospitals.

4.1.2.2 Indicator source

In the first stage of the project, 11 indicators were selected based on availability of data (MKG 2000-2003, Finhosta 2001-2004, Sociale Balans 2003 and the survey "Jaarlijkse Ziekenhuisstatistieken" 2002-2003), potential for improvement and content validity. They result from an exhaustive literature review and are inspired by national experiences and international similarities. In the future, a steering committee composed of voluntary hospitals will be established to evaluate the correctness of the feedback, to revise the initial list of indicators, to stimulate the use of indicators and to collect reactions from the users.

4.1.2.3 Methodology of data collection

The feedback is base on the administrative data from the Ministry of Health, Food chain Safety and Environment (including the MCD and the MND databases) In the future each hospital will receive a login and password in order to transmit their data anonymously via a secured internet connection. In order to support the broad perspective of hospital performance, the feedback is provided in balanced scorecards.

4.1.2.4 Current status

The first (paper) version of the feedback aimed to explore the possibilities of the administrative databases in connection with performance improvement. An internet version of the feedback will be available soon and will provide a synthesis table that summarizes the hospital's results and the comparison with the national average. A committee was created to spread the use of indicators and to evaluate the existing list of indicators.

4.1.3 Health indicators from the Scientific Institute of Public Health (IPH)

4.1.3.1 Aims

Since 1997, the Scientific Institute of Public Health (IPH) provides communication of Belgian health information to international organizations (WHO, EU, OECD)[110]. The IPH coordinates the collection of Belgian data for yearly updating of the "Health for All" database of the Regional Bureau for Europe, which is part of the WHO. The institute also answers questions concerning health, coming from WHO, OESO, European Commission and other national organizations.

The data are used to make an estimate of the general health condition of the Belgian population. Remarkable results can lead to new health policy priorities and projects.

4.1.3.2 Indicator source

Belgian data are collected from existing databases for health indicators concerning demographic and socio-economic statistics, health status, lifestyles, environment, and health care. The following clinical quality indicators (as defined in this project) can be identified:

number of dead-born fetuses with a weight of 1000 g or more

number of early neonatal deaths with a birth weight of 1000 g or more

number of live births with a birth weight of 1000 g or more

number of early neonatal deaths

number of dead-born fetuses

number of maternal deaths

average length of stay, all hospitals

average length of stay, acute care hospitals

number of caesarean sections

Percentage of live births weighing 2500 g or more

Surgical wound infection rate (%), all operations

4.1.3.3 Methodology of data collection

They monitor the population health status by secondary data collection on health indicators (selected by WHO, OECD) using data from birth and mortality statistics, registers of morbidity, and punctual or periodical health surveys conducted within the general population or specific target populations.

4.1.3.4 Current status

Data are collected through continuous data collections, surveys and temporary projects. The results are publicly available.

4.1.4 Quality indicators from the Initiative for Quality Promotion and Epidemiology in Diabetes Care (IQED)

4.1.4.1 Aims

The IQED project evaluates and promotes continuously the quality of diabetes care in the Belgian convention centers through collection of quality indicators and feedback [111].

4.1.4.2 Indicator source

Most important indicators of diabetes care were selected using the content of the Belgian diabetes guidelines.

4.1.4.3 Methodology of data collection

All Belgian diabetes convention centers participate obligatory to the data collection during two months every 12 months. Per convention centre, data of randomized selection of 10% of the patients (that fulfill certain conditions) are collected. This might cause sampling errors, as explained in the literature review (paragraph 2.2.7). The data are collected through specific registration software. The convention centers receive feedback through benchmarks, radar graphs and percentile lists, indicating the centre result and the position in relation to the other participating centers.

4.1.4.4 Current status

IQED evaluates and promotes continuously the quality of diabetes care in the Belgian convention centers through collection of quality indicators and feedback.

4.1.5 Colleges of physicians

4.1.5.1 Aims

In 1999, the Colleges of physicians were created to promote the quality in different medical specialties (cardiology, geriatrics, medical imaging, nephrology, oncology, neonatology, radiotherapy, reproductive medicine, intensive care, ambulatory care) [112].

4.1.5.2 Indicator source

The mission of the Colleges is to determine quality indicators and evaluation criteria which describe good medical practice, and to elaborate a registration model and a type of report.

4.1.5.3 Methodology of data collection

In the future, the registered data should be controlled and annually published nationally. Feedback should be provided to the hospitals and physicians involved.

4.1.5.4 Current status

Most Colleges have not progressed thoroughly in the dynamic to effect the quality cycle. In table 12, the main indicator fields defined by the different Colleges are listed. These indicators, however, do not answer expectations as defined for this project. They stay very vague and are not yet ready to be implemented in a systematic registration system (personal communication with Pascal Meeus).

Table 12: Indicator fields for each College of physicians.

College	Indicator field
Cardiology	Cardiac infarct mortality
Interventional cardiology	Post interventional morbidity and mortality
Electrophysiology and pacing	Appropriate indication for removal and pacing
Cardiac surgery	Benchmarking based on the register
Geriatrics	Early evaluation of geriatric patients
Imaging: radiology and echo	Respecting the guidelines of exam prescription
Imaging: nuclear medicine	Modalities to elaborate pulmonary knot suspect
Nephrology	
MIC	Existence and adequacy of a transfer policy
NIC	Benchmarking based on the register
Oncology	Results of choriocarcinoma care
Radiotherapy	Existence of a dosimetry
Reproductive medicine	Reduction of multiple pregnancy
Intensive care	Non-invasive ventilation
Ambulatory care	Accidents MUG (Mobiele Urgentiegroep)/SMUR(Service mobile Urgence)

Next to these indicators, some medical specialty groups systematically register specific data. The Belgian Society for Cardiac Pacing collect data concerning pacing through the internet. The Belgian Society of Gerontology and Geriatrics developed a "Belgian Minimum Geriatric Screening Tool" (BMGST). The Belgian Society of Nephrologists collects data that feeds the register of the EDTA (European Dialysis and Transplant Association). Centers of Reproductive Medicine have a systematic and mandatory register. These registers can serve as data sources for indicator use.

4.1.6 Use of quality indicators by the National Health Insurance Institute

4.1.6.1 Aims

The RIZIV/INAMI coordinates initiatives for the quality promotion using indicators based on prescription data and on data about tests and procedures performed by the caregivers [113]. The objective is to stimulate the discussion about specific themes within the local peer review groups for quality evaluation.

The priorities are defined by the National Council for the Promotion of Quality (CNPQ/NRKP). The CNPQ/NRKP is a platform composed of representatives from the Authorities, health insurance companies, scientific organizations, universities, and trade unions. They agree on a priority suitable for quality improvement initiatives.

4.1.6.2 Indicator source

The selection of the clinical quality indicators is based on guidelines (as the Belgian guidelines for antibiotics prescription) or on an "ad hoc" systematic literature review performed by the KCE (as for the pre-operative tests) [114].

4.1.6.3 Methodology of data collection

The prescription data used for the measurement of the indicators are extracted from Farmanet, a continuous registration system of prescription data. The data source for the measurement of the indicators relating to tests or procedures is the Intermutualistic Agency (IMA) that purposely collects the data related to the topic studied.

The scientific content of the feedback is based on existing guidelines or systematic reviews performed by the KCE. The participants of the CNPQ/NRKP platform agree on the content of the feedbacks that are next tested on a purposive sample. The feedbacks are sent to the physicians together with an evidence-based scientific message.

4.1.6.4 Current status

The data are collected either routinely (for the prescriptions) or on a project basis. The interpretation of the results relies on an anonymised comparison with the local, regional and national peers.

The following topics have already been chosen for feed-backs: the prescription of antibiotics, of antihypertensive agents, the pre-operative tests, mammography screening (2006), tests for the follow-up of low risk pregnancies (end 2006).

4.1.7 Clinical performance indicators for the health quality policy of Flemish hospitals

4.1.7.1 Aims

According to the Quality Decree of October 17th 2003 of the Minister-President of the Flemish Community, hospitals and other health care organizations need to maintain a quality management system. Therefore, a set of 69 clinical performance indicators was developed by the Centre for Health Services and Nursing Research (K.U.Leuven) and placed at the disposal of the organizations, in order to support their self-evaluation [6]. The indicators are subdivided in 12 domains: mortality, decubitus, falls, unplanned readmissions, unplanned transfer of inpatients, obstetric patient care, emergency patient care, ambulatory patient care, thrombo-embolic complications, infections, transfusion reactions, and use and distribution of medication.

4.1.7.2 Indicator source

Next to 8 existing indicator sets (table 13), 34 other literature sources were used for the indicator selection. The indicators were checked for essential characteristics (validity, reliability, potential for improvement, interpretability, evidence-based, process/result, generic/specific and case mix) and their relation with at least one feature of good quality care (safe, effective, patient centered, timely, efficient, equitable and continuous). In the end, the indicators were evaluated and completed by a group of experts.

Table 13: indicator sets used as a source for selection

USA, AHRQ Quality Indicators
USA, JCAHO Core Measure sets
USA, JCAHO ORYX non-core measures
UK, NHS Performance Indicators: February 2002
Scotland, Clinical Outcomes Working Group, Clinical Outcome Indicators
Sweden, National health care Quality Registries in Sweden 1999
Denmark, The National Quality Indicator Project
USA, Quality Indicator Project

4.1.7.3 Methodology of data collection

Initially, the Flemish government planned to develop a system to create a Flemish database and to provide feedback to the hospitals. However, up to now the Flemish government only provides feedback for the indicators that overlap with the MKG registration, for which information is transmitted by the federal government.

4.1.7.4 Current status

The development of a full-operational indicator system is not yet finished and is complicated by the fact that hospitals are free to choose for which indicators to register data. For now, hospitals use these indicators for self-evaluation and reporting towards the inspection. The use of the indicators is not mandatory, but merely one of the tools that can be applied to meet the obligation of self-evaluation.

4.1.8 Health indicators from the Flemish government

4.1.8.1 Aims

The health care administration of the Flemish government uses health indicators to collect data about the health condition of the Flemish population [115]. The data are used to guide the health policy in monitoring problem areas and in evaluating existing measures. They can also be used to identify new problems and to detect gaps in the health policy.

4.1.8.2 Indicator source

The indicators are derived from national mortality and birth statistics in the existing databases.

4.1.8.3 Methodology of data collection

The data are gathered with certificates and registration forms filled in by health professionals, administrative and municipal workers. These health indicators capture information concerning mortality, disease and health, and health care availability.

4.1.8.4 Current status

The data are available for all health professionals and policy makers, but also for the entire Flemish population.

4.1.9 Navigator©

4.1.9.1 Aims

The Centre for Health Services and Nursing Research (KUL) developed a proprietary indicator system with clinical performance for hospitals to monitor their quality of care and for comparison with other hospitals. All 388 process and outcome indicators are classified in 15 domains: mortality, decubitus, hospital falls, fixation, unplanned readmission, unplanned changes in health care process, obstetrics, emergency care, ambulatory care, thrombo-embolic complications, transfusion reactions, use and distribution of medication, antibiotics, and patient safety [116].

4.1.9.2 Indicator source

The indicator set is developed in the same way as the 69 clinical performance indicators mentioned in 4.1.7. Therefore, these clinical performance indicators are all integrated in the navigator© indicator set. The set is still growing by searching recent literature and pathology specific databases.

4.1.9.3 Methodology of data collection

Since January 2004, acute hospitals can sign in to the system. At present, 35 acute hospitals work with the navigator© indicator system. Each hospital chooses indicators that correspond with their own priorities and possibilities for improvement. Every three months,

navigator© offers a standard report with information concerning the hospital's evolution and a positioning compared to other hospitals that register data for the same indicators. Additional exploration functionalities with statistical process control permits hospitals to systematically monitor and steer their quality of care.

Navigator© also includes an extended network between hospitals. Participating hospitals are urged to attend 3 introduction courses in order to learn how the indicator system is constructed, how to register correctly and how to use all software instruments. They can log in to the navigator© website [116] where they can communicate (anonymously or not) with other hospitals and ask questions on the discussion forum and find extra information in the Navigator© library. Working groups with participating hospitals are organized in order to discuss reliability and correctness of registration of indicators, and to exchange ideas and experiences for actions for quality improvement.

4.1.9.4 Current status

After 2 years, the Navigator© indicator system and its network have grown and the number of participating hospitals increases every year. Up to now, the data collected by Navigator© is not publicly available. The possibility exists that general reports will be published yearly in the future.

Navigator© is a full-operational indicator system with clinical indicators that are adapted to the Belgian health care system. At present, the website and the indicator set are only available in Dutch, and thus participation of French speaking hospitals remains difficult in the near future.

4.1.10 Indicators for prevention in general practice

4.1.10.1 Aims

Although general practice is not the scope of this project, the methodology applied by the WVVH for developing indicators is worth mentioning in this context.

4.1.10.2 Indicator source

The Flemish scientific GP association (WVVH) currently develops quality indicators for prevention. The choice of the topics is based on the priorities defined by the Flemish Authority. Guidelines for GPs have analyzed these topics and are used as references to develop QI [117]. The WVVH methodology to develop prevention QI is based on a Delphi procedure with a panel of experts. These were selected among working GPs with an experience in research and quality activities. Twenty QI were proposed to the panel of 15 experts. They scored all QI according to 4 criteria: usefulness, clarity, acceptability and feasibility. After the second round, indicators were ranked using the RAND Appropriateness method and four indicators were finally selected by the panel.

4.1.11 Indicators of the Christian Sickness Fund (CSF)

4.1.11.1 Aims

- The Christian Sickness Fund is one of the non-profit sickness funds in Belgium. It possesses a rich database based on the very detailed hospitalization bills and other health care reimbursements of the Belgian national health insurance system. On top of this a complementary hospitalization insurance system created opportunities to set up partnerships between the sickness fund and the hospitals to improve the quality and efficiency of health care (personal communication with Xavier de Béthune).

4.1.11.2 Indicator source

- The Christian Sickness Fund defines indicators based on the information that can be retrieved from invoice data (for ex. length of stay, type of treatment…).

4.1.11.3 Methodology of data collection

Data from both hospital and ambulatory care are available and can be linked. The processed data supplemented with results from international scientific literature is placed at the disposal of all the hospitals and of individual practitioners who request access to their own data, through a secured website.

4.1.11.4 Current status

Different projects are running in voluntary hospitals, for ex. total hip replacement, transfusions and utilization of antibiotics.

Key points

- **Various Belgian initiatives exist for measuring health and quality indicators, though on a different governmental level and with different purposes.**
- **Some of these initiatives are overlapping. The main drawback is that similar data are collected on similar topics with different methods, leading to a potential discrepancy between the results. Moreover, the multiplicity of initiatives induces a duplication of the efforts from the health care providers to collect data for different initiatives with different purposes.**

4.2 AVAILABLE BELGIAN DATABASES POTENTIALLY USEFUL FOR MEASURING QUALITY INDICATORS

Bossuyt et al. summarized the sources and availability of health and health care data in Belgium [110]. The most relevant databases for this project are summarized below.

The federal government service of Public Health, Food chain safety and Environment collect data concerning the Belgian health care organizations. The registration of these data is important for the guidance to determine the health policy and financing of the Belgian health care organizations. Registration systems relevant for acute hospitals are the Minimal Clinical Data (MCD) or MKG/RCM (Minimale Klinische Gegevens/Résumé Clinique Minimum) and the Minimal Nursing Data (MND) or MVG/RIM (Minimale Verpleegkundige Gegevens/Résumé Infirmier Minimum). Other data collections include registration of the Medical Emergency Services (MES), the Scientific Institute of Public Health (IPH), IMA/AIM, Study center of Perinatal Epidemiology (SPE), hospital statistics, the National Institute of Statistics (NIS), Belgian Diabetes Registry (BDR) and National Cancer Registration (NCR).

4.2.1 Minimal Clinical Data (MCD), coupled with Minimal Financial Data (MFD)

The Minimal Clinical database is an administrative clinical database ("Résumé Clinique Minimum/ Minimale Klinische Gegevens" or RCM/MKG) gathering information transmitted by each hospital to the Ministry of Public Health. All non-psychiatric hospitals must participate to this data collection. The available information concerning outpatient or inpatient stay discharged during 2003 are mainly year of birth, sex, domicile zip code, length of stay, year and month of admission and discharge, in addition to all diagnoses and procedures coded in ICD-9-CM (International Classification of Disease, 9th revision,

Clinical modification, published in October 2001). The Ministry runs the APR-DRG version 15th grouper program to assign an APR-DRG (All-Patient Refined Diagnosis Related Group).

The registration is continuous and every registration period lasts 6 months. The purposes of MCD registration are:

- to determine the need for hospital facilities;
- to define the qualitative and quantitative recognition standards of hospitals and their services;
- to organize the financing of hospitals;
- to determine the policy concerning the practice of medicine;
- to outline a policy in relation with the epidemiology;
- to help the hospitals in their internal management (feedbacks on their data).

Because of the frequency of registration, data from MCD registration are available with one year delay, after a numerical validation process. Although the database contains complete information from every Belgian hospital, the reliability of the information is a major concern as there is a lack of external validation of the registered data.

The second database, the Financial Administrative database, gathers the inpatient claims data sent by the hospitals to the health insurers. This database gives information on the resources used during the stay (reimbursed medical acts, medical supplies, implants and reimbursed drugs). After patient anonymization, insurers send these financial data ("Résumé Financier Minimum/ Minimale Financiële Gegevens" or RFM/MFG) to the INAMI/RIZIV (National Institute for Illness and Invalidity Insurance), using a patient encryption algorithm. After a second encryption, validation and quality check by the Ministry and by the INAMI/RIZIV, the two records are transmitted to an interface body called the Technical Cell (or "Cellule Technique/Technische Cel") in order to be coupled using the encrypted patient key. The data are coupled at the very level of each stay so that tracing the patient medical history becomes possible. In 2003, the coupling was completed for 95 % of the inpatient stays (with the reserve mentioned above relating to the validity of the data).

4.2.2 Minimal Nursing Data (MND)

MND is a mandatory registration in all non-psychiatric hospitals since 1988. Before 2000, only inpatient hospital stays were registered. Since 2000, also outpatient hospitalizations and hospital stays of neonates that did not stay in the mother's room but were admitted to a neonatal care unit are registered. The registration is limited to 4 sample periods, i.e. the first 15 days of March, June, September and December. For each of the four periods, the federal government service determines 5 days of which the registered data need to be transmitted.

The registered data of MND contain general data about the hospital and the services, data concerning the patient and his hospital stay administered nursing care, non-mandatory data concerning the level of independence of the patient and data concerning personnel per nursing unit.

The purpose of MND registration is to support the health care policy. Since 1994, it is used for the financing of the hospitals. They receive additional means based on their nursing activity.

MND registration is not continuous and thus provides an incomplete picture of the collected data. Appealing to the MND database for indicator use may result in incorrect information, because of sampling errors (see literature review 2.2.7). The same question concerning the reliability of information can be raised as for MCD and MFD.

4.2.3 National Institute of Statistics

Since January 2003, the name "Nationaal Instituut voor de Statistiek/Institut National de Statistique" was officially changed into "Algemene Directie Statistiek en Economische informatie/Direction générale Statistique et Information économique", but it is still referred to as NIS/INS [118]. The NIS is an official statistical institute from the federal government. Its main mission is to collect, process and spread data concerning the Belgian society. Products of the NIS can be divided into 7 thematic domains: territory and environment, population, society, economics and finances, agriculture and related activities, industry, services, trade and transport. Data are retrieved from existing databases or by surveys.

Interesting data for the current project are the figures concerning the health condition of the Belgian population (cause of death, traffic accidents, death in traffic accidents, mental health and depression, body mass index distribution). Data retrieved from existing databases is available with one year delay, but is complete and reliable. Data retrieved by survey are not always up to date and may thus contain outdated information.

4.2.4 Scientific Institute of Public Health (IPH)

The Wetenschappelijk Instituut Volksgezondheid/Institut scientifique de Santé Publique (WIV/ISP) has as main mission scientific research in view of support of the national health policy [110].

One of the main objectives of the Epidemiology Unit of the IPH is to coordinate health information in Belgium.

- Network of sentinel laboratories: this system provides weekly surveillance of infectious pathology and antibiotics resistance by a network of laboratories for microbiology. The network represents 43% of all recognized private or hospital microbiology laboratories in 35 of 43 Belgian districts.
- Network of sentinel general practitioners: a network of general practitioners, spread all over the country, registers public health problems in order to evaluate their importance within the general population and to study some characteristics of the patients (e.g. age, sex, risk factors). In this way, GPs play an important role as information source on the health of the general population. About 170 GPs participate on a voluntary basis in the weekly recording by forms. Not only infectious diseases (e.g. measles, hepatitis, Lyme disease), but also non-infectious diseases (e.g. cancer, stroke, diabetes, asthma) and behavior related problems (e.g. suicide, accidents, violence) are recorded. Since 1979, about 40 public health problems have been studied by the sentinel network of GPs. Several automated intermediary and annual reports are produced and at the end of a registration program, scientific reports and articles are published.
- Health Interview Survey (HIS): this survey is periodically organized in order to gather information on health related issues in a representative sample of the population. Several types of information as health status, health determinants, personal characteristics, health consumption are collected simultaneously for the same person. The outcome is a global picture of the health of the population allowing identifying priority domains for the decision makers when designing the public health programs.
- Drugs program: to paint a picture of the extensiveness of the illegal drug phenomenon, objective and reliable information is necessary. The collection, analysis, synthesis and dissemination of data related to the illegal drug phenomenon is organized in order to provide politicians, professionals and citizens the information needed in order to campaign in an appropriate

way against illegal drugs. Each year, a report of the illegal drug phenomenon in Belgium is published. The data is based on the national Health Interview Survey and school survey projects.

- National registry for AIDS and HIV, based on data collected by clinicians and on data from reference laboratories identified by the federal government service of Public Health. Data on age, sex, nationality, risk behavior and clinical stage when diagnosed are collected. The results of the registration give a good estimation of the total number of seropositive persons diagnosed in Belgium.
- National Surveillance of Infections in the Hospitals (NSIH): participating hospitals are able to monitor local infection and antibiotic resistance rates. These results can be compared to those of other hospitals in Belgium, although a sampling bias should be taken into account: some hospitals that participate more frequently to this monitoring are faced with higher infection and resistance rates.
- The Centre of Operational Research in Public Health (CORPH) (Centrum voor Operationeel Onderzoek in de Volksgezondheid/Centre de Recherche opérationnelle en Santé publique) collects and processes information required in the public health decision making process (vital statistics, health indicators, health interview survey, and integration of information).
- The Initiative for Quality promotion and Epidemiology in Diabetes care (IQED) has been described in the paragraph 4.1.4.

4.2.5 National Cancer Register (NCR)

The National Cancer Register, supported by the Ministry of Health, Food chain safety and Environment collects data on newly diagnosed cancer cases. Data on age, sex, place of residence, type and site of cancer and given treatments are gathered anonymously. The aim of the NCR is to set up a high quality data file in order to produce reliable statistics. The NCR provides general data (numbers, tables and graphs) publicly available [119].

4.2.6 Studiecentrum voor Perinatale Epidemiologie (SPE)

This regional research centre registers data on hospital births from all maternity hospitals in the Flemish Region. Monthly or every two months, the maternity hospitals send their files with registered deliveries to the process centre. Data are checked with an error detection program. Every maternity hospital receives an annual report, with the possibility to compare the results with other maternity hospitals [120].

The obstetric and perinatal files contain the following parameters: identification of the mother, previous births, information on current pregnancy, delivery, condition at birth, post partum, perinatal mortality, maternal morbidity and mortality. The neonatal file contains following parameters: date of birth, transfer to NIC-unit, admission date of the child in the hospital, reasons for admission, specific pathology, discharge of the child, destination of the child, condition at discharge, data of death, classification of death cause.

4.2.7 Intermutualistic Agency (IMA/AIM)

The IMA/AIM is a non-profit organisation founded by 7 insurance companies in October 2002. Their general aim is to analyze data collected by health insurers within their missions. Projects concerning health care consumption of diabetic patients and pre-operative examination resulted in well constructed databases. Data are collected with indicators in co-operation with RIZIV (see 4.1.6) and the results are publicly available at the website of IMA/AIM [121].

- The project of health care consumption of diabetic patients: The primary objective of this project was a comparison of the health care consumption of patients with and without diabetes convention. The insurance companies pooled their data on diabetic patients and further exclusion/inclusion criteria were used to select the sample. The IMA/AIM performed the analyses on data concerning hospitalizations, ambulant medication use, clinical biology and complications in diabetic patients. An important restraint of this study is that the IMA/AIM did not receive any morbidity data, impeding the adjustment for the health care consumption.

The project of pre-operative tests: in this project, the insurance companies also pooled their data on pre-operative tests and further exclusion/inclusion criteria were used to select the sample. The IMA/AIM performed the statistical analyses and published the resulting data concerning the pre-operative tests prescription of the Belgian hospitals. Given the time frame of the data collection, this project received criticisms in relation with the reliability of the data.

The databases of IMA/AIM are limited to project-bound data collection, and therefore do not provide continuous information.

4.2.8 Belgian Diabetes Registry (BDR)

The RBD/BDR (Registre Belge du Diabète/Belgisch Diabetes Register) was founded in 1989 and is now grown to a national network of physicians and researchers who cooperate for scientific research on diabetes type I [122]. The main aim of the RBD/BDR consists of collecting data from diabetic patients and their relatives in order to help treat, cure or prevent the illness. Yearly, the number of new diabetic patients before the age of 40 is determined in Belgium.

Key points

- **Many Belgian databases could be used for measuring quality indicators, each of them presenting its own advantages and drawbacks. Some are generic, other ones are disease-specific. A major question is the validity and reliability of some databases, in particular for the MCD and coupled MCD/MFD databases.**
- **The data available in Belgium for measuring quality indicators are not (yet) integrated into a national health information system. This step would first require a standardization of the data collection procedure and a validation of the data collected. These prerequisites are essential to allow the use of the data for policy decisions and other purposes as comparative studies.**

Table 14: Summary table: Belgian initiatives for quality indicator use.

Initiative / Purpose	PATH-indicators	Multidimensional feedback - Ministry of Health	Health indicators IPH	Quality indicators IQED	Colleges of physicians
Comparison	National and international benchmarking	Comparison on national level	Data is communicated with international organizations	National benchmarking	Comparison on nationa level
Epidemiology			Epidemiological data are gathered on numerous disease and health aspects	Evaluation and promotion of quality of diabetes care	
Governmental policy			Monitoring the population health status and identify health policy priorities		
Local quality and internal policy	Assessing internal performance and identify areas for improvement	Assessing internal performance and identify areas for improvement			Promotion of good med practice in medical specialties

Table 14 (continued): Purposes of Belgian initiatives for quality indicator use.

Initiative / Purpose	*Quality indicators RIZIV/INAMI*	*Performance indicators of Flemish government*	*Health indicators of Flemish government*	*Navigator©*	*indicators of CSF*
Comparison	*Local, regional and national comparison*			*Local and regional comparison*	*International and national comparison*
Epidemiology	*Evaluating and promoting quality*		*Epidemiological data are gathered on numerous health aspects*		*Evaluating and improving quality*
Governmental policy		*Supporting self-evaluation*	*Monitoring health condition of Flemish population, evaluating existing measures and identifying problem areas and gaps in health policy*		
Local quality and internal policy	*Discussion of national comparison data in GLEM/LOKs*	*Improving quality and efficiency of health care on organizational level*		*Assessing internal performance and identify areas for improvement*	*Improving quality and efficiency of health care*

5 EXPLORATION OF THE USEFULNESS OF THE MKG/RCM AND MFG/RFM DATABASES FOR THE MEASUREMENT OF CLINICAL QUALITY INDICATORS IN BELGIUM

5.1 INTRODUCTION

The main objective of this part is to test the completeness and reliability of the information found in the MCD MFD databases to measure clinical quality indicators in Belgium. The reason to choose these databases is their comprehensiveness (all acute hospitals are obliged to provide these data to the Ministry of Health) and cost-effectiveness. Other databases will not be considered in this explorative study. It is not the objective of this study to validate the conceptual framework elaborated in chapter 4 (deviations from the conceptual framework will be indicated where necessary), nor is it to develop an exhaustive set of clinical quality indicators. The indicator sets developed for this explorative study are not intended to be used to measure the quality of care in acute hospitals.

5.2 SELECTION OF CLINICAL QUALITY INDICATORS

5.2.1 Selection of conditions/areas

Four conditions/areas were selected for the search of clinical quality indicators, aiming at the inclusion of an acute and chronic condition/area, a medical, surgical and obstetric condition/area, and a condition/area covering a broad population. The four criteria proposed in the conceptual framework were not used for this selection. The following conditions/areas were selected:

- acute stroke (acute and medical condition);
- perinatal care (mother and child) (acute and obstetric area);
- care of vulnerable elders (mainly chronic and medical area, covering a broad population);
- total hip prosthesis (acute and surgical condition).

These four selected conditions/areas refer to acute patient care as the scope of this research project is the clinical care in acute hospitals. The overlap between the selected conditions/areas is restricted so that the sets of clinical quality indicators completely differ from each other. For the indicators concerning the care of vulnerable elders, the search was further narrowed to those topics of the ACOVE Quality Indicators most related to acute patient care [62]: dementia, depression, diabetes mellitus, falls, heart failure, hypertension, ischemic heart failure, malnutrition, osteoarthritis, osteoporosis, pneumonia, pressure ulcers, and urinary incontinence (ACOVE Stroke Quality Indicators were included in the area 'acute stroke').

5.2.2 Sources of clinical quality indicators

The literature search described in the first part identified several indicator sets and databases, especially in the grey literature. In addition, experts were asked if they were aware of other sources of clinical quality indicators (Prof. Dr. JP Baeyens, College for Geriatrics; Prof. Dr. V. Thijs, President of the Belgian Stroke Council; Dr. A. Clerckx, Health Care Quality Management Policy Unit -FPS Health, Food Chain Safety and Environment; Prof. Dr. JP Simon, University Hospitals Leuven). A description and quality appraisal of these indicator sets and databases is provided in appendix 1. The Belgian sets and databases were discussed in chapter 4. For the explorative study, only those indicator sets and databases were included that had a long history, had a well established methodology, and served as a basis for the development of other indicator

sets (table 15 and 16). Therefore, specific databases of HMOs (e.g. Blue Cross Blue Shield) were excluded, because most of them originate from other indicator sets and databases. On the website of ANAES four interesting documents were found concerning stroke [123-126]. However, three documents were excluded from our search for clinical quality indicators for two reasons [124-126]. First, their content overlapped with the fourth set of indicators selected for this project [127]. Moreover, they had many indicators referring to the physical examination (information which cannot be found in the existing Belgian databases). Of the QIP indicators only the set related to acute care was included.

Both general (table 15) and condition specific (table 16) indicator sets were included in our search. For each of the four selected conditions/areas, ICSI and NICE guidelines were also checked for indicators (table 17), because these guideline developers were identified in our literature search as the only ones systematically incorporating indicators in their guidelines. Finally, a supplemental Medline search was performed (table 18).

Table 15. General indicator sets and databases.

Indicator set	Source
AHRQ Patient Safety Quality Indicators	http://www.qualityindicators.ahrq.gov/downloads/psi/psi_guide_v30.pdf
AHRQ Inpatient Quality Indicators	http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_guide_v30.pdf
ACHS Clinical Indicators	http://www.achs.org.au/content/screens/file_download/Users_Manual_2006.pdf
JCAHO	http://www.jcaho.org/pms/core+measures/index.htm
NHS Performance Indicators	http://www.performance.doh.gov.uk/nhsperformanceindicators/hlpi2000/arealist_h.html
QIP	http://www.internationalqip.com/indicators.aspx
Prestatie-indicatoren Ziekenhuizen	http://www.snellerbeter.nl/uploads/media/Basisset_20prestatie-indicatoren_20ziekenhuizen_20versie_20april_202004.pdf
NCQA (HEDIS©)	http://www.ncqa.org/Programs/HEDIS/HEDIS%202005%20Summary.pdf
NQMC	http://www.qualitymeasures.ahrq.gov/
Navigator©	http://www.navigator©.czv.be/files/2/overzicht%20set%20az%20300905.pdf
Gezondheidsindicatoren Vlaanderen	http://wvc.vlaanderen.be/gezondheidsindicatoren/
Danish National Indicator Project	http://www.nip.dk/
CBO	http://www.cbo.nl/product/richtlijnen/pdf/indicator2002.pdf
Eurostat	http://epp.eurostat.cec.eu.int/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/popul/health&language=en&product=EU_MAIN_TREE&root=EU_MAIN_TREE&scrollto=0

Table 16. Disease-specific indicator sets and databases.

Indicator set	Source
Acute stroke	
CMAJ	http://www.cmaj.ca/cgi/data/172/3/363/DC1/1
ANAES	http://www.anaes.fr/anaes/Publications.nsf/wEdition/AT_MALV-6FRFKN?OpenDocument&IdOuvrage=AT_MALV-6FRFKN&Type=Référentiel
Perinatal care	
PERISTAT	http://europeristat.aphp.fr/en/indicators/main.html
SPE	http://aps.vlaanderen.be/statistiek/nieuws/gezondheid/2003-07_SPE.htm
Public Health Agency of Canada	http://www.phac-aspc.gc.ca/publicat/cphr-rspc00/pdf/cphr00e.pdf
BAPM Neonatal Dataset	http://www.bapm.org/media/documents/publications/dataset_fullreview_20040300.pdf
Elderly care	
ACOVE	http://www.annals.org/content/vol135/issue8_Part_2/
Total hip prosthesis	
Swedish National Hip Arthroplasty Register	http://www.jru.orthop.gu.se/

Table 17. Selected ICSI and NICE guidelines.

Acute stroke	
ICSI	Diagnosis and initial treatment of ischemic stroke [128]
Perinatal care	
ICSI	Routine prenatal care [129]
NICE	Antenatal care [130]
NICE	Caesarean section [131]
NICE	Electronic fetal monitoring [132]
NICE	Induction of labour [132]
Elderly care	
NICE	Falls [133]
NICE	Pressure ulcer management [134]
Total hip prosthesis	
-	-

Table 18. Search strategy used for Medline search.

Condition	Search strategy
Acute stroke	"Quality Indicators, Health Care" [MeSH] AND "Cerebrovascular Accident"[MeSH]
Perinatal care	"Quality Indicators, Health Care" [MeSH] AND ("Pregnancy" [MeSH] OR "Perinatal Care" [MeSH] OR "Infant, Newborn" [MeSH])
Elderly care	"Quality Indicators, Health Care" [MeSH] AND ("Frail Elderly"[MeSH] OR "Aged"[MeSH] OR "Aged, 80 and over"[MeSH] OR "Geriatrics"[MeSH])
Total hip prosthesis	"Quality Indicators, Health Care" [MeSH] AND ("Arthroplasty, Replacement, Hip"[MeSH] OR "Hip Prosthesis"[MeSH] OR "Hip Joint/surgery"[MeSH] OR "Hip Fractures/surgery"[MeSH])

5.2.3 In- and exclusion criteria for clinical quality indicators

The selection of clinical quality indicators was based on three main criteria. First, the indicator had to measure at least one dimension of quality of care (safety, effectiveness, patient-centeredness, timeliness, efficiency, equity, continuity). Secondly, the clinical quality indicators had to relate to the clinical activity as defined in the conceptual framework. Finally, the indicator had to concern the acute hospital care, sometimes requiring a slight modification of the original indicator (e.g. the indicators developed by Saliba et al. were intended for nursing home care, but were also applicable to the acute hospital setting when replacing 'nursing home resident' by 'vulnerable elder' in the denominator [135]). Generic indicators, covering a broader spectrum of conditions than the four we selected, were excluded (e.g. postoperative mortality).

The selected sources of clinical quality indicators were independently searched by two researchers (JV and GV) for indicators meeting these three criteria by screening the description of the indicator.

For the selected indicators, the peer-reviewed literature was searched for existing evidence by one researcher (JV). For this search, the Cochrane Library was first screened for systematic reviews. In case no systematic review was found, the search was supplemented with an Ovid Medline search for systematic reviews or randomized controlled trials. Each indicator was graded for his level of evidence using the level of evidence scale of the Agency for Healthcare Policy and Research [136], which was also used in a previous KCE project about quality indicators for diabetes [68]. Only indicators with a level of evidence 1a (evidence from meta-analysis or systematic review of randomized controlled trials) or a level of evidence 1b (from at least one randomized controlled trial) were selected. The GRADE system (nowadays most commonly used) was not chosen for grading the evidence, because of its publication after the start of our project [137].

Finally, the selected evidence-based clinical quality indicators were screened for small variations, and – where possible – merged into one indicator. For these final indicators, the description, denumerator and nominator were provided.

5.2.4 Feasibility of the selected clinical quality indicators

For each evidence-based clinical quality indicator the a priori feasibility of measuring it using the MCD database was assessed by three researchers (JV, DP, CC). In some cases a slight modification of the indicator was necessary to ensure the feasibility. However, this modification never led to a major change of the original objective of the indicator. The results of this phase will be discussed in paragraph 5.3.4.

5.2.5 Discussion rounds with external experts

A discussion round was organized with external experts for each of the four conditions/areas. During these rounds, the methodology and preliminary results were presented with three main questions:

Did we miss any important source of clinical quality indicators?

Are the selected evidence-based clinical quality indicators relevant enough to be included?

Do we need to include other not evidence-based clinical quality indicators because of their extreme relevance?

Also during the discussion rounds, the definition of some evidence-based clinical quality indicators was changed to improve their feasibility.

Key point

- **The objective of this explorative study is to analyze the completeness and reliability of the information found in the MKG/RCM and MFG/RFM databases for the measurement of clinical quality indicators. Four conditions/areas were first selected.**
- **Clinical quality indicators were searched and selected for the four conditions when applicable to the acute hospital setting. Further steps were followed to select four final sets of clinical quality indicators. The researchers conducted a literature search to identify their level of evidence of the QI and they assessed the feasibility of their measurement using the MCD/MFG databases. Finally, the selected evidence-based clinical quality indicators were discussed in four separate expert groups.**

5.2.6 Results of the search for clinical quality indicators

5.2.6.1 Selection of clinical quality indicators (table 19, 20 and 21)

Overall results

In total, 511 indicators were identified, mainly in disease-specific databases (figure 6 and table 19). This important contribution of disease-specific indicator sets can be largely explained by the inclusion of the ACOVE indicators. Of the general indicator sets, Navigator© provided the most indicators, with at least one indicator for three of the four conditions (which was also true for AHRQ, ACHS and QIP). ICSI and NICE guidelines also provided at least one indicator for three of the four conditions. Only for stroke and elderly care, the Medline search identified additional indicators [138, 139, 135]. NQMC provided no indicators not already found in the other databases.

A large variation existed between the numbers of indicators found for each condition. This can be explained by several reasons. Firstly, the high number of indicators found for elderly care can be explained by the contribution of the ACOVE indicators, whereas for total hip replacement no such large disease-specific database was identified. Above this, the scope of the condition probably plays an important role. Whereas elderly care encompasses a broad range of areas, total hip replacement is one specific area. Perinatal care and acute stroke care are also rather specific areas, but their clinical care encompasses more facets than the clinical care for total hip replacement.

The majority of the identified indicators were process indicators, mainly because of the high number of process indicators found for elderly care and stroke. For perinatal care and total hip replacement more outcome indicators were identified.

Overall, three-quarter of the indicators was found to be clinical and applicable to the acute hospital setting. This was more often the case for process than for outcome indicators (79% vs. 67%). Quality indicators found in clinical practice guidelines most often were clinical and applicable to acute hospital care (89% of the identified indicators in guidelines).

An overview of all indicators is presented in the second appendix. The list has been divided into tables i.e., indicators excluded as non-clinical and/or not applicable to the acute hospital setting, clinical indicators excluded because of a low level of evidence and low relevance, clinical quality indicator with high level of evidence and/or relevance but excluded because of detailed administrative data deficiencies and the final set of feasible clinical quality indicators with high level of evidence and/or relevance.

Figure 6. Process of selection of feasible evidence-based clinical quality indicators applicable to the acute hospital setting.

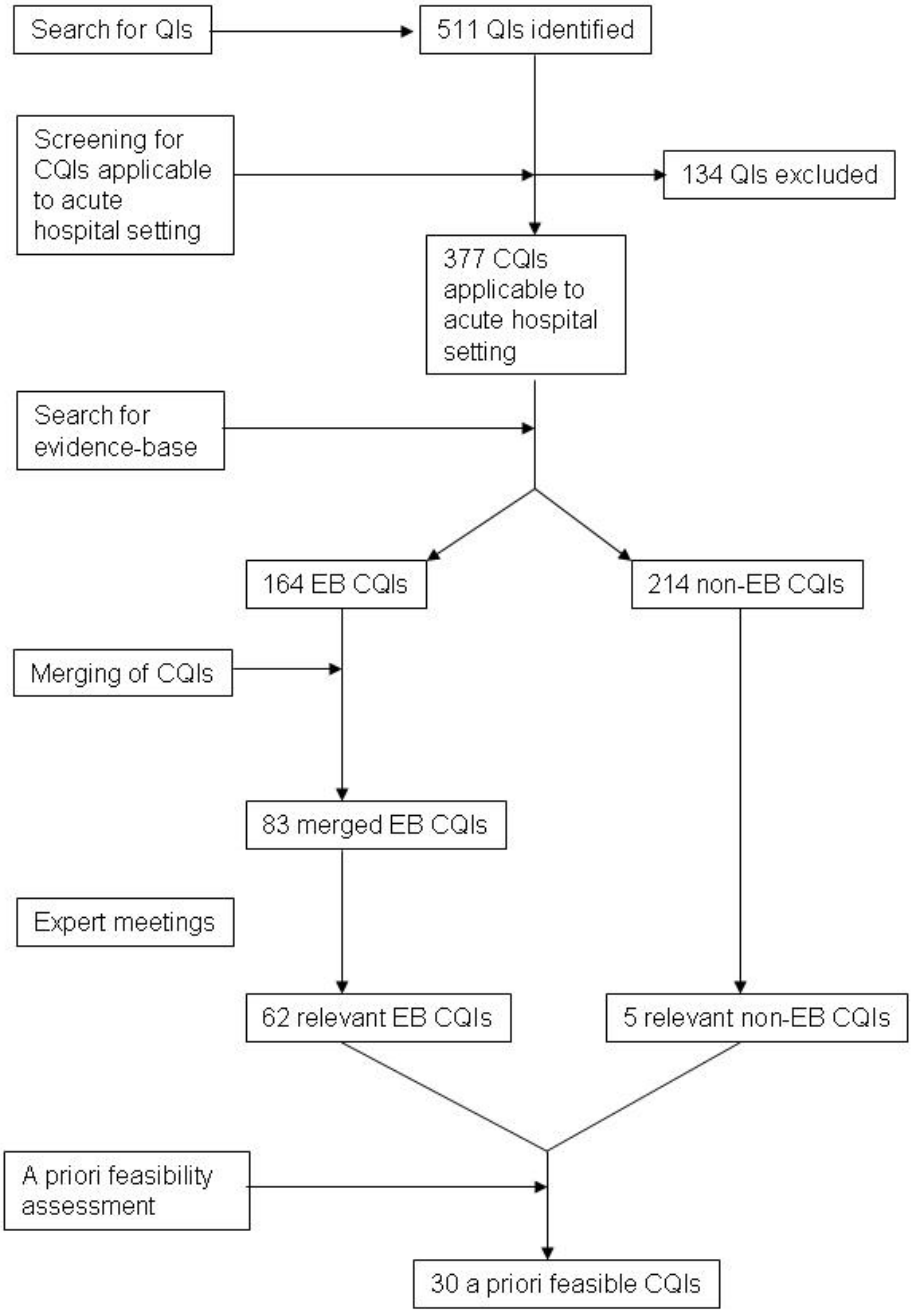


Table 19. Number of quality indicators according to set/database (the number of evidence-based clinical quality indicators applicable to the acute hospital setting are provided between parentheses).

	Stroke	Perinatal care	Elderly care	THR	Total
Total	111 (49)	153 (36)	231 (70)	16 (9)	511 (164)
AHRQ	1 (0)	12 (5)	-	1 (0)	14 (5)
ACHS	1 (1)	11 (0)	1 (0)	1 (0)	14 (1)
JCAHO	-	3 (2)	-	2 (2)	5 (4)
NHS	3 (0)	6 (0)	-	-	9 (0)
QIP	1 (0)	6 (1)	-	6 (6)	13 (7)
Prestatie-indicatoren	2 (0)	1 (0)	-	-	3 (0)
NCQA (HEDIS©)	-	-	3 (1)	-	3 (1)
NQMC	-	-	-	-	-
ANAES	34 (9)	-	-	-	34 (9)
Navigator©	1 (0)	20 (5)	41 (23)	-	62 (28)
Gezondheidsindicatoren	-	-	-	-	-
Eurostat	-	-	-	-	-
CBO	13 (10)	-	-	-	13 (10)
PERISTAT	NA	23 (3)	NA	NA	23 (3)
SPE	NA	5 (0)	NA	NA	5 (0)
Public Health Agency of Canada	NA	34 (8)	NA	NA	34 (8)
BAPM Neonatal Dataset	NA	7 (1)	NA	NA	7 (1)
ACOVE	8 (5)	NA	142 (36)	NA	150 (41)
Danish National Indicator Project	8 (3)	-	-	1 (0)	9 (3)
Swedish registry	-	-	-	5 (1)	5 (1)
ICSI	16 (7)	10 (4)	-	-	26 (11)
NICE	-	15 (7)	14 (5)	-	29 (12)
Medline	23 (14)	-	30 (5)	-	53 (19)

Results: clinical quality indicators for each condition

- Stroke:

One-hundred and eleven indicators (n=111) were identified (64 in general sets, 8 in specific sets, 16 in guidelines, and 23 in Medline). Most indicators were found in ANAES, Medline and clinical practice guidelines (ICSI and CBO). The majority of the identified indicators were process indicators. Twenty-four indicators did not answer to the definition of clinical care and five indicators were not found to be applicable to an acute hospital setting.

- Perinatal care:

In total, 153 indicators were withheld (59 in general sets, 69 in specific sets and 25 in guidelines). The Public Health Agency of Canada, PERISTAT and Navigator© provided most indicators. More outcome than process indicators were found. Thirty-nine indicators did not answer to the definition of clinical care and/or were not applicable to acute hospital care.

- Elderly care:

Two-hundred and thirty-one indicators (n=231) were selected (45 in general sets, 142 in specific sets, 14 in guidelines, and 30 in Medline). The large majority was found in the ACOVE indicator set. Above this, the indicators identified through the Medline search were developed as an addition to the ACOVE indicator set, but applicable to the nursing home setting [139, 135]. This is probably the reason why only two-third of these indicators proved to be clinical and/or applicable to the acute care setting.

The majority of the identified indicators for elderly care were process indicators. Sixty-two indicators were not considered as clinical and/or applicable to the acute hospital setting.

- Total hip prosthesis:

Only 16 indicators were found (10 in general sets, 6 in specific sets). The majority was found in the QIP indicator set and the Swedish registry. More outcome indicators were found than process indicators. Five indicators were not considered as clinical and/or applicable to acute hospital care.

Table 20. Characteristics of the quality indicators (all).

	Stroke	Perinatal care	Elderly care	THR	Total
Total (including structure indicators)	111	153	231	16	511
Clinical quality indicators (CQIs), applicable to acute hospital setting (AH)	83	114	169	11	377
Evidence-based (EB) CQIs + AH	49	36	70	9	164
Level of evidence Ia	34	28	48	9	119
Level of evidence Ib	15	8	22	0	45

Table 21. Characteristics of the process and outcome indicators.

	Stroke	Perinatal care	Elderly care	THR	Total
Process indicators	98	63	191	5	357
CQI & AH	75	61	141	5	282
EB CQIs	49	16	48	5	118
Outcome indicators	12	79	39	11	141
CQI & AH	8	53	28	6	95
EB CQIs	0	20	22	4	46

5.2.6.2 Evidence-base for the selected clinical quality indicators (table 20 and 21)

Overall, 44% of the selected clinical quality indicators (or 32% of all the identified indicators) was supported by strong evidence. For the majority of these evidence-based clinical quality indicators, systematic reviews or meta-analyses were found. More clinical outcome indicators than process indicators were found to be evidence-based (48% vs. 42% respectively).

The clinical quality indicators found in the clinical practice guidelines of ICSI and NICE most often were based on solid evidence (47% of the selected clinical quality indicators). Above this, 77% of the clinical quality indicators found in the CBO indicator set (also based on guidelines) were evidence-based.

A wide variation was found across the four conditions. Of the clinical quality indicators for perinatal care only about one out of three indicators was based on solid evidence, whereas almost all clinical quality indicators for total hip replacement had a level of evidence Ia. More than half of the clinical quality indicators for stroke were also based on strong evidence.

After screening the selected evidence-based clinical quality indicators for small variations and merging them where possible, a final list of 83 indicators was produced (12 for stroke, 22 for perinatal care, 42 for elderly care, 7 for THR).

For stroke, the Canadian Stroke Quality of Care Study [138] (identified in Medline) provided the most evidence-based clinical quality indicators (10 out of 12). A search in

this indicator set combined with a search in the CBO indicator set would have identified all twelve indicators.

Of the 22 merged evidence-based clinical quality indicators for perinatal care, 9 were identified in the Canadian Perinatal Surveillance System. Ten others were identified in clinical practice guidelines. Only a search in the Canadian Perinatal Surveillance System, the ICSI and NICE guidelines and Navigator© would have identified all 22 indicators.

Thirty-three of the 42 merged evidence-based clinical quality indicators for elderly care were found in the ACOVE indicator set. An additional search in Navigator©, the NICE guidelines and the set produced by Saliba et al [139, 135] would have identified the other 9 indicators.

For total hip prosthesis, 6 of the final 7 indicators were found in the QIP indicator set. All identified indicators of the JCAHO indicator set were also found in the QIP indicator set. A search combining the indicator sets of QIP and the Swedish registry would have identified all 7 final indicators.

5.2.6.3 Discussion rounds with external experts

Stroke

Of the 12 merged evidence-based clinical quality indicators, 5 were rephrased by the experts in stroke/neurology to improve their feasibility. The most frequent change made to the indicators was the removal of a time notion. One evidence-based clinical quality indicator was rejected because of its low discriminative potential (number of patients undergoing CT scan within 24h after admission for stroke).

Of the non-evidence-based clinical quality indicators, 5 were found to be highly relevant. Based on similarities, these were merged into 2 indicators.

Perinatal care

Of the 22 merged evidence-based clinical quality indicators, one was rephrased by the experts in obstetrics. Above this, seven indicators were rejected because of their low relevance for clinical practice.

Of the non-evidence-based clinical quality indicators, 21 were found to be highly relevant, which were merged into 3 indicators.

Elderly care

Three of the 42 merged evidence-based clinical quality indicators were rephrased by the clinical experts in geriatric medicine. Thirteen indicators were found to be irrelevant and were rejected.

Of the non-evidence-based clinical quality indicators, 47 were assessed as relevant. However, the feasibility of these indicators was heavily doubted by the experts. Therefore, no attempt was made to merge these indicators.

Total hip prosthesis

Two of the 7 merged evidence-based clinical quality indicators were reformulated by the expert group of orthopedists. No additional non-evidence-based clinical quality indicators of high relevance were identified.

Key points

- **The number of identified indicators found in the literature varied widely between the four selected conditions. The majority of them were process indicators.**
- **Evidence based guidelines proved to be a good source for clinical quality indicators. On the other hand, a Medline search did not identify a lot of additional indicators.**
- **Only a minority of the identified indicators were evidence-based clinical quality indicators that were applicable to the acute hospital setting.**
- **Discussion rounds with external experts led to rephrase some clinical quality indicators in order to improve their feasibility. Above this, 21 evidence-based clinical quality indicators were rejected and some non-evidence-based clinical quality indicators were added because of their high relevance.**

5.3 MEASUREMENT OF CLINICAL QUALITY INDICATORS IN BELGIAN ACUTE HOSPITALS

5.3.1 Selection of data sources

The choice of databases for the explorative study was based on the selection of data sources relating to hospital stays with the diagnoses and the sociodemographic characteristics of the patients. This explorative study was therefore run on the 2003 Minimal Clinical database and on the 2003 Financial administrative database. These databases are briefly described in section 4.2.1.

These administrative databases are already coupled and readily available on request. Hence, the explorative study of the four sets of indicators was based on data extracted from these sources, as they summarize the medical record.

5.3.2 Criteria for data extraction

The explorative study focused on the patient stays only, without reconstructing the whole episode of care for feasibility reasons (given the time constraints of this project). The patient identification across different stays was not taken into account. This had the advantage that data extraction requests were straightforward and did not imply back-and-forth information retrievals, like gathering all the stays from a selected patient. Referrals after an initial hospital stay leading to subsequent admissions were in consequence deliberately lost, although we acknowledge the fact that referral (and readmission) can be important parameters for quality.

The codes used for the extraction from the administrative databases were validated by the Technical Cell ("Cellule Technique/Technische Cel").

5.3.2.1 Acute ischemic stroke

The selection of ICD codes relating to acute ischemic stroke was performed by the data analyst in collaboration with two physicians. Studies on a similar topic were used as a support to select the appropriate codes in the administrative databases [140-142]. All stays of patients admitted with a following principal diagnosis were originally included in the data extraction:

- 433 ("occlusion and stenosis of precerebral arteries")
- 434 ("occlusion of cerebral arteries")
- 436 ("acute but ill-defined cerebrovascular disease")

The modifier code for 433 and 434 (5th digit of ICD-9-CM; in this case 1 for acute stroke, 0 for non-acute condition) was not specified in the original data request as it does not seem to be accurately coded [140]. Subarachnoid, intracerebral and other intracranial hemorrhages (430, 431 and 432), transient ischemic attack (435) and not acute ischemic event (438) were not selected as principal diagnosis. No unspecified codes (437.1 or 437.9) were selected. Stroke is indeed a relatively well known and then well coded condition and the aim was to select only the patients to whom the clinical quality indicators applied. The code non-specific 436 was however selected for two reasons. First, the Public Service of Health Manual [143] advises to code 436 into the clinical data when stroke is not further specified (precerebral or cerebral location) in the medical record. Second, this code was used by in methodologies described in the literature [140-142]. The choice of ICD-9 codes was preferred to APR-DRG's coding. The APR-DRG's from the Major Diagnostic Category (MDC 1: "Diseases and Disorders of the Nervous System") are indeed firstly grouped following the presence of operating room procedure. Therefore operated patients can belong to other APR-DRG's groups than those dedicated to acute ischemic stroke.

5.3.2.2 Perinatal Care

Use of APR-DRG's of MDC14 for Deliveries:

In this case, the APR-DRG's system was considered as a better selection tool than ICD-9-CM coding. The Major Diagnostic Category MDC14 ("Pregnancy, Childbirth and the Puerperium") is firstly structured according to the principal diagnosis before taking operating room procedure into account (unlike MDC1). If a pregnant patient is admitted for a condition linked to her pregnancy as a principal diagnosis (as for example a thrombophlebitis), this condition falls into the range of pregnancy diagnoses, automatically leading to MDC 14 APR-DRG's. As another example, a pregnant woman admitted for a stroke occurring during pregnancy will receive as principal diagnosis 674.0x ("cerebrovascular disorders in the puerperium") ideally accompanied by a cerebrovascular diagnosis code. Her MDC is also MDC14 (and not MDC 1).

The limitation to MDC 14 cases might miss a few complicated cases. As an illustration, the APR-DRG of a pregnant woman admitted for an appendectomy but who gives birth during the same stay will belong to MDC 6 "Diseases and disorders of the digestive system". In the same way, if she is admitted to deliver but incidentally has to undergo a procedure not related to pregnancy during her stay, such as an appendectomy, she will belong to one of the 'residual' APR-DRG (in this case 952 "non-extensive procedure unrelated to principal diagnosis"). But those complicated cases of deliveries that require atypical care are marginal.

All stays belonging to the following APR-DRG's were extracted:

- 540 (caesarean delivery),
- 541 (vaginal delivery with sterilization and/or dilatation and curettage),
- 542 (vaginal delivery with procedure except sterilization and/or dilatation and curettage),
- 560 (vaginal delivery) or
- 566 (other antepartum diagnoses).

Use of MDC15 for Neonates:

In the APR-DRG system, all patients aged below 29 days (≤ 28 days) are divided up into MDC 15 groups (Newborns and Other Neonates). They are classified following their birth weight, except for three APR-DRG's (neonates transferred before 5 days old, neonates with organ transplant and finally neonates with extracorporeal membrane oxygenation). Hence, only coding anomalies (leading to the residual APR-DRG's) will classify babies below 29 days outside MDC15. The link between the mother and the newborn can be theoretically retrieved from the administrative clinical records. This link can be necessary when a selected indicator analyses the outcome of the newborns in relation to the health status of the mother, or the number of gestation weeks (which

is indicated for each newborn) in relation with a procedure done during the stay of the mother.

5.3.2.3 Care of vulnerable elders

The RAND Corporation defines vulnerable elders as "persons 65 years of age and older who are at high risk for death or functional decline" [62]. The risk of mortality of each APR-DRG group is available in the minimal clinical database. However one same level is not homogeneous across APR-DRG's i.e., one level in one APR-DRG not being similar in term of prognostic to the same level in another APR-DRG. Therefore we used a proxy to assess the status of "vulnerable elderly" i.e., a stay in a (nursing) institution for the elderly before and/or after hospitalization. This narrow restriction would probably let some vulnerable elders aside from the selection. However, this selection was deliberately more specific than sensitive to be sure that the clinical quality indicators were only measured for the care of vulnerable elderly.

All stays of patients aged 65 or above, admitted in a home for the aged or in a psychiatric institution immediately before or after their hospitalization, were extracted.

5.3.2.4 Total hip prosthesis

THR was chosen to test clinical quality indicators relating to a specific operating room procedure. Billing codes and ICD-9-CM procedure coding were used simultaneously to be sure to be exhaustive in our data extraction.

The following INAMI/RIZIV billing codes were chosen to select the stays:

- 289041 ("hip arthroplasty with femoral prosthesis")
- 289063 ("hip arthroplasty with acetabulum prosthesis")
- 289085 ("total hip arthroplasty (acetabulum and femoral head)")
- 293440 ("revision hip arthroplasty")

The following ICD-9-CM procedure codes were also selection criteria:

- 81.51 ("Total hip replacement")
- 81.52 ("Partial hip replacement")
- 81.53 ("Revise hip replacement").

5.3.3 Feasibility of the measurement for the selected evidence-based clinical quality indicators

The researchers performed a first selection of the 83 evidence-based clinical quality indicators previously selected (see chapter 5.2.6.2). Some of them were a priori non measurable considering the information that had to be collected. However, during the discussion rounds with the external experts, 11 evidence-based clinical quality indicators were rephrased in order to improve their feasibility (see chapter 5.2.6.3).

In total, 67 clinical quality indicators were screened for their a priori feasibility (see paragraph 5.2.6.3):

Stroke: 11 evidence-based clinical quality indicators and 2 non-evidence-based clinical quality indicators;

Perinatal care: 15 evidence-based clinical quality indicators and 3 non-evidence-based clinical quality indicators;

Elderly care: 29 evidence-based clinical quality indicators;

Total hip prosthesis: 7 evidence-based clinical quality indicators.

Thirty (n=30) of the 67 indicators were judged feasible a priori (7 for stroke, 12 for perinatal care, 5 for elderly care, 6 for THR) (table 22), of which 27 were evidence-based and 3 were not.

Table 22. Feasible evidence-based and non-evidence-based clinical quality indicators (see appendix 2 for detailed information). The non-evidence-based indicators are asterisked.

Description
Number of patients with acute ischemic stroke undergoing ECG during hospitalization
Number of patients with acute ischemic stroke receiving a prophylactic dose of anticoagulation/heparin
Number of patients with acute ischemic stroke and nonvalvular atrial fibrillation that was discharged with anticoagulant therapy
Number of patients with acute ischemic stroke for whom a carotid artery imaging study is performed
Number of patients with acute ischemic stroke that was prescribed a statin
Number of patients with acute ischemic stroke receiving thrombolysis
Number of patients with acute ischemic stroke undergoing assessment by a physiotherapist/occupational therapist*
Rate of postoperative wound infection after caesarean delivery
Proportion of caesarean sections where the woman receives prophylactic antibiotics
Proportion of operative vaginal deliveries
Proportion of instrument-assisted vaginal deliveries with 3rd or 4th degree lacerations
Proportion of non-instrument-assisted vaginal deliveries with 3rd or 4th degree lacerations
Proportion of vaginal deliveries with episiotomy
Proportion of mothers with preterm birth (<34 weeks) that was given corticosteroids
Cases of birth trauma
All neonates who expire at the facility before the neonate becomes age 28 days
All liveborn neonates with respiratory distress syndrome
Caesarean delivery rate*
Proportion of deliveries with an induction of labor*
Number of vulnerable elders with dementia and depression that is treated with TCAs or SSRIs for the depression
Number of elder patients with a diagnosis of fall, gait- or balance problems, or polyneuropathy, that received physiotherapy
Number of vulnerable elders with heart failure and atrial fibrillation that is treated with anticoagulation
Number of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a beta blocker
Number of vulnerable elders with a recent myocardial infarction or recent coronary bypass graft surgery that is offered physiotherapy
Proportion of patients who develop a DVT during hospitalization for THR
Proportion of patients who develop a PE during hospitalization for THR
Proportion of patients who develop a surgical site infection during hospitalization for THR
Proportion of patients who receive thromboprophylaxis with LMWH or heparin for THR
Proportion of patients receiving prophylactic antibiotics with first generation cephalosporin's for THR
Proportion of patients receiving at maximum a 24h dose of first generation cephalosporin's for THR

As already stated, the definition of some indicators was adapted in order to be applied on administrative data. As a first illustration, some indicators mention that a procedure was 'offered'. In this study, the procedure was taken into account when effectively performed. The involvement and choice of the caregiver and patient were indeed not measurable. A second illustration is the difficulty to identify time notions mentioned in some indicators. This was the main reason to change the definition of some clinical quality indicators (in 6 of the 30 feasible indicators).

Table 23 summarizes the reasons why selected clinical quality indicators were rejected a priori.

Table 23. Number of dismissed indicators per topic and identified database insufficiencies

	Stroke	Perinatal care	Elderly care	THR	Total
EB CQIs	11	15	29	7	62
Non-EB CQIs	2	3	-	-	5
Dismissed indicators	6	6	24	1	37
Out-of-pocket drugs	**1**	**2**	**6**		9
Outpatient information			**2**	**1**	3
ICD-9-CM codification inaccuracy	**1**	**1**	**3**		5
No (accurate) timing of diagnostic technique or therapy	**1**	**1**	**7**		9
No information from medical record (on care process)	**4**	**4**	**8**		16
No information from medical record (on health status)			**12**		12
Feasible indicators	7	12	5	6	30

All information related to the period of care before or after the admission is missing except when some condition present at the admission does influence the episode of care (in that case, V codes in ICD-9-CM codes are to be registered in MCD). The same problem concerns drugs uptake. The drug treatment before hospitalization for example is not recorded (e.g. corticosteroids uptake for more than one month).

On the side of the financial data relative to pharmaceuticals, the timing of reimbursed drug prescription and a fortiori the timing of uptake are not recorded (e.g. thrombolysis within 3 hours after admission for the patients with stroke). Out-of-pocket drugs that are delivered during the admission and invoiced directly to the patient are not recorded since they are not borne by the national healthcare system (this leads to a frequent problem for aspirin and analgesics).

The coding in ICD-9-CM has limits as found in the literature review in section 2.2.7 and may lack of accuracy in some cases (e.g. no grading for Alzheimer diagnosis).

In the same way, some information from the patient medical records like health status cannot be translated into codes. This was a frequent problem with the indicators from the set ACOVE (for vulnerable elderly patients) that often refers to medical history and/or clinical information (e.g. vaccination status, cognitively intact elders, inability to reposition oneself). Laboratory/examination results represent an important lack in the MCD and their registration could complete ICD-9-CM coding when codes are inaccurate or do not exist (e.g. degree of left ventricular ejection). Other care procedures are not included nor in ICD-9-CM coding system neither in the financial data: care insured by paramedics such as logopedics or dieticians, nursing care, risk assessment,…. Some administrative data are also absent from the databases; e.g. the presence of a stroke unit (indicator for the condition of stroke) is not officially recorded in Belgium.

One indicator was not feasible within the framework of this project due to the necessity to track the patient through time and across hospitals (revision of total hip prosthesis after dislocation). This would be possible thanks to the patient key providing a procedure ensuring patient privacy.

Key points

About half of the selected and adjusted clinical quality indicators were judged feasible a priori with the administrative databases MCD/MFD.

In most cases, the main barrier impeding the feasibility was the lack of clinical information: health status, contra-indications or appropriateness of care.

The next deficiencies were the absence of information on care absent from invoice such as paramedical care, on out-of-pocket drugs and the absence of treatment timing.

5.3.4 Data Analysis

As explained in the previous section, the patient's episodes of care across different admissions were not reconstructed and the number of stays is the unit used in rates calculations rather than the number of patients. This can be a strong assumption if one episode of care is responsible for several admissions. For example, in the analysis of obstetrical lacerations, only surgical procedures occurring during the same stay than delivery were taken into account. Subsequent admissions for obstetrical lacerations were not considered.

Eleven indicators were validated by four participating hospitals: Centre Hospitalier Chrétien Sites Saint-Joseph / Saint-Vincent (Liège), Cliniques Universitaires Saint-Luc (Brussels), Heilige Hartziekenhuis Roeselare-Menen vzw (Roeselare), Ziekenhuis Oost – Limburg (Genk). The aim of this validation was to assess the reliability of the data collection and the reflection of hospital practice.

5.3.5 Results of the feasibility measurement for the selected clinical quality indicators

5.3.5.1 Results of the measurement

- The detailed results per indicator including a chart showing the distribution between hospitals are in appendix 3. Table 24 summarizes these results.

Table 24. Results of the feasibility measurement

Selected clinical quality indicator	National Result
Proportion of patients with acute ischemic stroke undergoing ECG during hospitalization	72.5 %
Proportion of patients with acute ischemic stroke undergoing assessment by physiotherapist/ occupational therapist	68.4 %
Proportion of patients with acute ischemic stroke receiving a prophylactic dose of anticoagulation/heparin	0.8 %
Proportion of patients with acute ischemic stroke and nonvalvular atrial fibrillation that was discharged with anticoagulant therapy	7.5 %
Proportion of patients with acute ischemic stroke, and for whom a carotid artery imaging study is performed	52.3 %
Proportion of patients with acute ischemic stroke that was prescribed a statin	9.3 %
Proportion of patients with acute ischemic stroke receiving thrombolysis	1 %
Cases of birth trauma	1.6 %
Inpatient neonatal mortality	0.2 %
Proportion of post operative wound infection after caesarean delivery	1.6 %
Percentage of caesarean deliveries where the woman receives prophylactic antibiotics	56.9 %
Rate of operative vaginal deliveries	11.7 %
Severe neonatal morbidity rate: respiratory distress syndrome rate	1.3 %
Cases of obstetric trauma (3rd or 4th degree lacerations) after instrument-assisted vaginal delivery	2 %
episiotomy rate	48.8 %
Cases of obstetric trauma (3rd or 4th degree lacerations) after vaginal delivery without instrument assistance	0.5 %
Proportion of mothers with preterm birth (<34 weeks) that was given corticosteroids	52.3 %
Caesarean delivery rate	18.6 %
Proportion of deliveries with an induction of labour	28.4 %
Proportion of vulnerable elders with dementia **and** depression that is treated for the depression with TCAs or SSRIs	71.4 %
Proportion of vulnerable elders with a diagnosis of heart failure and atrial fibrillation that is treated with anticoagulation	74.1 %
Proportion of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a beta blocker	58.9 %
Proportion of vulnerable elders with a recent myocardial infarction or recent coronary bypass graft that is offered physiotherapy	59.8 %
Proportion of elder patients with gait- or balance problems that received physiotherapy	85.8 %
Proportion of patients with deep venous thrombosis after THR	0.4 %
Proportion of patients with pulmonary embolism after THR	0.3 %
Proportion of surgical site infections in patients undergoing THR	1.3 %
Proportion of patients who receive thromboprophylaxis for THR	99.4 %
Proportion of patients receiving prophylactic antibiotics with first generation cephalosporin's	81.6 %
Proportion of patients receiving at maximum 24 h dose of first generation cephalosporin's for total hip replacement	73.7 %

Some of these clinical quality indicators showed large hospital variability. For example both the percentage of caesareans deliveries with antibiotic prophylaxis (mean of hospital rates 56.6%; standard deviation 29.3%) and the episiotomy rate (mean of hospital rates: 59.6%; standard deviation 23.5 %) ranged from 0% to 100%. The mean of all hospitals giving an induction of labour was 28 % with a standard deviation of 21.2%. In some cases, the mean of hospital means was different from the national mean (calculated on all stays on a national level): a rate of 38.4% versus 52.3 % of mothers with preterm birth receiving corticosteroids, indicates a lower rate in hospitals with a lower number of caesareans.

5.3.5.2 Validation of the results

Table 25 compares the results calculated by the four hospitals that validated the results on their own database the results calculated by the KCE on the administrative databases (hospitals have been anonymised).

Table 25. Compared results of the feasibility measurement by validating hospital.

Selected clinical quality indicator / Hospital	KCE results (%)				Hospital results (%)			
	A	B	C	D	A	B	C	D
Proportion of patients with acute ischemic stroke undergoing ECG during hospitalization	75.9	79.5	81	67.2	77.5	79.3	81.9	67.0
Proportion of patients with acute ischemic stroke undergoing assessment by physiotherapist/ occupational therapist	55.7	75.1	64.7	60.8	58.1	77.2	63.3	64.6
Proportion of patients with acute ischemic stroke receiving thrombolysis	0.8	0	0.8	7.4	0.8	0	0	6.6
Proportion of post operative wound infection after caesarean delivery	0	2.5	0	0.7	0	2.4	0	0.6
Rate of operative vaginal deliveries	4.5	10.3	7.4	15	4.5	10.3	8.4	15.6
Episiotomy rate	49.4	69.3	76.7	14.3	48.4	69.4	76.4	14.9
Proportion of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a beta blocker	61.2	62.3	54.9	78.1	62.9	66.3	59	95.0
Proportion of vulnerable elders with a recent myocardial infarction or recent coronary bypass graft that is offered physiotherapy (*)	38.5	66.7	33.3	62.5	45.5	58.8	50	0
Proportion of patients with deep venous thrombosis after THR	0	0.6	0	0	0	0.5	0	0
Proportion of surgical site infections in patients undergoing THR	4.6	0.6	0	0	n.a.	n.a.	0	0
Proportion of patients receiving at maximum 24 h dose of first generation cephalosporin's for total hip replacement	74.6	76.2	89	97	n.a.	72.3	94.3	n.a.

(*) the differences are influenced by a low denominator.

Results of the calculations were similar on hospital data and on data present in the administrative databases. However, the number of stays retrieved by the KCE was somewhat lower than the effective number of stays due to three main reasons. Firstly, stays after an occupational accident or stays from patients not affiliated to health insurers are not present in MFD. Secondly, the validation during the coupling process between the MCD and the financial data can lead to stays exclusion when matching is not complete (globally 95% MFD). Finally, hospitals have a legal invoice period of 2 years while the financial data used for the coupling cover a period of a year and a half. Some hospitals could not retrieve information (often related to ATC codification).

The following considerations have emerged from the validation process:

- Proportion of patients with a diagnosis of stroke undergoing ECG during hospitalization: only the electrocardiogram billing code was taken into account. However a patient can also be followed by a continuous monitoring reimbursed under other billing codes that cannot be invoiced the same day of an electrocardiogram. The results are thus underestimated and this is especially true in hospitals having a stroke unit.
- Proportion of patients with acute ischemic stroke receiving thrombolysis: The result was low (with a maximum observed in a Belgian hospital of 8 %) probably due to the difficulty to perform the thrombolysis in the 3 hours after the occurrence of the first symptoms, when the thrombolysis can be effective.
- Proportion of patients with acute ischemic stroke undergoing assessment by physiotherapist/occupational therapist: as physiotherapy is included in the financing of geriatric beds and cannot thus be isolated in the financial data, this indicator should only be tested on medical and surgical index beds. It has to be noted that all patients with acute ischemic stroke do not have to receive this kind of treatment. Finally the rate can be lowered by the transfer policy of the hospital.
- Proportion of postoperative wound infection after caesarean delivery: the ICD-9-CM code for wound infections after caesareans (674.3 instead of general code 998.5 postoperative infection) can also be used in the case of a haematoma or a hemorrhage. The reporting of this condition is compulsory but globally under coded and can lead to an underestimation of the reality in some hospitals. Another underestimation results of later infection outbreaks (after the hospitalization for the delivery).
- Rate of operative vaginal deliveries: the result is very dependent of the hospital coding behavior as ICD-9-CM coding is facultative in this case.
- Episiotomy rate: the measured rate spread between 0% and 100% and was the largest variation observed on the validation set of 11 clinical quality indicators between the four validating hospitals. However, ICD-9-CM coding for episiotomy is also facultative. This in fact impairs the usefulness of the indicator.
- Proportion of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a beta-blocker: a low rate is not necessary alarming as ACE inhibitor and beta-blockers do not have to be given to all vulnerable elderly patients belonging to the denominator. Heart failure can indeed result from a cause that does not require this type of medication (e.g. renal failure).
- Proportion of vulnerable elders with a recent myocardial infarction or recent coronary bypass graft surgery that is offered physiotherapy: the same problem linked to the financing system was underlined as in the measurement of physiotherapy in acute ischemic stroke patients. The selecting code could have been precised with the use of 5th digit. The 410.x1 code indicates a recent infarction (410.x2 being used after 8 weeks).
- Proportion of patients with deep venous thrombosis after total hip replacement: the number of selected stays was too low due to another ICD-9-CM possibility to code this condition. Above this, a high number of deep venous thromboses (and pulmonary embolisms) are not diagnosed, leading to an underestimated prevalence.

- Proportion of patients with surgical site infection after total hip replacement: as for wound infection after a caesarean section, surgical site infections after a hip replacement can occur after the discharge of the patient from the hospital. The use of this indicator requires thus the flagging of the patient.
- Proportion of patients receiving at maximum a 24 h dose of first generation cephalosporin's for THR: the dose defined as a daily dose cefazolin by the WHO is 3 g. When calculation algorithm was executed using a more realistic dose of 6 g., the proportion reached 73.7% instead of 9.7% which was abnormally low.

A general remark was made on the absence of a filter concerning patients deceased at the hospital or transferred to another hospital. It was suggested to impose a minimum length of stay in the calculation of some clinical quality indicators to avoid this bias.

6 DISCUSSION

The different parts of this project are leading towards one objective, i.e. a framework for measuring quality indicators in Belgium, with a particular focus on the measurement of clinical quality indicators in Belgian administrative databases. The different steps of the research yielded complementary results that are discussed in this chapter.

6.1 CLINICAL QUALITY INDICATOR: WHAT'S IN A NAME

The literature search showed that 'quality indicator' and 'clinical quality indicator' are terms covering different realities for different purposes (e.g. quality improvement, benchmarking, decision support). Above this, different terms are used for the same concept, e.g. quality measure, quality indicator, indicator. Nevertheless, the conceptual framework was able to define clinical quality indicators within the larger group of quality indicators. For this purpose, 'clinical care' has been defined, since the absence of a definition of "clinical quality indicator" was a major shortcoming in the literature.

An important part of the adopted definition of quality indicator is its relation with at least one of the key characteristics of quality of health care. In the literature review, various dimensions of quality were identified, which were reduced to 7 key characteristics in the conceptual framework. However, a dimension that wasn't identified through the literature search was 'appropriateness'. Health care can be considered appropriate if the care is tailored to the patient's needs (patient-centeredness) and if the balance of good to harm is sufficiently high to justify the provided care [144], which in fact is closely related to the dimension 'effectiveness'. However, appropriateness not only relates to benefits and risks, but also to the costs of the provided care [144], and therefore also relates to 'efficiency'. Nevertheless, the literature showed that 'appropriateness' was sufficiently covered by 'patient-centeredness', 'effectiveness' and 'efficiency', and should therefore not be added as an additional dimension in the conceptual framework.

The literature review provides a broad overview on the state-of-the-art about the development and use of (clinical) quality indicators. The followed methodology allowed retrieving a high number of relevant articles. However, some drawbacks due to the qualitative nature of the topic were identified. First, a quality appraisal of such literature is difficult: the objective selection of high-quality reports was problematical, probably leading to the inclusion of lower-quality reports and definitions. Secondly, much grey literature has been written on the topic: some papers (and potentially good definitions) may have been missed, although this bias is probably limited through the high number of contacts with experts in the field. Finally, the definitions of 'quality indicator' were isolated without taking into account the accompanying commentary of the authors, which probably lead to a loss of some additional valuable information.

6.2 STRENGTHS AND LIMITATIONS OF THE CONCEPTUAL FRAMEWORK

The conceptual framework developed in this project is the first initiative to situate the development and use of clinical quality indicators in the Belgian policy context. Importantly, the framework provides a clear link between the measurement of the quality of health care (using indicators) and the ultimate goal of improved health. This important link with health is also well addressed in the recent OECD report [19]. However, the scope of the OECD framework is broader than clinical quality indicators and it aims at international comparison. Importantly, our conceptual framework does not rule out this international comparison.

The proposed conceptual framework has a few limitations inherent to the methodology used for its development. It is based on a systematic literature review, but in the absence of objective quality criteria, the key points were selected using the preferences and experience of the authors. The major part of the included literature concerns (acute) hospitals and only few references address the use of quality indicators for

example in general practice. Therefore, the generalization of the framework to other health services than the acute hospital (e.g. general practice, revalidation, nursing care) can only be done after a check of the literature on the use of quality indicators in these settings. Also, since the review focused on quality and clinical quality indicators, the conceptual framework cannot be blindly applied to other indicators, e.g. those relating to the organisation of care. For example, the evidence base, an important selection criterion for clinical quality indicators, probably has less importance for the selection of indicators in other areas of care.

6.3 TIME FOR A CENTRALISED DATA COLLECTION?

The health competencies in Belgium are divided up among the different governments. They elaborate their own health program, according to their specific needs and scope of interest. This leads to a scattered registration, collection and reporting of health data with only a minor coupling between the different databases. In other words, many health data are available in Belgium, but they are not integrated into a global health information system. The information about one patient is compartmented: the data collection for measuring quality indicators therefore requires a lot of labour to couple data from different health information systems. The explorative study of this project illustrates this point: data about the procedures were found in the minimal clinical data, data about the treatment (if prescribed) were found in the minimal financial data, but other useful information related to the follow-up or the patient's history was missing.

Up to now, the treasure of health data in Belgium remains scattered and many possibilities remain unexploited. Hospitals invest a lot of time and manpower collecting data in different formats to send it to different health institutions. For example, the same data are collected for MCD-registration, for indicators for the self-evaluation required by the Flemish government and for the voluntary based system Navigator©. A centralized data collection system with well constructed feedbacks would enhance the efficiency of the system. This feedback is also very important to keep the hospitals motivated to collect the necessary data correctly.

A centralized data collection in combination with a standardized format would greatly facilitate the data analysis and the subsequent feedback. Moreover, hospitals would save the time and money invested for collecting the necessary data. A centralized data collection would also facilitate data validation, which is a necessary step for obtaining reliable information possibly useful for benchmarking.

An important feature of a useful feedback is that it is provided at short notice after the registration period. Previous feedbacks concerning hospital activity were sometimes out of date and not valuable for internal evaluation. Feedbacks on recent hospital data would enhance the detection of problem areas and suggest actions for improvement in an early stage. In turn, timely feedback could be an extra motivation for hospitals to cooperate in the data collection system.

Databases that include data on the whole population or a representative sample of the population and that are systematically updated should be addressed to gather information for indicators. Databases resulting from isolated surveys based on random samplings (such as the National Health Surveys) usually do not meet the requirements for measuring quality indicators. Information should be exact, complete and up to date.

Internationally valid clinical indicator sets exist in Belgium, but a fully operational indicator system is missing on a national level. On the regional level, Navigator© is an operational system providing information for the local hospital policy. The development of a national system should get inspiration from this regional initiative and from international systems as proposed by the OECD. This will facilitate the comparison of indicators on an international level. If an operational indicator system is launched, the people who are involved in the collection and the input of the data need to be trained and educated in order to obtain valid, reliable and comparable data. Health professionals can be motivated if constructive feedback and benchmarking are provided.

6.4 LESSONS LEARNED FROM THE EXPLORATIVE STUDY

6.4.1 Sources of clinical quality indicators

Clinical quality indicators are most often found in the grey literature. A Medline search did not identify a lot of additional indicators for the selected conditions. On the other hand, clinical practice guidelines proved to be a rich source for evidence-based clinical quality indicators. Although only NICE, ICSI and CBO were searched, they provided one fifth of the evidence-based clinical quality indicators. This stresses the need to include guidelines in a search for clinical quality indicators.

For stroke and total hip prosthesis a search in two sources, and for perinatal and elderly care a search in four sources would have identified all the selected evidence-based quality indicators. For three of the four conditions (not for total hip prosthesis), guidelines were obligatory to retrieve all the indicators, again stressing their importance as a source for clinical quality indicators.

6.4.2 Selection of clinical quality indicators

The explorative study focused on a search for disease-specific clinical quality indicators. The disadvantage of working with disease-specific indicators is that they mainly provide a picture of the quality of care of individual providers/services rather than a global picture. The choice for disease-specific indicators may also explain the low number of retrieved indicators for total hip prosthesis, which are mostly contained in generic surgical indicators sets.

The evidence base was an important criterion in the selection of clinical quality indicators: only those indicators supported by systematic reviews (level 1a) or individual randomized controlled trials (level 1b) were selected. However, it should be stressed that restricting the evidence to systematic reviews and randomized trials is no guarantee for reaching the right conclusions. In fact, a formal quality appraisal (e.g. by methodologists) and content analysis (e.g. by clinical experts) of the retrieved evidence is highly recommendable. Also, the transparency on how conclusions were reached is needed.

Furthermore, using the evidence base as a selection criterion led to the exclusion of several clinically relevant indicators, e.g. the caesarean delivery rate or the vaginal birth rate after prior caesarean delivery (VBAC). Moreover, some of the included evidence-based indicators were found to be less clinically relevant. This problem was solved by subjecting all indicators to the assessment of an expert panel, an essential step for the development of a clinical quality indicator set according to the proposed conceptual framework. This step led to the additional inclusion of five non-evidence-based but highly relevant clinical quality indicators and the exclusion of 21 evidence-based but less relevant clinical quality indicators. This stresses the need for involving clinical experts in the selection of clinical quality indicators and illustrates what evidence-based medicine should be: the integration of both evidence and clinical experience. Evidence base cannot be an exclusive criterion for the selection of clinical quality criteria. A level of evidence 1b or even a level 1a can still be arbitrary and lead to wrong conclusions.

A second point described in the conceptual framework was also beyond the scope of the explorative study. The conceptual framework stressed the link between a quality indicator and the key dimensions of quality of care. In the explorative study, the researchers only checked that the selected indicators assessed the dimensions effectiveness and efficiency of the quality of care. They did not further identify which indicator covered which dimension. However, an ideal quality indicator set should theoretically cover every key dimension of quality with at least one quality indicator.

6.4.3 Selection of databases

Administrative databases encounter well-known advantages and limitations, in Belgium and abroad. Routinely collected discharge data are less expensive in time and resources than surveys or medical record extraction. They cover a wide geographic area, they are

representative, and methods of data analysis can be easily replicated [145-147]. They are 'the most comprehensive and consistent sources of encounter-level health information available today' according to Johantgen et al [146] 'and practical and cost-effective on selected components of healthcare quality available today' according to Hurtado et al (cited by Glance et al.) [148]. Prospective payment based on administrative databases fosters the exhaustiveness and accuracy of coding (with a certain risk of up coding). In Belgium, a part of hospital funding relies on data transmitted by hospitals in administrative databases. Moreover, the possible number of diagnoses is relatively high (more than 20), in contrast to some databases abroad [149, 150]. In some studies, coded diagnoses have identified more cases than when using routine surveillance methods [151, 152]. Limitations of clinical discharge data are mainly bound to the ICD-9-CM coding limitations, as found in the literature review of this study (see 2.2.7.). The ICD-9-CM classification can be imprecise or non-specific for certain conditions and does not include physiological parameters [153, 154, 145]. It may be more accurate and complete for major operating room procedures than minor ones [147]. Coding is also dependent on the clarity of the documentation in the medical record and is subject to variability between hospitals [146]. Finally, it is not possible yet to identify conditions already present on admission in the MCD. As a conclusion, administrative databases may be screened to identify potential quality problems and to identify hospitals that may be targeted preferentially for a deeper analysis, but they cannot determine with certainty that a patient has received suboptimal care [155]. An application of indicators on those databases would require a strong risk-adjusted model.

As stated above, MCD-MFD data are only available 2 to 3 years after registration, due to registration periods, validation and coupling of the data. The quality of care is hence assessed with an important delay. Moreover, the data availability is subjected to a procedural authorization by the Belgian Privacy Commission.

The main restriction of the applicability of indicators based on the MCD-MFD data is the lack of information present in the medical record but not registered in the MCD. The two other principal shortages are the absence of timing (for drug prescription, occurrence of complications…) in the MCD and MFD and the absence of out-of-pocket drugs and medical or paramedical care not covered by hospital patient invoice in the MFD, of which the purpose is financial and not clinical. In this project, these shortages were overcome by rephrasing some clinical quality indicators with the help of clinical experts (again stressing the importance of their involvement).

Comorbidities are under/overestimated in some hospitals due to coding behavior. Coding behavior differences between hospitals were assumed to be homogeneously distributed and independent from the quality of care, which means that any coding bias was randomly distributed across all hospitals. However, as written by Johantgen et al, 'if the coding of complications is inconsistent across hospitals, differences in complication rates will not be meaningful' [146]. For example, quality indicators can be biased by underreporting of adverse events in some hospitals, and therefore report an artificially higher quality than in hospitals meticulously coding each adverse event.

In this study clinical quality indicators were searched that measure the quality of care offered during hospital stay. This raises two important issues. First, the global quality of care received by one patient through different hospitals would require tracing the patient's records over time. Second, the measure of quality computed on stays in a particular hospital does not allow any inference about the quality of care of this hospital. Patient transfers may be the markers of a good quality of care or the markers of worse outcomes in the facility. Tracing individuals over time and hospitals would be a solution. As an illustration, hospitals transferring neonates in poor health who eventually die in another hospital will not show a high rate of mortality. In that case, it is difficult to state that the mortality rate is an accurate measure of quality:

Planned enhancements of the MCD (from 2007-2008) will solve a few gaps in the collected data. Some laboratory results will be registered (the list of examinations to be recorded is not determined yet). A second amelioration is the differentiation in registration of diagnoses present at the admission. The difference between conditions already present and conditions emerging during hospitalization will be possible and

clinical quality indicators dealing with adverse events will be more easily drawn from the data. Finally, the precise date and hour of admission and discharge will be requested, instead of the month and day of the week at present. This will enhance the quality of coupling with financial data. The modified MCD, integrated with other databases collected by the service of Public Health (Minimal Nursing Data) have to be approved first by the Belgian Privacy Commission.

The feasibility of indicators built on specific procedures is better than of indicators relying on other clinical data, such as medication prescriptions or clinical procedures not recorded in the MCD. Billing data are more exhaustive (i.e., all procedures have been charged), but the procedure codes sometimes lack precision. On the opposite, data from the clinical codification are more precise (cf. obstetric surgical repair), but not always coded for all patients.

Some indicators would have been feasible if other data sources were used, e.g.:

Health insurer's data: the Intermutualistic data (health insurers, IMA/AMI) are for example useful for:

- time of death of deceased insured persons. A coupling with the administrative databases is necessary to capture mortality outside hospital.
- IMA/AMI does have the timing (date) of prescription that could give a proxy for all reimbursed drugs prescribed by intervals of 24 hours. Unfortunately, knowing the date of prescription does not give any information about the real uptake. Moreover, indicators for acute conditions sometimes require a delay in hours.

Data collection from the medical records in hospitals is useful for indicators relating to specific pathologies. Few indicators are available from administrative databases when they relate to precise pathologies (i.e. stroke and elderly) or when the patient's clinical health status is of utmost importance in the patient's management (e.g. the percentage of carotid stenosis, the grade of Alzheimer disease). As an illustration, the ACOVE indicators often cannot be used on the available administrative databases. Information directly drawn from the medical record is then needed. However, these indicators could be an opportunity for monitoring the quality activities from the Belgian Geriatrics College.

6.4.4 Measurement of clinical quality indicators using MCD/MFD data

The measurement of clinical quality indicators using MCD/MFD data highlighted the need for discussing their selection with experts from the field as well as with experts accustomed with administrative data collection in hospitals. The translation of each indicator into a precise data selection algorithm is crucial to guarantee a meaningful data collection. Issues such as influence of deceased patients or short stays before transfer to another hospital must be considered.

Some results were considered lower than expected without showing any large hospital variability. Several hypotheses should then be raised: the applicability of the indicator to all patients included in the denominator (as the frail elderly), a problem in the definition of the numerator (for example, the selected ATC classes have to include all products available to target a same therapeutic aim), a problem in the data collection (registration errors or facultative nature of the registration) or a questionable Belgian practice. In this latter possibility, the interpretation has also to take account of the date of data collection: the practice may have considerably evolved during the three last years.

When there is a low number of stays in the denominator, one case in the numerator has a major influence on the hospital rate. A minimal denominator number can be applied when the condition is frequent but it is not always possible (as for neonatal mortality).

This explorative study illustrates the fact that clinical quality indicators are measures that require cautious interpretations. Important hospital variability raises questions, especially if the condition has a high prevalence. When guidelines exist on the process or outcome measured, they provide a scientific basis to set up ideal rates to which hospitals may strive. Otherwise a discussion between peers is needed to determine the best quality achievable in acute care setting.

The explorative study also illustrates that no matter how high the level of evidence for an indicator, or no matter how well the indicator is accepted and implemented internationally, the validity of an indicator depends on the system for which it is used and on the accuracy and completeness of the database from which data are extracted. Therefore, each individual indicator needs to be judged, checked and validated before implementation. As a final remark, it should be mentioned that a validation of the hospital data by independent external reviewers would have been an added value for the explorative study. However, internal validity checks were preferred in this project for acceptability and feasibility reasons.

7 CONCLUSIONS

This report is a first step in defining a clear and explicit strategy to monitor the quality of health care. It proposes a conceptual framework for the development of (clinical) quality indicators in the Belgian context.

This report does not make any decision on the persons/institutions in charge that should initiate and manage a quality system in Belgium. All stakeholders agree on the need for measuring quality in the health care sector. Quality initiatives are currently fragmented between many institutions. The KCE urgently advocates a harmonized measurement system that should be common to all health care sectors.

At the national level, a first and crucial step is the assignment of the persons and institutions responsible and accountable for quality measurement. A specific quality system has therefore to be set up, for the time being based on current databases and initiatives. This report provides a framework that will allow those persons and institutions to set up such a system that can be adapted to any health care setting according to health care priorities.

The next steps for policy makers and stakeholders will be to identify the priority areas that need quality monitoring based on explicit health objectives and to agree on the purposes and use of this quality monitoring.

Specifically, when developing a (clinical) quality indicator system, the following has to be considered:

- The objectives and the use of each quality indicator system have to be decided on and explicited in advance. Quality indicators can be used for many policy reasons – as was shown in the international overview – ranging from unrestrictive feedback to care providers to the publicly publishing of the results and the coupling with financing. A neutral evaluation of the consequences on the quality of health care (and health objectives) of these options – in accordance with a policy of high quality – is necessary. Indeed, foreign examples show the pernicious effects, such as cream skimming, to which some initially well meant systems can lead.
- In order to have a successful indicator system, a valid and complete database is a necessary precondition. To allow inter-hospital comparison and peer review at regional and national levels, standardized registration methodology and data analyses are recommended. In order to be useful a quality indicator system needs to give timely feedback to its users (i.e. policy makers and organisations/health professionals). In view of the scattered quality initiatives at present, coordination of this registration and feedback is needed as stated above. The measurement of quality should not impose a supplementary administrative burden for health care workers but the initiative should rely as much as possible on already existing data.
- High quality clinical evidence is of utmost importance for the development of a set of clinical quality indicators. The transparent involvement of clinical experts is necessary and is an added value in the final selection and formulation of clinical quality indicators.

This project included an explorative study on the feasibility of measuring quality indicators in administrative databases. The measurement has been carried out with the MCD/MFD databases as they were readily available. However, other databases potentially also provide useful data for the measurement of quality indicators (e.g., information on drug prescriptions). The data from the Intermutualistic agency are an illustration of this.

Unfortunately, given the delay for coupling different databases, this explorative study could only focus on one database. The MCD/MFD database (combination of ICD codes and nomenclature codes including medication) seems to be useful for only a limited number of indicators, as was shown in our evaluation study. Some deficiencies were found:

- The possibility of up- or under coding and the lack of primary validation are a threat for the reliability of the MCD/MFD database and its use for the measurement of clinical quality indicators. This lack of primary validation is also a concern for other databases, although these were not evaluated in the present study.
- Because of a lack of important information in the MCD/MFD database, such as some clinical data (e.g. patient's history, comorbidities), time notion and information on out-of-pocket drugs, many potentially relevant clinical quality indicators cannot be measured using these databases alone. However, an alternative is not readily available.
- The delay with which the coupled MCD/MFD data are made available is a real barrier. The administrative procedure to make use of these data should be simplified.

In the start-up of any quality indicator system various validation steps are necessary, ranging from primary validation of registered data to the validation of the derived quality indicators in at least a few hospitals. These steps are feasible in the Belgian context, as was shown in the present report. However, to walk through these steps, efforts are needed, primarily on the level of clinical excellence, but also on the level of resources. Nevertheless, these are crucial steps to initiate a credible and professional quality system.

8 SUMMARY TABLES OF INDEXED LITERATURE (LITERATURE REVIEW)

Author	Ref	Date	Summary
Allison	93	2000	Review on the use of inferential statistics in the interpretation and reporting of quality measures.
Arling	100	2005	Critical evaluation of nursing home quality indicators. Recommendation of strategies to make indicators more valuable as quality assessment tools
Ballard	31	2003	Describes the implementation of a clinical indicator system by the Baylor Health Care System (BHCS) in Texas.
Barnsley	29	1996	Description of the experiences of the Clinical Outcome Indicator Project in Canada. Addresses in detail the following issues: intended use and end users of indicator information, aspects of indicator validity, data quality issues, and dissemination and use of indicator information.
Blumenthal	61	1996	Introduction on a series about the quality of care. In this article alternative definitions of quality of care are reviewed, taking into account different perspectives from different stakeholders.
Booth	46	1997	Considers the issues of indicator validity, responsiveness, and reliability, based on the experiences from the National Aggregate Database of the ACHS.
Brook	41	2000	Review on the quality of care, the measurement of quality, and strategies to improve quality of care in the next century.
Campbell	83	1999	Two-round postal Delphi survey health care managers and family physicians two determine the face validity 240 potential quality indicators of primary care. Concluded is that consensus panel judgments are influenced by panel composition and by the type of feedback given to participants.
Campbell	23	2000	Definition of quality of care. Two principal dimensions are suggested: access and effectiveness. A distinction is made between the care for individuals and for populations.
Campbell	33	2002	Overview of research methods used in developing and implementing quality indicators in primary care. Three issues are found important: which stakeholder perspectives are the indicators intended to reflect, what aspects of health care are being measured, and what evidence is available?
Collopy	30	2000	Description of the role of clinical indicators in the accreditation program of the ACHS.
Derose	52	2003	Description of the development of a set of public health quality indicators for the Public Health Division of the LA County Department of Health Services.
Donabedian	21	1978	Classification of the major approaches to the assessment of the process and outcomes of medical care.
Donabedian	20	1980	Review of the methods to measure quality of care.
Donabedian	28	1990	Description of the concept of quality of care based on 7 dimensions: efficacy, effectiveness, efficiency, optimality, acceptability, legitimacy, and equity.
Eddy	94	1998	Review on possible problems associated with performance measurement, and their solutions.
Flowers	99	2005	Review on public health indicators, their essential features, pitfalls, and some ways of presenting indicators.
Freeman	48	2002	Extensive review on the use of performance indicators to improve health care quality.
Geraedts	47	2003	Description of the methodological requirements for clinical performance measures.
Giuffrida	49	1999	Multiple regression analysis relating admission rates standardized for age and sex for asthma, diabetes, and epilepsy to socioeconomic population characteristics and to the supply of secondary care resources. Conclusion is that performance indicators should relate to those aspects of care which can be altered by the staff whose performance is being measured.
Griffith	42	2002	Comparison between 7 outcome measures and JCAHO performance measures. A low correlation was found.
HSRG	25	1992	Review on quality of health care and the assessment of it.
Hofer	35	1997	Description of a methodology to select quality indicators.
JCAHO	38	1989	Gives a definition of a clinical indicator, with examples of different types of indicators and necessary attributes of indicators.
Jeacocke	59	2002	Description of a methodology combining quantitative and qualitative research to develop quality indicators for general practice.
Jencks	36	1994	Description of the HCFA's Health Care Quality Improvement Program.
Kazandjian	5	2003	Description of the Quality Indicator Project (QIP)
Keating	97	2003	Assessment of diabetes quality indicators using administrative and medical records data. Using administrative data alone may lead to

Author	Ref	Date	Summary
			underdetection of indicators.
Mainz	[39]	2003	Review on definitions, characteristics, and categories of clinical indicators for quality improvement in health care.
Mainz	[56]	2003	Review on the development and testing of evidence-based clinical indicators.
Mainz	[3]	2004	Description of the Danish National Indicator Project
Mant	[51]	1995	Comparison of the relative sensitivity of measures of process and outcome to differences in quality of care for the hospital treatment of myocardial infarction. Concluded is that disease specific mortality is an insensitive tool to compare the quality of care among hospitals.
Mant	[43]	2001	Review of the strengths and weaknesses of outcome and process measures.
Maxwell	[26]	1992	Review on the quality of care and its dimensions.
McGlynn	[45]	1998	Description of four essential steps in developing a clinical performance measure: choosing clinical areas to measure, selecting performance indicators within each area, designing specifications for consistent implementation of a measure, evaluating the scientific strength of a measure.
McLoughlin	[95]	2001	Description and comparison of recent national performance improvement initiatives in the US, UK, and Australia.
O'Leary	[27]	1992	Opinion statement about the role of JCAHO in continuous quality improvement.
Portelli	[96]	1997	Feasibility testing of matching ICD-9-CM codes with a selected number of clinical indicators developed by the ACHS CEP.
Rubin	[40]	2001	Review on the development and implementation of process measures of quality.
Rubin	[44]	2001	Review on the advantages and disadvantages of process measures of quality.
Scully	[98]	2003	Comparison of the results for selected AHRQ quality indicators using hospital and physician coded data. A large discrepancy was found.
Sofaer	[58]	2000	Description of the storytelling methodology to develop performance indicators.
Veillard	[109]	2005	Description of the first stage of the performance assessment tool for quality improvement in hospitals (PATH) project in 8 European countries.

9 APPENDIXES

APPENDIX 1. INDICATOR SETS AND DATABASES

GENERIC INDICATOR SETS AND DATABASES

1. Australian Council on Healthcare Standards (ACHS)

Country of origin	Australia
Objectives for CQI measurement	• To increase the involvement of clinicians in evaluation and quality improvement activities. • To add the surveying of patient care processes and outcomes to the ACHS Evaluation and Quality Improvement Program. • To create and provide useful tools for flagging potential problems and / or areas for improvement in health care. • To facilitate the collection of national data on the processes and outcomes of patient care.
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients not mentioned)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Not reported
• updating procedure mentioned?	Yes
Description of CQI set:	
• Clinical areas covered?	21 subsets, covering: adverse drug reactions, anesthesia, day surgery, dermatology, emergency medicine, gastrointestinal endoscopy, hospital in the home, hospital-wide CQIs, infection control, intensive care, internal medicine, mental health, obstetrics and gynecology, ophthalmology, oral health, pediatric medicine, pathology, radiation oncology, radiology, and surgery
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Partly (mainly to guidelines)
Useful for the development of CQIs in Belgium?	Yes, but additional literature search necessary
Link	http://www.achs.org.au/content/screens/file_download/Users_Manual_2006.pdf

2. Agency for Healthcare Research and Quality (AHRQ)

Country of origin	US
Objectives for CQI measurement	• to highlight potential quality concerns • to identify areas that need further study and investigation • to track changes over time
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients?)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes
• pilot testing?	Yes
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Prevention Quality Indicators: 14 indicators Inpatient Quality Indicators: 34 indicators Patient Safety Indicators: 27 indicators Pediatric Quality Indicators: 18 indicators
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	Prevention QI: http://www.qualityindicators.ahrq.gov/downloads/pqi/pqi_technical_specs_v30a.pdf Inpatient QI: http://www.qualityindicators.ahrq.gov/downloads/iqi/iqi_technical_specs_v30.pdf Patient SI: http://www.qualityindicators.ahrq.gov/downloads/psi/psi_technical_specs_v30.pdf Pediatric QI : http://www.qualityindicators.ahrq.gov/downloads/pdi/pdi_technical%20specs_v30.pdf

3. Joint Commission on Accreditation of Healthcare Organizations (JCAHO)

Country of origin	US
Objectives for CQI measurement	• basis for accreditation • comparison of the results of care across organizations • to accurately understand the basis for current performance so that better results can be achieved through focused improvement actions
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Acute myocardial infarction (14 indicators), heart failure (4 indicators), pneumonia (12 indicators), surgical infection prevention (3 indicators), pregnancy and related conditions (3 indicators)
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes, but additional literature search necessary
Links	http://www.jcaho.org/pms/core+measures/aligned_manual.htm

4. Health Plan Employer Data and Information Set (HEDIS©)

Country of origin	US
Objectives for CQI measurement	• to ensure that purchasers and consumers have the information they need to reliably compare the performance of managed health care plans
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	Partly
Description of CQI set:	68 indicators
• Clinical areas covered?	Effectiveness of care, availability of care, satisfaction with the experience of care, health plan stability, use of services, health plan descriptive information
• CQI specifications provided?	No
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Partly
Links	http://www.ncqa.org/programs/hedis/ (no free access to detailed information!)

5. National Quality Measures Clearinghouse (NQMC)

Country of origin	US
Objectives	• to promote widespread access to quality measures by the health care community and other interested individuals
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not applicable
• supporting evidence:	
▪ literature review performed?	Not applicable
▪ literature review described?	Not applicable
• pilot testing?	Not applicable
• updating procedure mentioned?	Not applicable
Description of CQI set:	Database of healthcare quality indicators and indicator sets with the following components: • Structured, standardized abstracts (summaries) containing information about measures and their development • A utility for comparing attributes of two or more quality measures in a side-by-side comparison • Links to full-text quality measures (when available) and/or ordering details for the full measure
• Clinical areas covered?	515 indicators covering a broad range of diseases, 98 mental health indicators
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.qualitymeasures.ahrq.gov/

6. The American Medical Association (AMA)

Country of origin	US
Objectives	• to assist quality improvement activities within physician practices • to track changes over time in the context of continuous quality improvement in patient care
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (no patients)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Not stated (but coding and data collection specifications are provided)
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Chronic stable coronary artery disease, heart failure, osteoarthritis, adult diabetes, adult influenza immunization, asthma, chronic obstructive pulmonary disease, colorectal cancer screening, community-acquired bacterial pneumonia, hypertension, major depressive disorder, pediatric acute gastroenteritis, prenatal testing, problem drinking, screening mammography, and tobacco use.
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes (CQIs are based on clinical practice guidelines)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.ama-assn.org/ama/pub/category/4837.html

7. OECD Health Care Quality Indicators Project (HCQI)

Country of origin	OECD countries
Objectives	• to collect **internationally comparable** data reflecting the health outcomes and health improvements attributable to medical care delivered in OECD countries
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (no patients)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No (but references provided)
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Cardiac care, diabetes care, primary care and prevention, mental health, and patient safety
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	HCQI project: http://www.oecd.org/document/31/0,2340,en_2649_33929_2484127_1_1_1_1,00.html Conceptual framework: http://www.oecd.org/dataoecd/1/36/36262363.pdf

8. International Quality Indicator Project (QIP)

Country of origin	US (involved countries: UK, Germany, Italy, Ireland, Portugal, Austria, Switzerland, Luxemburg, China, Taiwan, Singapore)
Objectives	• to assist healthcare organizations identify opportunities for improvement in patient care
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated explicitly
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Yes (but not described)
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Acute care, psychiatric care, long term care, and home care
• CQI specifications provided?	No
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.internationalqip.com/indicators.aspx

9. EUROSTAT

Country of origin	EU
Objectives	• to provide the European Union with statistics at European level that enable comparisons between countries and regions
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Indicators on public health (partly based on national health surveys: http://www.iph.fgov.be/epidemio/epinl/index4.htm), health and safety at work, and structural indicators on health
• CQI specifications provided?	No
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes, but additional literature search and pilot testing necessary
Links	http://epp.eurostat.cec.eu.int/portal/page?_pageid=0,1136184,0_45572595&_dad=portal&_schema=PORTAL

10. National Health Service (NHS)

Country of origin	UK
Objectives	• to provide comparison between NHS organizations • to improve performance overall
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated for all indicators
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Broad range of conditions
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes, but additional literature search and pilot testing necessary
Links	http://www.performance.doh.gov.uk/nhsperformanceindicators/2002/technical.html

11. National Centre for Health Outcomes Development (NCHOD)

Country of origin	UK
Objectives	• monitoring standards of quality of care
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Yes
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Outcome indicators for ten conditions (asthma, breast cancer, cataract, diabetes mellitus, fracture proximal femur, myocardial infarction, normal pregnancy and childbirth, severe mental illness, stroke, urinary incontinence)
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://nchod.uhce.ox.ac.uk/

12. Clinical Indicators Support Team (CIST)

Country of origin	UK (Scotland) (CIST is a part of the NHS)
Objectives	• to provide information that can help the health service in Scotland improve the quality of care it provides fro patients
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	No
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Broad range of conditions covered
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.show.scot.nhs.uk/indicators/Outcomes/Updates.htm

13. Kwaliteitsinstituut voor de Gezondheidszorg (CBO)

Country of origin	The Netherlands
Objectives	• self-monitoring • benchmarking • to reveal areas that need actions for quality improvement and to evaluate these actions • to measure and follow-up the quality policy
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	No (only health care providers)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes (in clinical practice guidelines)
• pilot testing?	Yes
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Stroke, postoperative wound infection, diabetes
• CQI specifications provided?	No
• Level of evidence provided?	Indirectly (in clinical practice guidelines)
• Reference to literature provided?	Indirectly (in clinical practice guidelines)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.cbo.nl/product/richtlijnen/pdf/indicator2002.pdf

14. Prestatie-indicatoren

Country of origin	The Netherlands
Objectives	• internal guidance of quality improvement • accountability of the hospitals
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Yes
• updating procedure mentioned?	Yes
Description of CQI set:	
• Clinical areas covered?	Broad range of conditions covered
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Partly
Links	http://www.snellerbeter.nl/uploads/media/Basisset_20prestatie-indicatoren_20ziekenhuizen_20versie_20april_202004.pdf

15. Agence Nationale d'Accréditation et d'Evaluation en Santé (ANAES)

Country of origin	France
Objectives	• accreditation • promotion of good clinical practice
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients?)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes (in ANAES guidelines)
• pilot testing?	No
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Broad range of conditions covered
• CQI specifications provided?	No
• Level of evidence provided?	Yes
• Reference to literature provided?	Yes (to ANAES guidelines)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.anaes.fr/anaes/anaesparametrage.nsf/HomePage?ReadForm (Les référentiels d'évaluation)

16. Danish National Indicator Project (DNIP)

Country of origin	Denmark
Objectives	• to create awareness in patients, families, doctors, nurses and other healthcare professionals about the extent to which the completion and outcomes of the treatment are up to the standards which is expected from a well-functioning healthcare service
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients?)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Partly (results) (in Danish)
• pilot testing?	No
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	7 conditions: diabetes, lung cancer, schizophrenia, heart failure, hip fracture, stroke, and acute surgery for gastro-intestinal bleeding
• CQI specifications provided?	Yes (in Danish)
• Level of evidence provided?	Yes (in Danish)
• Reference to literature provided?	Yes (in Danish)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.nip.dk/nipUK.htm

17. Bundesgeschäftsstelle Qualitätssicherung (BQS) Qualitaetsindikatoren

Country of origin	Germany
Objectives	• internal quality management • external comparison (benchmarking) • quality reporting
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Broad range of conditions covered
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.bqs-qualitaetsindikatoren.de/ (in German)

DISEASE-SPECIFIC INDICATOR SETS AND DATABASES

Stroke

1. National Stroke Unit Program

Country of origin	Australia
Objectives for CQI measurement	• Improvements in direct and specific aspects of patient care relevant to acute stroke • Reflection on what happens at an aggregate or population level at the health care organization rather than at an individual patient level • To highlight, examine and improve the underlying system
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not explicitly mentioned
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	Yes
• updating procedure mentioned?	No
Description of CQI set:	9 indicators
• Clinical areas covered?	Acute stroke care
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes, but not explicitly linked to the CQI
Useful for the development of CQIs in Belgium?	Yes
Link	http://www.strokefoundation.com.au/pages/image.aspx?assetId=RDM38251.5060930556

2. Canadian Stroke Quality of Care Study

Country of origin	Canada
Objectives	• support of initiatives including regionalization of stroke care, clinical practice guideline development, and quality of care improvement efforts
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients?)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes
• pilot testing?	No
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Acute ischemic stroke care in hospitals
• CQI specifications provided?	No
• Level of evidence provided?	Yes
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.cmaj.ca/cgi/reprint/172/3/363

Perinatal care

1. Reproductive Health Indicators

Country of origin	Australia
Objectives for CQI measurement	• to provide a picture of Australia's reproductive health status; • to enable risk and protective factors relevant to reproductive health to be highlighted; • to provide a basis from which international and sub-population comparisons can be made; • to provide baselines for prospective measurement and monitoring of Australia's reproductive health; • to provide a foundation from which a comprehensive conceptual and information framework on reproductive health can be developed.
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not explicitly stated, but discussion on available data sources is provided
• updating procedure mentioned?	No
Description of CQI set:	44 indicators
• Clinical areas covered?	10 subsets, covering: fertility, sub fertility, sexually transmissible infections, family planning, prenatal/antenatal factors, pregnancy and assisted conception, childbirth, maternal health outcomes, fetal and infant health outcomes, and cancer of the reproductive tract
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes, but additional literature search necessary
Link	http://www.npsu.unsw.edu.au/rhi.pdf

2. Monitoring and Evaluating Perinatal Health (PERISTAT)

Country of origin	EU
Objectives	To monitor and evaluate perinatal health and care in the European Union. More particularly: ▪ to assess maternal and infant mortality and morbidity associated with events in the perinatal period; ▪ to describe the evolution of risk factors for perinatal health outcomes in the population of childbearing women, including demographic, socio-economic and behavioral characteristics; ▪ to monitor the use and consequences of medical technology in the care of women and infants during pregnancy, delivery and the postpartum period.
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes (patients?)
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Feasibility testing ongoing
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Neonatal health, maternal health, population characteristics or risk factors, and health care services
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes, but additional literature search necessary
Links	http://europeristat.aphp.fr/en/index.html

3. British Association of Perinatal Medicine (BAPM) Neonatal dataset

Country of origin	UK
Objectives	• to prepare standardized annual reports • ascertainment of population-based outcomes • internal audit • clinical benchmarking
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Neonatal care
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Partly
Links	http://www.bapm.org/media/documents/publications/dataset_fullreview_20040300.pdf

4. Canadian Perinatal Surveillance System (CPSS)

Country of origin	Canada
Objectives	• to develop and evaluate interventions, with the aim of reducing health disparities and promoting health
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	No
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Perinatal care
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.phac-aspc.gc.ca/publicat/cphr-rspc00/pdf/cphr00e.pdf

5. REPROSTAT

Country of origin	EU
Objectives	• to provide health professionals, policy makers, researchers and health service user groups with reproductive health indicators that they can use to monitor and evaluate reproductive health and associated health care in the European Union
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Over 200 reproductive health professionals were consulted; no involvement of patients.
• supporting evidence:	
▪ literature review performed ?	Not stated
▪ literature review described?	Not stated
• pilot testing?	Yes (in Italy and Germany)
• updating procedure mentioned?	No
Description of CQI set:	13 core indicators, 1 recommended indicator, and 4 indicators that need further development
• Clinical areas covered?	Sexual behavior, youth, contraception, fertility & reproduction, abortion, emerging areas
• CQI specifications provided?	Yes
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://ec.europa.eu/health/ph_projects/2001/monitoring/fp_monitoring_2001_a1_frep_02_en.pdf

Elderly care

1. Quality Indicators for Assessing Care of Vulnerable Elders (ACOVE)

Country of origin	US
Objectives	• to assess the overall care delivered to vulnerable elders by a plan, medical group, or health system • to identify areas in need of improvement
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	No (only health care providers)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	21 subsets, covering: continuity and coordination of care (13 indicators), dementia (14 indicators), depression (17 indicators), diabetes mellitus (10 indicators), end-of-life care (14 indicators), falls (6 indicators), hearing loss (6 indicators), heart failure (14 indicators), hospital care (9 indicators), hypertension (8 indicators), ischemic heart disease (13 indicators), malnutrition (8 indicators), medication use (12 indicators), osteoarthritis (11 indicators), osteoporosis (9 indicators), pain management (7 indicators), pneumonia (11 indicators), pressure ulcers (11 indicators), preventive care (8 indicators), stroke and atrial fibrillation (10 indicators), urinary incontinence (10 indicators), and vision care (15 indicators)
• CQI specifications provided?	No
• Level of evidence provided?	No
• Reference to literature provided?	Yes
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.annals.org/content/vol135/issue8_Part_2/

Total hip prosthesis

1. Swedish National Hip Arthroplasty Register

Country of origin	Sweden
Objectives	• to define the epidemiology of total hip replacement in the Swedish population as a whole and to identify risk factors for poor outcomes that relate to patient characteristics, the implant and the procedure
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Not stated
• supporting evidence:	
▪ literature review performed?	Not stated
▪ literature review described?	No
• pilot testing?	Not stated
• updating procedure mentioned?	No
Description of CQI set:	
• Clinical areas covered?	Total hip arthroplasty
• CQI specifications provided?	No
• Level of evidence provided?	No
• Reference to literature provided?	No
Useful for the development of CQIs in Belgium?	Yes, but check of literature is necessary
Links	http://www.jru.orthop.gu.se/

CLINICAL PRACTICE GUIDELINES

1. Institute for Clinical Systems Improvement (ICSI)

Country of origin	US
Objectives	• to champion health care quality • to help identify and accelerate the implementation of best clinical practice
Methodology for CQI development:	Based on clinical practice guidelines
• involvement of key stakeholders (including patients)?	No (only health care providers)
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	No
• pilot testing?	No
• updating procedure mentioned?	Yes
Description of CQI set:	
• Clinical areas covered?	Clinical practice guidelines for a wide range of conditions. Each guideline contains a chapter 'Priority aims and suggested measures'.
• CQI specifications provided?	Partly (only for a few examples)
• Level of evidence provided?	Indirectly (in the guideline itself)
• Reference to literature provided?	Indirectly (in the guideline itself)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.icsi.org/index.asp

2. National Institute for Health and Clinical Excellence (NICE)

Country of origin	UK
Objectives	• to provide national guidance on the promotion of good health and the prevention and treatment of ill health
Methodology for CQI development:	
• involvement of key stakeholders (including patients)?	Yes
• supporting evidence:	
▪ literature review performed?	Yes
▪ literature review described?	Yes
• pilot testing?	Not stated
• updating procedure mentioned?	Yes
Description of CQI set:	
• Clinical areas covered?	Clinical practice guidelines for a wide range of conditions. Each guideline contains a chapter 'Auditable standards'.
• CQI specifications provided?	Partly (exceptions are provided sometimes)
• Level of evidence provided?	Indirectly (in the guideline itself)
• Reference to literature provided?	Indirectly (in the guideline itself)
Useful for the development of CQIs in Belgium?	Yes
Links	http://www.nice.org.uk/page.aspx?o=ourguidance

APPENDIX 2. OVERVIEW OF THE INDICATORS FOR THE EXPLORATIVE STUDY

In this appendix, an overview is provided of all identified indicators for the explorative study. The indicators are divided into four groups: indicators excluded as non-clinical and/or not applicable to the acute hospital setting (table 1), clinical indicators excluded because of a low level of evidence and low relevance (table 2), excluded clinical quality indicator with high level of evidence and/or relevance (table 3),with detailed administrative data deficiencies when applicable (table 4) and the final set of feasible clinical quality indicators with high level of evidence and/or relevance (table 5).

TABLE 1. INDICATORS EXCLUDED AS NON-CLINICAL AND/OR NOT APPLICABLE TO THE ACUTE HOSPITAL SETTING.

	Source	**Reason for exclusion**
Stroke		
À la sortie, le dossier mentionne la délivrance d'un rendez-vous de suivi avec un médecin responsable de la prise en charge du patient (neurologue, médecin de réadaptation, gériatre, médecin traitant, etc.)	ANAES	Not clinical
En cas de retour à domicile ou de décès, le compte rendu d'hospitalisation est adressé au médecin de ville dans un délai inférieur ou égal à 8 jours	ANAES	Not clinical
En cas de transfert, le patient quitte l'établissement avec son compte rendu d'hospitalisation	ANAES	Not clinical
L'heure d'appel du contact avec le médecin de l'UNV/USINV, en vue d'une admission, est notée	ANAES	Not clinical
L'heure exacte d'arrivée dans l'établissement de santé (UNV/USINV ou imagerie) est notée	ANAES	Not clinical
L'heure exacte de l'examen clinique du patient réalisé par le médecin de l'équipe neuro-vasculaire est notée	ANAES	Not clinical
Le centre de régulation et de réception des appels organise le transport vers l'établissement de santé (imagerie ou UNV/USINV)	ANAES	Not clinical
Le délai entre l'appel du 15 et l'arrivée dans l'établissement de santé (imagerie ou UNV/USINV) est inférieur à 1 heure	ANAES	Not clinical
Le dossier mentionne que le médecin de ville est informé de la sortie ou du décès du patient	ANAES	Not clinical
Le dossier mentionne que le patient quitte le service avec les fiches de synthèse des infirmiers	ANAES	Not clinical
Le dossier mentionne que le patient quitte le service avec les fiches de synthèse des masseurs-kinésithérapeutes	ANAES	Not clinical
Le dossier mentionne que le patient quitte le service avec les fiches de synthèse des orthophonistes	ANAES	Not clinical
Le patient (ou la personne qu'il a désignée) est informé des bénéfices et des risques des traitements envisagés	ANAES	Not clinical
Le patient fait l'objet d'un passage initial dans le service d'imagerie (IRM ou à défaut scanner cérébral)	ANAES	Not clinical
L'heure d'appel du 15 est notée	ANAES	Not clinical
L'heure de début des symptômes est notée	ANAES	Not clinical

	Source	Reason for exclusion
L'heure de prise en charge du patient par l'infirmier est notée	ANAES	Not clinical
Les résultats des différents paramètres sont notés (pouls, TA, SaO2, température)	ANAES	Not clinical
Le dossier mentionne que le patient et/ou son entourage sont associés au projet de sortie	ANAES	Not clinical
Number of patients with acute stroke for whom education was provided for patient and caregivers before patient discharge and documented in a chart	CMAJ	Not clinical
Percentage of patients presenting in the ED with ischemic stroke for whom patient/family education is documented in the medical record	ICSI	Not clinical
Percentage of patients admitted to a hospital unit with ischemic stroke for whom patient/family education is documented in the medical record	ICSI	Not clinical
Hospital has a stroke unit for the acute care of stroke patients	Prestatie-indicatoren	Not clinical
Le 15 a été contacté	ANAES	Not applicable to acute hospital setting
Le délai entre le début des symptômes et l'examen clinique réalisé par un médecin de l'équipe d'UNV/USINV est compris entre 3 et 6 heures	ANAES	Not applicable to acute hospital setting
Le délai entre le début des symptômes et l'examen clinique réalisé par un médecin de l'équipe d'UNV/USINV est inférieur ou égal à 3 heures	ANAES	Not applicable to acute hospital setting
En phase aiguë, le patient est inclus dans un protocole thérapeutique de recherche clinique (loi Huriet)	ANAES	Not applicable to acute hospital setting
Mortality at 180d after stroke	Prestatie-indicatoren	Not applicable to acute hospital setting
Perinatal care		
Date of discharge, transfer or death	BAPM	Not clinical
Percentage of women having CS that have a documented discussion on benefits and risks of CS compared with vaginal birth specific to the woman and her pregnancy	NICE	Not clinical
Percentage of women requesting a CS that have a documented discussion on the reasons for the request	NICE	Not clinical
Prevalence of prenatal alcohol consumption	CPSS	Not applicable to acute hospital setting
Proportion of mothers with low pre-pregnancy body mass index	CPSS	Not applicable to acute hospital setting
Proportion of pregnant women reporting physical abuse	CPSS	Not applicable to acute hospital setting

	Source	Reason for exclusion
Proportion of pregnant women reporting high psychological stress	CPSS	Not applicable to acute hospital setting
Mothers' smoking at booking	NHS	Not applicable to acute hospital setting
Mothers' education	Peristat	Not applicable to acute hospital setting
Distribution of parity	Peristat	Not applicable to acute hospital setting
Mothers' smoking during pregnancy	Peristat CPSS	Not applicable to acute hospital setting
Maternal age	Peristat SPE	Not applicable to acute hospital setting
Rate of infants with low birth weight	AHRQ	Not applicable to acute hospital setting
Weight on discharge home	BAPM	Not applicable to acute hospital setting
Head circumference on discharge home	BAPM	Not applicable to acute hospital setting
Rate of live births to teenage mothers	CPSS	Not applicable to acute hospital setting
Rate of live births to older mothers	CPSS	Not applicable to acute hospital setting
Prevalence of breastfeeding at least 3 months	CPSS	Not applicable to acute hospital setting
Breastfeeding 6-8 weeks after birth	NHS	Not applicable to acute hospital setting
Proportion of mothers diagnosed with depression or anxiety within 12 months of childbirth	NHS	Not applicable to acute hospital setting
Number of stillbirth and neonatal death	NHS Navigator© Peristat SPE CPSS	Not applicable to acute hospital setting

	Source	Reason for exclusion
Percentage of all births following fertility treatment	Peristat	Not applicable to acute hospital setting
Distribution of birth weight	BAPM Peristat	Not applicable to acute hospital setting
Distribution of gestational age	BAPM Peristat	Not applicable to acute hospital setting
Multiple birth rate	BAPM Peristat CPSS	Not applicable to acute hospital setting
Prevalence of congenital anomalies: number of live birth, fetal deaths and induced abortions with neural tube defects or down's syndrome	Peristat CPSS	Not applicable to acute hospital setting
Rate of term babies transferred/admitted to a NICU for reasons other than congenital abnormalities	ACHS	Not applicable to acute hospital setting
Transfer of newborns to NICU or N*-unit	Navigator©	Not applicable to acute hospital setting
Elderly care		
Number of health delivery organizations where pneumococcal or influenza vaccination rates among patients are low (<60% of persons at risk for pneumococcal and influenza disease and <90% of institutionalized elderly), that uses methods to increase the rate of vaccination	ACOVE	Not clinical
Number of health care organizations caring for vulnerable elders, that have a formal plan to offer and encourage influenza vaccination among its employees	ACOVE	Not clinical
Number of vulnerable elders with a caregiver where the physician discussed or referred the patient and caregiver for discussion about patient safety, provided education on how to deal with conflicts at home, and informed them about community resources for dementia	ACOVE	Not clinical
Number of vulnerable elders with newly diagnosed dementia that is advised by the physician not to drive a motor vehicle	ACOVE	Not clinical
Number of vulnerable elders with dementia that is physically restrained in the hospital for whom the target behavioural disturbance or safety issue justifying use of the restraints is identified to the consenting person and is documented in the chart	ACOVE	Not clinical
Number of vulnerable elders that is physically restrained and for whom the target behavioural disturbance requiring restraint is identified, where the team includes methods other than physical restraints in the care plan	ACOVE	Not clinical
Number of health care professionals caring for elder patients that is trained in falls risk assessment, appropriate referral of people at increased risk of falls, and measures to decrease the likelihood of falls	NICE	Not clinical

	Source	Reason for exclusion
Number of elder patients that is demented and at risk for wandering that wears and identification	Saliba D et al	Not clinical
Number of female vulnerable elders that is counselled about oestrogen replacement therapy	ACOVE	Not clinical
Number of vulnerable elders which have documentation of the presence or absence of urinary incontinence during the initial evaluation	ACOVE	Not clinical
Number of elder patients having chronic urinary retention and overflow UI, not being a candidate for a more definitive procedure, not having severe physical or mental impairments, and for whom indwelling urethral catheterisation is used, for whom there is documentation in the medical record that he has terminal illness, pressure ulcers in the relevant area, or that the patients prefers indwelling catheter to an intermittent or suprapubic catheter	Saliba D et al	Not clinical
Number of elder patients that is given diuretics for whom the indication for the diuretic is stated in the medical record	Saliba D et al	Not clinical
Number of patients with pressure ulcers that have access to appropriate pressure-relieving support surfaces or strategies throughout a 24-hour period	NICE	Not clinical
Number of vulnerable elders with involuntary weight loss of greater than or equal to 10% of body weight over 1 year or less that has this weight loss (or a related disorder) documented in the medical record as an indication that the physician recognized malnutrition as a potential problem	ACOVE	Not clinical
Number of elder patients in whom the nutritional status Resident Assessment Protocol (RAP) was triggered for whom the presence or absence of malnutrition was documented by the care provider	Saliba D et al	Not clinical
Number of patients treated with a COX nonselective NSAID, for whom there is evidence that the patient was advised of the risk for gastro-intestinal bleeding associated with these drugs	ACOVE	Not clinical
Number of female vulnerable elders that is counseled regarding intake of dietary calcium and vitamin D and weight-bearing exercises	ACOVE	Not clinical
Number of vulnerable elder smokers who develop pneumonia, that are advised to quit smoking	ACOVE	Not clinical
Number of diabetic vulnerable elders with a HbA1c of 10% or higher that is referred for diabetic education at least annually	ACOVE	Not applicable to acute hospital setting
Number of ambulatory vulnerable elders diagnosed with symptomatic osteoarthritis, that is offered education regarding natural history, treatment, and self-management of the disease at least once within 6 months of diagnosis	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with annual documentation of presence or absence of urinary incontinence	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with a diagnosis of a new depression episode, for whom the medical record documents at least three of the nine DSM-IV target symptoms for major depression within the first month of diagnosis	ACOVE	Not applicable to acute hospital setting
Total prevalence of pressure ulcers	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 1	Navigator©	Not applicable to acute hospital setting

	Source	Reason for exclusion
Prevalence of pressure ulcers stage 2	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 3	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 4	Navigator©	Not applicable to acute hospital setting
Total prevalence of pressure ulcers at admission	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 1 at admission	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 2 at admission	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 3 at admission	Navigator©	Not applicable to acute hospital setting
Prevalence of pressure ulcers stage 4 at admission	Navigator©	Not applicable to acute hospital setting
Number of diabetic elders with a diabetic foot	Navigator©	Not applicable to acute hospital setting
Number of vulnerable elders that has documentation that they were asked at least annually about the occurrence of recent falls	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders reported or found to have new or worsening difficulty with ambulation, balance, or mobility, for whom there is documentation that a basic gait, mobility, and balance evaluation was performed within 6 months that resulted in specific diagnostic and therapeutic recommendations	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with established coronary heart disease that smokes and is offered counselling for smoking cessation at least annually and has this offer documented in the medical record	ACOVE	Not applicable to acute hospital setting
Number of smoking female vulnerable elders that is counselled annually about smoking cessation	ACOVE	Not applicable to acute hospital setting
Number of ambulatory vulnerable elders with a diagnosis of symptomatic osteoarthritis of the knee for longer than 12 months, with no contraindication to exercise, and physically and mentally able to exercise, for whom there is evidence that a directed or supervised strengthening or aerobic exercise program was prescribed at least once since the time of diagnosis	ACOVE	Not applicable to acute hospital setting
Number of ambulatory vulnerable elders diagnosed with symptomatic osteoarthritis for 12 months or longer, for whom there is evidence that the patient was offered education regarding natural history, treatment, and self-management of the disease at least once within 6 months of diagnosis	ACOVE	Not applicable to acute hospital setting

	Source	Reason for exclusion
Number of vulnerable elders without meaningful symptom response after 6 weeks of treatment, that received one of the following treatment options by the 8th week of treatment: optimization of medication dose, referral to a psychiatrist, initiation of medication	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with only partial response after 12 weeks of treatment, that is offered one of the following treatment options by the 16th week of treatment: switch to a different medication class, adding of a second medication, adding of psychotherapy, initiation of medication, consideration of ECT, or referral to a psychiatrist	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders responding to antidepressant medication that is continued on the drug at the same dose for at least 6 months and made at least one clinician contact during that time period	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with diabetes that has his HbA1c measured at least every 12 months	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with an elevated HbA1c level that is offered a therapeutic intervention aimed at improving glycaemic control within 3 months if the HbA1c level is 9.0% to 10.9%, and within 1 month if the HbA1c level is 11% or higher	ACOVE	Not applicable to acute hospital setting
Number of diabetic vulnerable elders without established renal disease and not receiving an ACE inhibitor or ACE receptor blocker that received an annual test for proteinuria	ACOVE	Not applicable to acute hospital setting
Number of diabetic vulnerable elders with elevated blood pressure that is offered a therapeutic intervention to lower blood pressure within 3 months is 150-160/90-100 mmHg or within 1 month if blood pressure is greater than 160/100 mmHg	ACOVE	Not applicable to acute hospital setting
Number of diabetic vulnerable elders not being blind, that receives an annual dilated eye examination	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders diagnosed with symptomatic osteoarthritis, for whom his or her functional status and degree of pain is assessed annually	ACOVE	Not applicable to acute hospital setting
Number of ambulatory vulnerable elders with newly diagnosed osteoarthritis of the knee, with no contraindication to exercise, and physically and mentally able to exercise, for whom a directed or supervised strengthening or aerobic exercise program is prescribed within 3 months of diagnosis	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with severe symptomatic osteoarthritis of the knee or hip who failed to respond to non-pharmacologic and pharmacologic therapy, and with no contraindication for surgery, that is referred to an orthopaedic surgeon to be evaluated for total joint replacement within 6 months unless a contraindication to surgery is documented	ACOVE	Not applicable to acute hospital setting
Number of ambulatory vulnerable elders with an osteoporotic fracture that is offered physical therapy or an exercise program within 3 months	ACOVE	Not applicable to acute hospital setting
Number of female vulnerable elders with newly diagnosed osteoporosis, that is offered treatment with HRT or bisphosphonates or calcitonin within 3 months of diagnosis	ACOVE	Not applicable to acute hospital setting
Number of vulnerable elders with no history of anaphylactic hypersensitivity to eggs or to other components of the influenza vaccine, that is offered an annual influenza vaccination	ACOVE HEDIS	Not applicable to acute hospital setting

	Source	Reason for exclusion
Number of vulnerable elders presenting with onset or discovery of stroke, MI, dementia, malignancy, chronic pain, alcohol or substance abuse or dependence, anxiety disorder, or personality disorder, that is asked about or treated for depression or is referred to a mental health professional within 2 months of diagnosis of the condition	ACOVE	Not applicable to acute hospital setting
Number of elder patients receiving a diagnosis of a new depression episode for whom the medical record documents testing for hypothyroidism (using a TSH level) within 1 month after or 3 months before the diagnosis	Saliba D et al	Not applicable to acute hospital setting
Number of diabetic elder patients that has his feet examined at least annually	Saliba D et al	Not applicable to acute hospital setting
Number of elder patients remaining hypertensive that is offered a therapeutic intervention to lower blood pressure: within 3 months if systolic blood pressure 161-180 mmHg or within 1 month if systolic blood pressure > 180 mmHg	Saliba D et al	Not applicable to acute hospital setting
Number of elder patients that is diagnosed with hypertension and initiated with pharmacologic intervention for whom follow-up blood pressure checks occur every 2 weeks until blood pressure control (<150/90 mmHg) or targeted blood pressure goal has been achieved	Saliba D et al	Not applicable to acute hospital setting
Number of elder patients with hypertension treated with pharmacological therapy and achieving blood pressure control (<150/90 mmHg) or targeted blood pressure goal that has follow-up blood pressure checks at least every 3 months	Saliba D et al	Not applicable to acute hospital setting
Number of elder patients that is newly prescribed a non-OTC drug to treat new joint pain for whom evidence is documented within 4 weeks that the affected joint was examined	Saliba D et al	Not applicable to acute hospital setting
Number of elder patients with delirium or a potentially reversible cognitive impairment that is corrected for whom is documented that the physician reviewed either the next MDS cognitive score or has performed another cognitive evaluation within 6 months	Saliba D et al	Not applicable to acute hospital setting
Total hip prosthesis		
Implant survival	Swedish registry	Not applicable to acute hospital setting
Annual proportion of patients treated with a total hip arthroplasty who undergo reoperation	Swedish registry	Not applicable to acute hospital setting
Annual proportion of patients treated with a total hip arthroplasty who undergo revision	Swedish registry	Not applicable to acute hospital setting
Annual proportion of patients treated with a total hip arthroplasty who develop a periprosthetic femoral fracture	Swedish registry	Not applicable to acute hospital setting
Proportion of patients treated with a total hip arthroplasty who undergo reoperation within 2 years	NIP	Not applicable to acute hospital setting

TABLE 2. CLINICAL INDICATORS EXCLUDED BECAUSE OF A LOW LEVEL OF EVIDENCE AND RELEVANCE.

	Source	**Reason for exclusion**
Stroke		
Number of vulnerable elders of whom the combined risk of surgery (patient characteristics and hospital or surgeon experience) is 10% or greater, for whom carotid endarterectomy was not performed	ACOVE	Level of evidence <1b
Number of male vulnerable elders with carotid artery symptoms and diagnosed with nondisabling stroke, and having had carotid imaging documenting greater than 70% carotid stenosis on the side ipsilateral to the hemisphere producing the symptoms, and for whom the medical record does not document that no facility is available with less than 6% 30-day morbidity and mortality, that received referral for evaluation for carotid endarterectomy within 4 weeks of the diagnostic study or event, whichever is later	ACOVE	Level of evidence <1b
Number of vulnerable elders with stroke, for whom the medical record documents that smoking status was assessed, and, if smokers, were counselled to stop smoking	ACOVE	Level of evidence <1b
In-hospital mortality after stroke	AHRQ Navigator©	Level of evidence <1b
En cas d'infarctus cérébral une échographie cardiaque transthoracique et si nécessaire transoesophagienne est réalisée	ANAES	Level of evidence <1b
L'échographie cardiaque est réalisée dans un délai inférieur à 3 jours	ANAES	Level of evidence <1b
Number of patients receiving oral anticoagulation on discharge	CBO	Level of evidence <1b
Number of patients with acute stroke that is mobilized and out of bed within 24 h of onset of stroke symptoms unless contraindicated	CMAJ	Level of evidence <1b
Number of patients with acute stroke for whom a smoking history was assessed before patient discharge and documented in a chart	CMAJ	Level of evidence <1b
Number of patients with acute stroke with an indwelling urethral catheter (should be avoided)	CMAJ	Level of evidence <1b
Number of patients with acute stroke that was assessed for and prescribed a blood pressure-lowering agent if appropriate	CMAJ	Level of evidence <1b
Number of patients that had a blood glucose level checked on arrival at ED and regularly for the first 24 h	CMAJ	Level of evidence <1b
Number of patients with elevated pre-prandial blood glucose level that is treated with glucose-lowering agents	CMAJ	Level of evidence <1b
Number of patients with acute stroke and fever that is treated with antipyretics to reduce temperature to less than 38°C	CMAJ	Level of evidence <1b
Percentage of stroke patients who receive IV fluids	ICSI	Level of evidence <1b
Percentage of stroke patients mobilized from bed within 48 hours of admission	ICSI	Level of evidence <1b
Percentage of stroke patients who receive appropriate treatment for hypoxia	ICSI	Level of evidence <1b
Percentage of non-tPA stroke patients who have hypertension appropriately managed according to the guideline	ICSI	Level of evidence <1b
Percentage of stroke patients who receive appropriate intervention for hyperthermia	ICSI	Level of evidence <1b

	Source	Reason for exclusion
Percentage of stroke patients who receive appropriate intervention for hypo- or hyperglycaemia	ICSI	Level of evidence <1b
Discharge to prior home situation within 56d after admission for stroke	NHS	Level of evidence <1b
Mortality at 30d after stroke	NHS	Level of evidence <1b
Readmission within 28d after discharge	NHS	Level of evidence <1b
Mortality at 30d after stroke	NIP	Level of evidence <1b
Inpatient mortality	QIP	Level of evidence <1b
Number of patients with AF receiving anticoagulation within 14d after admission for stroke	NIP	Discussion on when to start treatment
Number of patients with stroke having hypertension on discharge	CBO	Discussion on when to start treatment
Number of patients with stroke undergoing evaluation of nutritional status within 48h after admission	NIP	No proven benefit for nutritional support
Perinatal care		
Rate of PCS for failure to progress after a period of labour with cervical dilatation of ≤3 cm	ACHS	Level of evidence <1b
Rate of PCS for fetal distress in all deliveries	ACHS	Level of evidence <1b
Rate of PCS for fetal distress in all patients delivering by PCS only	ACHS	Level of evidence <1b
Rate of primiparous patients not requiring surgical repair of the lower genital tract	ACHS	Level of evidence <1b
Proportion of babies born with an Apgar score of ≤6 at 10 minutes post delivery	ACHS Peristat	Level of evidence <1b
Proportion of babies born with an Apgar score of ≤4 at 5 minutes post delivery	ACHS Peristat CPSS	Level of evidence <1b
Cases of obstetric trauma (3rd or 4th degree lacerations) after caesarean delivery	AHRQ	Level of evidence <1b
Cases of obstetric trauma (4th degree lacerations) after caesarean delivery	AHRQ	Level of evidence <1b
Rate of neonatal hospital readmission within 7 or 28 days after discharge at birth	CPSS	Level of evidence <1b
Rate of early neonatal discharge from the hospital after birth (within 48 hours and weighing ≥2,500 g)	CPSS	Level of evidence <1b
Rate of early maternal discharge from hospital after childbirth (within 2 days after vaginal birth and within 4 days after caesarean birth)	CPSS	Level of evidence <1b
Rate of maternal readmission within three months after discharge following childbirth	CPSS	Level of evidence <1b
Proportion of low birth weight neonates with low cord blood pH	CPSS	Level of evidence <1b
Proportion of low birth weight neonates with abnormal cord blood base deficit	CPSS	Level of evidence <1b
Resuscitation rate in low birth weight neonates	CPSS	Level of evidence <1b

	Source	Reason for exclusion
Maternal mortality (direct obstetric deaths only)	CPSS	Level of evidence <1b
Rate of general anaesthesia use in caesarean deliveries	CPSS	Level of evidence <1b
Percentage of women who are assessed for risk status on entry to labour and delivery	ICSI	Level of evidence <1b
Percent of women whose time from admission with active labour to evaluation of labour's progress is less than 2 hours	ICSI	Level of evidence <1b
Among those who had begun oxytocin and with non-reassuring FHR tracing, the percentage of births with discontinuance of oxytocin	ICSI	Level of evidence <1b
Percentage of births with either scalp stimulation, scalp pH, or vibroacoustic stimulation of those births with intervention for non-reassuring FHR tracing	ICSI	Level of evidence <1b
Percent of women in the guideline population (nullipara female, without concomitant medical problems, at term pregnancy (36 completed weeks), having contractions, singleton fetus, cephalic presentation, no evidence of fetal distress, expected normal spontaneous vaginal delivery and diagnosis of failure to progress) with failure to progress diagnosis who have oxytocin	ICSI	Level of evidence <1b
Cases of birth trauma with caesarean delivery	Navigator©	Level of evidence <1b
Unexpected death of term baby	Navigator©	Level of evidence <1b
Unexpected death of moderate preterm baby	Navigator©	Level of evidence <1b
Cases of obstetric trauma after caesarean delivery	Navigator©	Level of evidence <1b
Thrombo-embolic complications after delivery	Navigator©	Level of evidence <1b
Prolonged hospital stay after caesarean delivery	Navigator©	Level of evidence <1b
Prolonged hospital stay after vaginal birth	Navigator©	Level of evidence <1b
Maternal mortality	Navigator© Peristat CPSS	Level of evidence <1b
Maternal morbidity	Navigator© Peristat CPSS	Level of evidence <1b
Number of repeated caesarean deliveries	Navigator© QIP	Level of evidence <1b
Percentage of live births admitted to neonatal unit for 48 hours or less	NHS	Level of evidence <1b
Percentage of live births admitted to neonatal unit for more than 48 hours	NHS	Level of evidence <1b
Percentage of CS where an appropriate method of thromboprophylaxis is used	NICE	Level of evidence <1b
Percentage of CS where antacids are given prior to regional or general anaesthesia	NICE	Level of evidence <1b
Percentage of planned CS carried out after 39 weeks	NICE	Level of evidence <1b

	Source	Reason for exclusion
Percentage of CS for abnormal fetal heart rate pattern, in cases of suspected fetal acidosis, in which fetal blood sampling is undertaken	NICE	Level of evidence <1b
Percentage of CS carried out using a regional block	NICE	Level of evidence <1b
Caesarean delivery undertaken before onset of labour	Peristat	Level of evidence <1b
Caesarean delivery undertaken during labour	Peristat	Level of evidence <1b
Instrument assisted vaginal delivery	Peristat	Level of evidence <1b
Distribution of births by mode of delivery	Peristat SPE CPSS	Level of evidence <1b
Trial of labour success	QIP	Level of evidence <1b
Percentages of delivery with regional anaesthesia use	SPE CPSS	Level of evidence <1b
Rate of PCS for failure to progress after a period of labour with cervical dilatation of >3 cm	ACHS	Trend towards less cesarean sections
Elderly care		
Number of vulnerable elders with dementia that is screened for depression during the initial evaluation	ACOVE	Level of evidence <1b
Number of patients admitted to a geriatric medicine or geriatric rehabilitation unit for whom there is documented assessment of mental function on admission or during admission when more appropriate	ACHS	Level of evidence <1b
Number of vulnerable elders admitted to a hospital or new to a physician practice, that has a multidimensional assessment of cognitive ability and of functional status documented	ACOVE	Level of evidence <1b
Number of vulnerable elders placed in physical restraints for whom the following measures are enacted: consistent release from the restraints at least every 2 hours; face-to-face reassessment by a physician or nurse at least every 4 hours and before renewal of the restraint order; observation at least every 15 minutes, and more frequently if indicated by the patient's condition, while the patient is in restraints; interventions every 2 hours related to nutrition, hydration, personal hygiene, toileting, and range of motion exercises	ACOVE	Level of evidence <1b
Number of vulnerable elders with symptoms of dementia that correspond in time with the initiation of new medications, for whom the physician discontinued or justified the necessity of continuing these medications	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed dementia that has serum levels of vitamin B12 and TSH measured	ACOVE	Level of evidence <1b
Number of vulnerable elders with signs of dementia and focal neurological findings that suggest an intracranial process, that is offered neuroimaging (CT or MRI)	ACOVE	Level of evidence <1b
Number of elder patients with a non-English native language for whom the baseline cognitive and functional screening is performed in the patient's native language	Saliba D et al	Level of evidence <1b

	Source	Reason for exclusion
Number of elder patients without a previous diagnosis of dementia failing a memory screen or presenting with memory loss or forgetfulness for whom an assessment of memory, a diagnosis of treatment for dementia, an explanation for the memory loss, or a referral to neurology, psychiatry, geriatrics, or psychology is documented	Saliba D et al	Level of evidence <1b
Number of vulnerable elders with symptoms of dementia for whom the medication list is reviewed by the physician for initiation of medications that might correspond chronologically to the onset of dementia symptoms	ACOVE	Level of evidence <1b
Number of vulnerable elders taking a MAOI that received medications that interact with MAOIs within 2 weeks after termination of the MAOI	ACOVE	Level of evidence <1b
Number of vulnerable elders taking an SSRI (paroxetine, sertraline, fluvoxamine, citalopram, or fluoxetine) that is started on a MAOI within 2 weeks after termination of the SSRI (5 weeks for fluoxetine) (should not be done)	ACOVE	Level of evidence <1b
Number of vulnerable elders treated for depression, for whom at each treatment visit suicide risk is documented if he had suicidal ideation during a previous visit	ACOVE	Level of evidence <1b
Number of elder patients reporting severe grief continuing more than 2 months after the loss of a spouse or significant relationship, that is asked about depression, treated for depression, or referred to a mental health professional at the time of the report	Saliba D et al	Level of evidence <1b
Number of vulnerable elders presenting with symptoms of depression that is asked about or treated for depression or is referred to a mental health professional within 2 weeks of presentation	ACOVE	Level of evidence <1b
Number of vulnerable elders treated for depression with antidepressants, for whom the antidepressant is prescribed at appropriate starting doses and an appropriate titration schedule to a therapeutic dose, therapeutic blood level, or remission of symptoms by 12 weeks, is given	ACOVE	Level of evidence <1b
Number of vulnerable elders diagnosed with depression that is offered antidepressant treatment, psychotherapy, or ECT within 2 weeks after diagnosis unless there is documentation within that period that the patient has improved, or unless the patient has substance abuse or dependence, in which case treatment may wait until 8 weeks after the patient is in a drug- or alcohol-free state	ACOVE	Level of evidence <1b
Number of vulnerable elders with a history of cardiac disease and started on a TCA, from whom a baseline ECG was obtained before initiation of, or within 3 months before, treatment	ACOVE	Level of evidence <1b
Number of vulnerable elders with depression and psychotic features or melancholic or vegetative depression with pervasive anhedonia, unreactive mood, psychomotor disturbances, severe terminal insomnia, and weight and appetite loss, that is not treated by psychotherapy alone, unless he is unwilling or unable to take medication	ACOVE	Level of evidence <1b
Number of vulnerable elders with depression and psychotic features that is referred to a psychiatrist and received treatment with a combination of an antidepressant and an antipsychotic, or with ECT	ACOVE	Level of evidence <1b
Number of vulnerable elders with a diagnosis of a new depression episode, for whom the medical record documents the presence or absence of suicidal ideation and psychosis on the day of diagnosis of depression	ACOVE	Level of evidence <1b
Number of vulnerable elders with thoughts of suicide, for whom the medical record documents, on the same date, that the	ACOVE	Level of evidence <1b

	Source	Reason for exclusion
patient either has no immediate plan for suicide or that the patient was referred for evaluation for psychiatric hospitalization		
Number of diabetic elder patients with body weight <120% of ideal, adequate glycaemic control (HbA1c <9% or glucose <200 mg/dl) and losing weight on a special diet, that is changed to a regular diet	Saliba D et al	Level of evidence <1b
Number of diabetic vulnerable elders that has his blood pressure checked	ACOVE	Level of evidence <1b
Number of elder patients with a glucose level of >300 mg/dl for whom a specific therapeutic intervention aimed at glycaemic control was initiated within 2 weeks or care goals or other records indicate why this is not appropriate	Saliba D et al	Level of evidence <1b
Number of falls of fixated patients	Navigator©	Level of evidence <1b
Number of elder patients at increased risk of falls that is offered information on reducing risk of falls and appropriate interventions	NICE	Level of evidence <1b
Number of elder patients taking medication that commonly causes hypotension for whom the care provider documented postural changes in blood pressure and pulse at least once	Saliba D et al	Level of evidence <1b
Number of elder patients that is asked about previous falls by their health care professional	NICE	Level of evidence <1b
Number of elder patients with postural hypotension for whom the physician note documents further evaluation for possible causative factors (eg diabetes, medications)	Saliba D et al	Level of evidence <1b
Number of vulnerable elders that has documentation that they were asked about or examined for the presence of balance or gait disturbances at least once	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed heart failure, where the left ventricular ejection fraction was evaluated within 1 month	ACOVE	Level of evidence <1b
Number of vulnerable elders hospitalized with heart failure, from whom serum electrolytes and creatinine and blood urea nitrogen were measured within 1 day of hospitalization	ACOVE	Level of evidence <1b
Number of vulnerable elders with heart failure and treated with digoxin, from whom the digoxin level was checked within 1 week if signs of toxicity develop	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed heart failure, for whom the following physical examination findings were documented at presentation: body weight; blood pressure; heart rate; and results of lung, cardiac, and abdominal or lower-extremity examination	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed heart failure, for whom the following studies were done within 1 month of diagnosis of heart failure (unless the tests were performed within the previous 3 months): chest radiography; electrocardiography; complete blood count; and measurement of serum sodium and potassium, serum creatinine, and thyroid-stimulating hormone (in patients with atrial fibrillation or heart failure of no obvious etiology)	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed heart failure, from whom a history was taken at the time of diagnosis and hospitalization to document the presence or absence of previous myocardial infarction; coronary artery disease; revascularization; current symptoms of chest pain or angina; history of hypertension, diabetes, hypercholesterolemia, valvular heart disease, or thyroid disease; smoking status; current medications; and functional capacity (for example, New York Heart	ACOVE	Level of evidence <1b

	Source	Reason for exclusion
Association functional status)		
Number of vulnerable elders with heart failure, left ventricular ejection fraction of 40% or less, and no atrial fibrillation, that is *not* treated with a first- or second-generation calcium-channel blocker	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed hypertension that has an echocardiography performed within 4 weeks of the diagnosis	ACOVE	Level of evidence <1b
Number of elder patients diagnosed with new hypertension that received a physical examination within 4 weeks of diagnosis including: a fundoscopic eye examination, a lung examination, a cardiac examination (including evaluation of pulses), an abdominal examination (including assessment for bruits), and an extremity examination	Saliba D et al	Level of evidence <1b
Number of elder patients treated with antihypertensive medication that has its supine and standing blood pressures measured with each adjustment of blood pressure medication	Saliba D et al	Level of evidence <1b
Number of vulnerable elders with hypertension and a blood pressure below 170/90 mmHg for whom evidence exists that three or more blood pressure measurements of 140/90 mmHg or greater were obtained before diagnosis	ACOVE	Level of evidence <1b
Number of vulnerable elders with newly diagnosed hypertension from whom the presence or absence of other cardiovascular risk factors was documented	ACOVE	Level of evidence <1b
Number of vulnerable elders with hypertension and asthma for whom no betablocker therapy was used for hypertension	ACOVE	Level of evidence <1b
Number of vulnerable elders hospitalized with an acute myocardial infarction that is offered assessment of left ventricular function before discharge or within 3 days after hospital discharge	ACOVE	Level of evidence <1b
Number of vulnerable elders with established coronary heart disease and unknown cholesterol level, that had a fasting cholesterol evaluation including total, LDL and HDL cholesterol levels	ACOVE	Level of evidence <1b
Number of community-dwelling vulnerable elders that is weighed at each physician office visit and has these weights documented in the medical record	ACOVE	Level of evidence <1b
Number of community-dwelling vulnerable elders with involuntary weight loss or hypoalbuminuria (<3.5 g/dl) that received an evaluation for potentially relevant comorbid conditions, including medications that might be associated with decreased appetite, depressive symptoms, and cognitive impairment	ACOVE	Level of evidence <1b
Number of community-dwelling vulnerable elders with involuntary weight loss or hypoalbuminuria (<3.5 g/dl) that received an evaluation for potentially reversible causes of poor nutritional intake	ACOVE	Level of evidence <1b
Number of elder patients at risk for malnutrition for whom oral intake and calorie counts are documented daily for at least 3 days	Saliba D et al	Level of evidence <1b
Number of elder patients with a significant decreased oral intake (>25%) for 3 consecutive days for whom an evaluation of reasons for the decrease in oral intake is initiated within 2 days	Saliba D et al	Level of evidence <1b
Number of hospitalised vulnerable elders from whom the nutritional status is documented during the hospitalisation by evaluation of oral intake or serum biochemical testing	ACOVE	Level of evidence <1b
Number of hospitalised vulnerable elders unable to take foods orally for more than 72 hours that was offered alternative	ACOVE	Level of evidence <1b

	Source	Reason for exclusion
alimentation		
Number of patients with enteral or parenteral feeding	Navigator©	Level of evidence <1b
Number of patients with unplanned weight loss	Navigator©	Level of evidence <1b
Number of elder patients with a feeding tube for whom there is documentation that one of the following was tried first: dietician consult, assistance with feeding or oral nutritional supplement	Saliba D et al	Level of evidence <1b
Number of elder patients with recent weight loss or hypoalbuminemia and all other potentially reversible causes being addressed and with unsuccessful behavioural nursing intervention alone, for whom the medical record documents referral to a dietician or initiation of nutritional supplement	Saliba D et al	Level of evidence <1b
Number of vulnerable elders who were hospitalized for a hip fracture and having evidence of nutritional deficiency, that was treated with oral or enteral nutritional protein-energy supplementation postoperatively	ACOVE	Level of evidence <1b
Number of vulnerable elders with stroke and persistent dysphagia at 14 days, for whom a gastrostomy or jejunostomy tube was considered for enteral feeding	ACOVE	Level of evidence <1b
Number of vulnerable elders with monoarticular joint pain associated with redness, warmth, or swelling AND with an oral temperature greater than 38.0°C and no previously established diagnosis of pseudogout or gout, for whom a diagnostic aspiration of the painfully swollen red joint is performed on the same day	ACOVE	Level of evidence <1b
Number of vulnerable elders whose oral pharmacological therapy for osteoarthritis is changed from acetaminophen to a different oral agent, for whom there is evidence that the patient had a trial of maximum-dose acetaminophen (suitable for age and comorbid conditions)	ACOVE	Level of evidence <1b
Number of vulnerable elders with osteoarthritis that is treated with acetaminophen as an initial oral pharmacologic therapy (unless documented contraindication)	ACOVE	Level of evidence <1b
Number of bedfast elder patients for whom mobilisation is attempted unless there is a contraindication	Saliba D et al	Level of evidence <1b
Number of male vulnerable elders with osteoporosis and who are hypogonadal, that is offered testosterone treatment	ACOVE	Level of evidence <1b
Number of vulnerable elders with a new diagnosis of osteoporosis, for whom an underlying cause of osteoporosis is sought by checking medication use and current alcohol use during the initial evaluation period	ACOVE	Level of evidence <1b
Number of vulnerable elders admitted with pneumonia that is treated with antibiotics within 8 hours of hospital arrival	ACOVE	Level of evidence <1b
Number of vulnerable elders with community-acquired pneumonia who are switched from parenteral to oral antimicrobial therapy, that meet all of the following criteria: a clinically improving condition, hemodynamic stability, and tolerance of oral medication or food and fluids	ACOVE	Level of evidence <1b
Number of vulnerable elders admitted to the hospital with community-acquired pneumonia with hypoxia, that recieve oxygen therapy	ACOVE	Level of evidence <1b
Number of vulnerable elders with community-acquired pneumonia who are discharged home, that are stable on the day before the day of discharge	ACOVE	Level of evidence <1b

	Source	Reason for exclusion
Number of vulnerable elders with empyema, that undergo a drainage	ACOVE	Level of evidence <1b
Number of vulnerable elders with a clean full-thickness pressure ulcer and no improvement after 4 weeks of treatment, for whom the appropriateness of the treatment plan and the presence of cellulitis or osteomyelitis are assessed	ACOVE	Level of evidence <1b
Number of vulnerable elders with a full-thickness pressure ulcer who present with systemic signs and symptoms of infection, such as elevated temperature, leukocytosis, confusion, and agitation, and these signs and symptoms do not have another cause, for whom the ulcer is debrided of necrotic tissue within 12 hours	ACOVE	Level of evidence <1b
Number of vulnerable elders with a full-thickness pressure ulcer who present with systemic signs and symptoms of infection, such as elevated temperature, leukocytosis, confusion, and agitation, and these signs and symptoms do not have another cause, with whom a tissue biopsy or needle aspiration sample is obtained and sent for culture and sensitivity testing within 12 hours	ACOVE	Level of evidence <1b
Number of vulnerable elders with a partial-thickness pressure ulcer and no improvement after 2 weeks of treatment, for whom the appropriateness of the treatment plan is assessed	ACOVE	Level of evidence <1b
Number of vulnerable elders with pressure ulcers, for whom the pressure ulcers are assessed for location, depth and stage, size, and presence of necrotic tissue	ACOVE	Level of evidence <1b
Number of patients with pressure ulcers that have their ulcer assessed initially (within 6 hours) and of which the assessment is ongoing	NICE	Level of evidence <1b
Number of vulnerable elders with a clean full-thickness or a partial-thickness pressure ulcer, with whom a moist wound-healing environment is provided with topical dressings	ACOVE	Level of evidence <1b
Number of vulnerable elders with a full-thickness sacral or trochanteric pressure ulcer covered with necrotic debris or eschar, for whom debridement by using sharp, mechanical, enzymatic, or autolytic procedures are done within 3 days of diagnosis	ACOVE	Level of evidence <1b
Number of vulnerable elders with a stage 2 are greater pressure ulcer, for whom a topical antiseptic is used on the wound (should not be done)	ACOVE	Level of evidence <1b
Number of patients with grade 3 or 4 pressure ulcers that have alternating pressure overlay or sophisticated low pressure support as a minimum and are closely observed	NICE	Level of evidence <1b
Number of patients of which a pressure ulcer that is identified as a grade 2 or above is documented as a clinical incident	NICE	Level of evidence <1b
Number of patients of which the plan of care contains a classification/grade for all pressure ulcers using the European Pressure Ulcer Advisory Panel classification system	NICE	Level of evidence <1b
Number of elder patients having chronic urinary retention and overflow UI, not being a candidate for a more definitive procedure, not having severe physical or mental impairments, and for whom indwelling urethral catheterisation is used, for whom there is documentation in the medical record that he has terminal illness, pressure ulcers in the relevant area, or that the patients prefers indwelling catheter to an intermittent or suprapubic catheter	Saliba D et al	Level of evidence <1b
Number of vulnerable elders with new urinary incontinence that persists for more than 1 month or urinary incontinence at	ACOVE	Level of evidence <1b

	Source	Reason for exclusion
the time of a new evaluation, for whom a targeted history is obtained that documents each of the following: 1) characteristics of voiding, 2) ability to get to the toilet, 3) previous treatment for urinary incontinence, 4) importance of the problem to the patient, 5) mental status		
Number of vulnerable elders with new urinary incontinence that persists for more than 1 month or urinary incontinence at the time of a new evaluation, for whom a targeted physical examination is performed that documents 1) a rectal examination and 2) a genital system examination (including a pelvic examination for women)	ACOVE	Level of evidence <1b
Number of vulnerable elders with new urinary incontinence that persists for more than 1 month or urinary incontinence at the time of a new evaluation, for whom a dipstick urinanalysis and post-void residual are obtained	ACOVE	Level of evidence <1b
Number of female vulnerable elders with documented stress urinary incontinence caused by isolated intrinsic sphincter deficiency or intrinsic sphincter deficiency with coexistent hypermobility, for whom a sling or artificial sphincter procedure are used	ACOVE	Level of evidence <1b
Number of vulnerable elders who undergo surgery or periurethral injections for urinary incontinence, for whom subtracted cystometry is performed before the procedure	ACOVE	Level of evidence <1b
Number of vulnerable elders who have clinically significant newly discovered overflow urinary incontinence and indwelling urethral catheterization is used, for whom there is documentation that the patient is not a candidate for alternative interventions as a result of severe physical or mental impairments or does not want alternative interventions	ACOVE	Level of evidence <1b
Number of vulnerable elders identified as at risk for pressure ulcer development or a pressure ulcer risk assessment score indicates that the person is at risk, for whom a preventive intervention addressing repositioning needs and pressure reduction (or management of tissue loads) are instituted within 12 hours	ACOVE	Conflicting evidence for repositioning
Number of diabetic vulnerable elders with a fasting total cholesterol of 240 mg/dl or higher, that is offered an intervention to lower cholesterol	ACOVE	Which therapeutic intervention?
Number of vulnerable elders with dementia and cerebrovascular disease that is offered appropriate prophylaxis against stroke	ACOVE	What is appropriate prophylaxis?
Number of falls with injury as a result	Navigator©	Level of evidence <1b
Number of falls with injury of level 1 as a result	Navigator©	Level of evidence <1b
Number of falls with injury of level 2 as a result	Navigator©	Level of evidence <1b
Number of falls with injury of level 3 as a result	Navigator©	Level of evidence <1b
Number of vulnerable elders with heart failure and left ventricular ejection fraction of 40% or less, that is not treated with a type I antiarrhythmic agent unless an implantable cardioverter-defibrillator is in place	ACOVE	Level of evidence <1b
Number of vulnerable elders with established coronary heart disease and an LDL cholesterol level greater than 130 mg/dl and a trial of step II diet therapy that was not offered or ineffective, that was offered cholesterol-lowering medication	ACOVE	Evidence against threshold of 130 mg/dl
Number of patients with pressure ulcers that have their ulcers dressed with modern wound dressings to create the	NICE	What modern wound

	Source	Reason for exclusion
optimum wound healing environment		dressings?
Total hip replacement		
Mortality rate	AHRQ	Level of evidence <1b
The rate of a post-operative in-hospital infection in primary THR	ACHS	Level of evidence <1b

TABLE 3. EXCLUDED CLINICAL QUALITY INDICATORS WITH HIGH LEVEL OF EVIDENCE AND/OR RELEVANCE (NON-EVIDENCE-BASED INDICATORS ARE MARKED WITH AN ASTERIX).

Description	**Original indicator(s)**	**Source**	**Reason for exclusion**
Stroke			
Number of patients for whom the NINDS inclusion/exclusion criteria were applied for patient selection for thrombolysis	Number of patients for whom the NINDS inclusion/exclusion criteria were applied for patient selection for thrombolysis	CMAJ	No information on application of NINDS criteria
Number of patients for whom a tPA best-practice treatment protocol was followed for tPA administration (e.g., AHA, AAN)	Number of patients for whom a tPA best-practice treatment protocol was followed for tPA administration (e.g., AHA, AAN)	CMAJ	No information on the use of protocol
	Percentage of stroke patients receiving tPA according to guideline	ICSI	
Number of patients with symptomatic carotid stenosis ≤ 70% (ECST) receiving carotid surgery	Number of patients with symptomatic carotid stenosis ≤ 70% (ECST) receiving carotid surgery	CBO	ICD-9-CM diagnosis codification does not give any precision on results
Number of patients undergoing CT scan within 24h after admission for stroke	Number of patients undergoing CT scan within 24h after admission for stroke	NIP CBO	Not discriminative enough
	Number of patients undergoing CT scan for diagnosis of stroke	ACHS CBO	
	Number of vulnerable elders with a presumed stroke, for whom a CT or MRI of the head was obtained before initiation or continuation of thrombolytic treatment, anticoagulant therapy, or antiplatelet therapy	ACOVE	
	Une IRM cérébrale et/ou un scanner cérébral sont réalisés dans un délai inférieur à 1 heure après l'arrivée dans l'établissement.	ANAES	
	Number of patients undergoing immediate CT scan after admission for stroke under certain conditions	CBO	
	Number of patients potentially eligible for tPA that have CT	CMAJ	

Description	Original indicator(s)	Source	Reason for exclusion
	brain scan completed within 25 min of arrival at ED		
	Number of patients ineligible for tPA for whom a CT/MRI was completed within 24 h	CMAJ	
	Number of patients ineligible for tPA and for whom CT/MRI was not completed within 24 h of arrival at ED, that has a CT/MRI completed before hospital discharge	CMAJ	
	Percentage of stroke patients who undergo a CT scan within 25 minutes of arrival in the ED	ICSI	
Number of patients receiving aspirin in the acute phase of stroke	Number of patients receiving aspirin in the acute phase of stroke	CBO	No information about non reimbursed drugs
	Number of vulnerable elders diagnosed with acute atherothrombotic ischemic stroke, that is offered antiplatelet treatment within 48 hours following the stroke, unless the patient is already receiving anticoagulant treatment.	ACOVE	
	En cas d'infarctus cérébral et en l'absence de thrombolyse, un traitement par l'aspirine (160-300 mg) est prescrit au patient dans un délai inférieur à 24 heures.	ANAES	
	En cas de thrombolyse et en l'absence d'hémorragie secondaire le malade est mis sous aspirine 24 à 48 heures après.	ANAES	
	Number of patients receiving aspirin on discharge	CBO	
	Number of patients with acute stroke for whom acute ASA therapy was initiated within 48 h (and as soon as possible) after stroke onset unless contraindicated	CMAJ	
	Number of patients with acute ischemic stroke that was discharged with antithrombotic therapy unless contraindicated	CMAJ	
	Percentage of stroke patients who are not candidates for tPA treatment who receive aspirin within 24 hours of hospitalisation, after a negative head CT, unless contraindicated	ICSI	
	Number of patients receiving a platelet inhibitor within 48h after admission for stroke	NIP	
Number of patients hospitalised on a stroke unit within 48h after admission for stroke	Number of patients hospitalised on a stroke unit within 48h after admission for stroke	NIP	No information on admission in a stroke unit
	Number of vulnerable elders admitted to the hospital with a	ACOVE	

Description	Original indicator(s)	Source	Reason for exclusion
	diagnosis of acute ischemic stroke, that is admitted to a specialized acute or combined acute and rehabilitative stroke unit, or transferred to a specialized stroke unit if such a unit is available in the hospital		
	Le dossier du patient est discuté dans le cadre d'une réunion pluridisciplinaire.	ANAES	
	Number of patients with acute stroke managed on a designated stroke unit	CMAJ	
Number of patients with acute ischemic stroke and aphasia or dysphagia receiving logopedic assessment/therapy*	Number of patients with acute stroke for whom a dysphagia screen or protocol was initiated before the patient was given food or drink, and the results were documented	CMAJ	No code for logopedic assessment/therapy
	Percentage of stroke patients who are at risk for aspiration who receive an early swallow evaluation	ICSI	
	Number of patients with stroke and aphasia receiving logopedic therapie	CBO	
Perinatal care			
Rate of vaginal births after a previous caesarean section (VBAC)*	VBAC rate, uncomplicated	AHRQ	No information on previous CS
	VBAC rate	JCAHO Navigator© Peristat AHRQ QIP ACHS	
Percentage of women who have an uncomplicated singleton breech pregnancy at 36 weeks' gestation that have a documented offer of external cephalic version	Percentage of women who have an uncomplicated singleton breech pregnancy at 36 weeks' gestation that have a documented offer of external cephalic version	NICE	No information on documentation
Percentage of women in labour that have continuous support during labour, provided by women with or without prior training, for example a doula, a childbirth educator or a female relative	Percentage of women in labour that have continuous support during labour, provided by women with or without prior training, for example a doula, a childbirth educator or a female relative	NICE	Not relevant
Percentage of women with uncomplicated pregnancies beyond 41 weeks with documented offer of induction of labour	Percentage of women with uncomplicated pregnancies beyond 41 weeks with documented offer of induction of labour	NICE	Little relevance

Description	Original indicator(s)	Source	Reason for exclusion
Percentage of CS where antiemetics are given prior to regional or general anaesthesia	Percentage of CS where antiemetics are given prior to regional or general anaesthesia	NICE	Not relevant
Percentage of documented involvement of consultant obstetricians in the decision making for CS	Percentage of documented involvement of consultant obstetricians in the decision making for CS	NICE	No information on documentation
Percent of women in the guideline population (nullipara female, without concomitant medical problems, at term pregnancy (36 completed weeks), having contractions, singleton fetus, cephalic presentation, no evidence of fetal distress, expected normal spontaneous vaginal delivery) who have spontaneous rupture of membranes (SROM) or early amniotomy	Percent of women in the guideline population (nullipara female, without concomitant medical problems, at term pregnancy (36 completed weeks), having contractions, singleton fetus, cephalic presentation, no evidence of fetal distress, expected normal spontaneous vaginal delivery) who have spontaneous rupture of membranes (SROM) or early amniotomy	ICSI	Not relevant
Prevalence of ever breastfeeding	Prevalence of ever breastfeeding	CPSS	No information on breastfeeding
	Percentage of infants breastfeeding throughout the first 48 hours	Peristat	
Use of surfactant in pregnancies of < 34 weeks of gestation	Use of surfactant in pregnancies of < 34 weeks of gestation	CPSS	No information about non reimbursed drugs
Percentage of women in spontaneous labour with an uncomplicated singleton pregnancy at term monitored using a partogram with a 4-hour action line	Percentage of women in spontaneous labour with an uncomplicated singleton pregnancy at term monitored using a partogram with a 4-hour action line	NICE	No code for partogram
Preterm birth rate	Preterm birth rate	CPSS	Controversial definition
Postterm birth rate	Postterm birth rate	CPSS	Controversial definition
Percentage of births with amnioinfusion when either of the following is present: thick meconium or repetitive severe variable decelerations or oligohydramnios	Percentage of births with amnioinfusion when either of the following is present: thick meconium or repetitive severe variable decelerations or oligohydramnios	ICSI	Not relevant
Elderly care			
Number of vulnerable elders with mild to moderate Alzheimer disease that is treated with a cholinesterase inhibitor	Number of vulnerable elders with mild to moderate Alzheimer disease that is treated with a cholinesterase inhibitor	ACOVE	Mild or moderate Alzheimer is not differentiated in ICD-9-CM diagnosis codes

Description	Original indicator(s)	Source	Reason for exclusion
Number of vulnerable elders started on an antidepressant medication, that received on of the following medications as first- or second-line therapy: TCAs, MAOIs, benzodiazepines, or stimulants	Number of vulnerable elders started on an antidepressant medication, that received on of the following medications as first- or second-line therapy: TCAs, MAOIs, benzodiazepines, or stimulants	ACOVE	Benzodiazepines not reimbursed
Number of diabetic vulnerable elders without anticoagulant therapy that is offered daily aspirin therapy	Number of diabetic vulnerable elders without anticoagulant therapy that is offered daily aspirin therapy	ACOVE	No information about non reimbursed drugs
	Number of diabetic elders with a daily dose aspirin ≥75 mg	navigator©	
Number of falls during hospital admission	Number of falls during hospital admission	navigator©	No specific code for hospital
	Number of falls during the day	navigator©	
	Number of falls during admission in G-unit	navigator©	
	Number of multiple falls during hospital admission	navigator©	
	Number of falls during the night	navigator©	
Number of vulnerable elders with heart failure and atrial fibrillation and documented contraindications to anticoagulation, that was offered aspirin	Number of vulnerable elders with heart failure and atrial fibrillation and documented contraindications to anticoagulation, that was offered aspirin	ACOVE	No information about non reimbursed drugs
Number of vulnerable elders with heart failure and left ventricular ejection fraction of 40% or less, that is not treated with a type I antiarrhythmic agent unless an implantable cardioverter-defibrillator is in place	Number of vulnerable elders with heart failure and left ventricular ejection fraction of 40% or less, that is not treated with a type I antiarrhythmic agent unless an implantable cardioverter-defibrillator is in place	ACOVE	Not relevant
Number of vulnerable elders with newly diagnosed heart failure, for whom education about disease management was provided and documented	Number of vulnerable elders with newly diagnosed heart failure, for whom education about disease management was provided and documented	ACOVE	No information on education
Number of vulnerable elders remaining hypertensive after nonpharmacologic intervention for whom pharmacologic antihypertensive treatment was initiated	Number of vulnerable elders remaining hypertensive after nonpharmacologic intervention for whom pharmacologic antihypertensive treatment was initiated	ACOVE	No information on blood pressure
Number of vulnerable elders requiring pharmacotherapy for treatment of hypertension for whom a once- or twice-daily medication was used unless there is documentation regarding the need for agents that require more frequent dosing	Number of vulnerable elders requiring pharmacotherapy for treatment of hypertension for whom a once- or twice-daily medication was used unless there is documentation regarding the need for agents that require more frequent dosing	ACOVE	No information on which drugs
Number of vulnerable elders with hypertension that received recommendation about nonpharmacologic therapy with lifestyle modification	Number of vulnerable elders with hypertension that received recommendation about nonpharmacologic therapy with lifestyle modification	ACOVE	Not relevant
Number of elder patients developing a hypertensive emergency	Number of elder patients developing a hypertensive emergency	Saliba et al	Not relevant

Description	Original indicator(s)	Source	Reason for exclusion
with a diastolic blood pressure > 120 mmHg and with manifestations of critical target organ damage for whom parenteral hypertensive therapy is initiated while the patient is in a monitored setting in the hospital to reduce mean arterial blood pressure by 25% acutely and diastolic blood pressure to 100-110 mmHg within the next several hours	with a diastolic blood pressure > 120 mmHg and with manifestations of critical target organ damage for whom parenteral hypertensive therapy is initiated while the patient is in a monitored setting in the hospital to reduce mean arterial blood pressure by 25% acutely and diastolic blood pressure to 100-110 mmHg within the next several hours		
Number of elder patients that is prescribed a diuretic that has his serum electrolytes checked within 7 days after initiation of therapy, after dose adjustment, and at least yearly	Number of elder patients that is prescribed a diuretic that has his serum electrolytes checked within 7 days after initiation of therapy, after dose adjustment, and at least yearly	Saliba et al	No information on timing
Number of vulnerable elders with a significant left main or significant three-vessel coronary artery disease with left ventricular ejection fraction less than 50%, that is offered coronary artery bypass graft surgery	Number of vulnerable elders with a significant left main or significant three-vessel coronary artery disease with left ventricular ejection fraction less than 50%, that is offered coronary artery bypass graft surgery	ACOVE	Not relevant
Number of vulnerable elders with an acute myocardial infarction or unstable angina that is offered aspirin therapy within 1 hour of presentation	Number of vulnerable elders with an acute myocardial infarction or unstable angina that is offered aspirin therapy within 1 hour of presentation	ACOVE	No information about non reimbursed drugs
Number of vulnerable elders with an acute myocardial infarction or unstable angina who did not undergo angiography and who do not have contraindications to revascularisation, that is offered noninvasive stress testing 4 to 21 days after the infarction or anginal event	Number of vulnerable elders with an acute myocardial infarction or unstable angina who did not undergo angiography and who do not have contraindications to revascularisation, that is offered noninvasive stress testing 4 to 21 days after the infarction or anginal event	ACOVE	Not relevant
Number of vulnerable elders with established coronary heart disease and not receiving warfarin, that is offered antiplatelet therapy	Number of vulnerable elders with established coronary heart disease and not receiving warfarin, that is offered antiplatelet therapy	ACOVE	No information about non reimbursed drugs
Number of vulnerable elders without contraindications to revascularisation and with an acute myocardial infarction or unstable angina with one or more of the following: pain refractory to medical therapy (over 1 hour of aggressive medical therapy), recurrent angina or ischemia at rest or with low-level activities, ischemia accompanied by symptoms of heart failure, that is offered urgent catheterization	Number of vulnerable elders without contraindications to revascularisation and with an acute myocardial infarction or unstable angina with one or more of the following: pain refractory to medical therapy (over 1 hour of aggressive medical therapy), recurrent angina or ischemia at rest or with low-level activities, ischemia accompanied by symptoms of heart failure, that is offered urgent catheterization	ACOVE	Less relevant
Number of vulnerable elders with an acute myocardial infarction that is measurable by electrocardiography and not	Number of vulnerable elders with an acute myocardial infarction that is measurable by electrocardiography and not	ACOVE	Not relevant

Description	Original indicator(s)	Source	Reason for exclusion
having contraindications to reperfusion therapy, that is offered treatment with reperfusion therapy	having contraindications to reperfusion therapy, that is offered treatment with reperfusion therapy		
Number of vulnerable elders with unstable angina or an acute myocardial infarction that is offered beta-blocker therapy within 12 hours of presentation	Number of vulnerable elders with unstable angina or an acute myocardial infarction that is offered beta-blocker therapy within 12 hours of presentation	ACOVE	No information on timing
Number of elder patients with recent weight loss or hypoalbuminemia and all other potentially reversible causes being addressed, for whom assistance with feeding was offered	Number of elder patients with recent weight loss or hypoalbuminemia and all other potentially reversible causes being addressed, for whom the medical record documents that assistance with feeding was offered	Saliba et al	No information on weight loss
Number of vulnerable elders who are taking corticosteroids for more than one month, that is recommended the use of calcium and vitamin D supplements at least once	Number of vulnerable elders who are taking corticosteroids for more than one month, that is recommended the use of calcium and vitamin D supplements at least once	ACOVE	No information on calcium
Number of vulnerable elders with osteoporosis that is recommended the use of calcium and vitamin D supplements at least once	Number of vulnerable elders with osteoporosis that is treated with calcium and vitamin D supplements	ACOVE	No information on calcium
Number of hospitalized vulnerable elders eligible for vaccination (that is, is not up-to-date with pneumococcal or influenza vaccination) that received vaccination against pneumococcus and influenza (during flu season)	Number of hospitalized vulnerable elders eligible for vaccination (that is, is not up-to-date with pneumococcal or influenza vaccination) that received vaccination against pneumococcus and influenza (during flu season)	ACOVE	Not relevant
	Number of vulnerable elders with no history of allergy to the pneumococcal vaccine who are not known to have already received a pneumococcal vaccine, that is offered a pneumococcal vaccine	ACOVE	
Number of patients with increased risk to develop pressure ulcers, who develop pressure ulcers	Number of patients with increased risk to develop pressure ulcers, who develop pressure ulcers	navigator©	No information on increased risk
Total prevalence of pressure ulcers that developed during hospital admission	Total prevalence of pressure ulcers that developed during hospital admission	navigator©	No specific information for hospitals
	Prevalence of multiple pressure ulcers developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at trochanter major developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at crista iliaca developed during hospital admission	navigator©	

Description	Original indicator(s)	Source	Reason for exclusion
	Prevalence of pressure ulcers at os sacrum developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at other locations developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at the back of the head developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at the heels developed during hospital admission	navigator©	
	Prevalence of pressure ulcers at the scapula developed during hospital admission	navigator©	
	Prevalence of pressure ulcers developed during admission in G-unit	navigator©	
	Prevalence of pressure ulcers developed during surgery	navigator©	
	Prevalence of pressure ulcers stage 1 developed during hospital admission	navigator©	
	Prevalence of pressure ulcers stage 2 developed during hospital admission	navigator©	
	Prevalence of pressure ulcers stage 3 developed during hospital admission	navigator©	
	Prevalence of pressure ulcers stage 4 developed during hospital admission	navigator©	
Prevalence of pressure ulcers developed during surgery	Prevalence of pressure ulcers developed during surgery	navigator©	No information on link between surgery and ulcer
Number of pressure ulcers that deteriorate during hospital admission	Number of pressure ulcers that deteriorate during hospital admission	navigator©	No information on deterioration
Number of vulnerable elders identified as at risk for pressure ulcer development ánd who have malnutrition (involuntary weight loss of ≥10% over 1 year or low albumin or prealbumin levels), for whom nutritional intervention or dietary consultation are instituted	Number of vulnerable elders identified as at risk for pressure ulcer development ánd who have malnutrition (involuntary weight loss of ≥10% over 1 year or low albumin or prealbumin levels), for whom nutritional intervention or dietary consultation are instituted	ACOVE	No information on risk
Number of elder patients with a pressure ulcer that received a nutritional assessment within 1 week by a dietician or a PCP	Number of elder patients with a pressure ulcer that received a nutritional assessment within 1 week by a dietician or a PCP	Saliba D et al	No information on timing

Description	Original indicator(s)	Source	Reason for exclusion
Number of patients with grade 1 or 2 pressure ulcers that have a high-specification foam mattress/cushion as a minimum and are very closely observed for deteriorations	Number of patients with grade 1 or 2 pressure ulcers that have a high-specification foam mattress/cushion as a minimum and are very closely observed for deteriorations	NICE	No information on observation
Number of vulnerable elders admitted to an intensive care unit or a medical or surgical unit, who cannot reposition himself or herself or has limited ability to do so, for whom risk assessment for pressure ulcers is done on admission	Number of vulnerable elders admitted to an intensive care unit or a medical or surgical unit, who cannot reposition himself or herself or has limited ability to do so, for whom risk assessment for pressure ulcers is done on admission	ACOVE	No information on risk assessment
Number of cognitively intact vulnerable elders who are capable of independent toileting ánd who have documented stress, urge, or mixed incontinence without evidence of hematuria or high post-void residual, for whom behavioural treatment is offered	Number of cognitively intact vulnerable elders who are capable of independent toileting ánd who have documented stress, urge, or mixed incontinence without evidence of hematuria or high post-void residual, for whom behavioural treatment is offered	ACOVE	No information on cognition, independent toileting, …
Number of diabetic vulnerable elders with proteinuria that is offered therapy with an ACE inhibitor	Number of diabetic vulnerable elders with proteinuria that is offered therapy with an ACE inhibitor	ACOVE	Less relevant
Number of diabetic elder patients with one additional cardiac risk factor (ie smoker, hypertension, hypercholesterolemia, or renal insufficiency/microalbuminuria) that is offered an ACE inhibitor or receptor blocker	Number of diabetic elder patients with one additional cardiac risk factor (ie smoker, hypertension, hypercholesterolemia, or renal insufficiency/microalbuminuria) that is offered an ACE inhibitor or receptor blocker	Saliba et al	Less relevant
Number of vulnerable elders with hypertension and renal parenchymal disease (serum creatinine concentration greater than 1.5 mg/dl or more than 1g of protein/24h of collected urine) that was offered therapy with an ACE inhibitor	Number of vulnerable elders with hypertension and renal parenchymal disease (serum creatinine concentration greater than 1.5 mg/dl or more than 1g of protein/24h of collected urine) that was offered therapy with an ACE inhibitor	ACOVE	Less relevant
Number of vulnerable elders that had an acute myocardial infarction and is offered a beta-blocker	Number of vulnerable elders that had an acute myocardial infarction and is offered a beta-blocker	ACOVE	Less relevant
Number of vulnerable elders older than 75 years of age, treated with warfarin or with a history of peptic ulcer disease or gastrointestinal bleeding AND who are being treated with a COX nonselective NSAID, that is offered concommitant treatment with either misoprostol or a proton-pump inhibitor	Number of vulnerable elders older than 75 years of age, treated with warfarin or with a history of peptic ulcer disease or gastrointestinal bleeding AND who are being treated with a COX nonselective NSAID, that is offered concommitant treatment with either misoprostol or a proton-pump inhibitor	ACOVE	Less relevant
Total hip prosthesis			
Early revision due to dislocation	Early revision due to dislocation	Swedish registry	No information on previous THP

TABLE 4. REASONS OF EXCLUSION WHEN FEASIBILITY ON ADMINISTRATIVE DATA IS NOT POSSIBLE.

Description	**Out of pocket drugs**	**Outpatient information**	**Codification inaccuracy (ICD-9-CM)**	**NO (accurate) timing of diagnostic or therapeutic intervention**	**No information from Medical Record concerning …..**	
					care process	**health status**
Stroke						
Number of patients for whom the NINDS inclusion/exclusion criteria were applied for patient selection for thrombolysis					x	
Number of patients for whom a tPA best-practice treatment protocol was followed for tPA administration (e.g., AHA, AAN)					x	
Number of patients with symptomatic carotid stenosis ≤ 70% (ECST) receiving carotid surgery			x			
Number of patients receiving aspirin in the acute phase of stroke	x			x		
Number of patients hospitalised on a stroke unit within 48h after admission for stroke					x	
Number of patients with acute ischemic stroke and aphasia or dysphagia receiving logopedic assessment/therapy*					x	
Perinatal care						
Percentage of women who have an uncomplicated singleton breech pregnancy at 36 weeks' gestation that have a documented offer of external cephalic version					x	
Percentage of women in labour that have continuous support during labour, provided by women with or without prior training, for example a doula, a childbirth educator or a female relative					x	
Percentage of CS where antiemetics are given prior to regional or general anaesthesia	x			x		
Percentage of documented involvement of consultant obstetricians in the decision making for CS					x	
Percent of women in the guideline population (nullipara female, without concomitant medical problems, at term pregnancy (36			x		x	

Description	Out of pocket drugs	Outpatient information	Codification inaccuracy (ICD-9-CM)	NO (accurate) timing of diagnostic or therapeutic intervention	No information from Medical Record concerning …..	
					care process	health status
completed weeks), having contractions, singleton fetus, cephalic presentation, no evidence of fetal distress, expected normal spontaneous vaginal delivery) who have spontaneous rupture of membranes (SROM) or early amniotomy						
Use of surfactant in pregnancies of < 34 weeks of gestation	x					
Elderly care						
Number of vulnerable elders with mild to moderate Alzheimer disease that is treated with a cholinesterase inhibitor			x			
Number of vulnerable elders started on an antidepressant medication, that received on of the following medications as first- or second-line therapy: TCAs, MAOIs, benzodiazepines, or stimulants	x			x		
Number of diabetic vulnerable elders without anticoagulant therapy that is offered daily aspirin therapy	x					
Number of falls during hospital admission			x			
Number of vulnerable elders with heart failure and atrial fibrillation and documented contraindications to anticoagulation, that was offered aspirin	x					x
Number of vulnerable elders with newly diagnosed heart failure, for whom education about disease management was provided and documented			x		x	
Number of vulnerable elders remaining hypertensive after nonpharmacologic intervention for whom pharmacologic antihypertensive treatment was initiated				x		x
Number of elder patients that is prescribed a diuretic that has his serum electrolytes checked within 7 days after initiation of therapy, after dose adjustment, and at least yearly		x		x	x	
Number of vulnerable elders with an acute myocardial infarction or unstable angina that is offered aspirin therapy within 1 hour of	x			x		

Description	Out of pocket drugs	Outpatient information	Codification inaccuracy (ICD-9-CM)	NO (accurate) timing of diagnostic or therapeutic intervention	No information from Medical Record concerning …..	
					care process	health status
presentation						
Number of vulnerable elders with established coronary heart disease and not receiving warfarin, that is offered antiplatelet therapy	x					
Number of vulnerable elders with unstable angina or an acute myocardial infarction that is offered beta-blocker therapy within 12 hours of presentation				x		
Number of elder patients with recent weight loss or hypoalbuminemia and all other potentially reversible causes being addressed, for whom assistance with feeding was offered					x	x
Number of vulnerable elders who are taking corticosteroids for more than one month, that is recommended the use of calcium and vitamin D supplements at least once		x				x
Number of vulnerable elders with osteoporosis that is recommended the use of calcium and vitamin D supplements at least once						x
Number of patients with increased risk to develop pressure ulcers, who develop pressure ulcers						x
Total prevalence of pressure ulcers that developed during hospital admission						x
Prevalence of pressure ulcers developed during surgery				x		
Number of pressure ulcers that deteriorate during hospital admission						x
Number of vulnerable elders identified as at risk for pressure ulcer development ánd who have malnutrition (involuntary weight loss of ≥10% over 1 year or low albumin or prealbumin levels), for whom nutritional intervention or dietary consultation are instituted					x	x
Number of elder patients with a pressure ulcer that received a nutritional assessment within 1 week by a dietician or a PCP				x	x	

Description	Out of pocket drugs	Outpatient information	Codification inaccuracy (ICD-9-CM)	NO (accurate) timing of diagnostic or therapeutic intervention	No information from Medical Record concerning …..	
					care process	health status
Number of patients with grade 1 or 2 pressure ulcers that have a high-specification foam mattress/cushion as a minimum and are very closely observed for deteriorations					x	
Number of vulnerable elders admitted to an intensive care unit or a medical or surgical unit, who cannot reposition himself or herself or has limited ability to do so, for whom risk assessment for pressure ulcers is done on admission					x	x
Number of cognitively intact vulnerable elders who are capable of independent toileting ánd who have documented stress, urge, or mixed incontinence without evidence of hematuria or high post-void residual, for whom behavioural treatment is offered					x	x
Number of vulnerable elders older than 75 years of age, treated with warfarin or with a history of peptic ulcer disease or gastrointestinal bleeding AND who are being treated with a COX nonselective NSAID, that is offered concommitant treatment with either misoprostol or a proton-pump inhibitor	x					x
Total hip prosthesis						
Early revision due to dislocation		(xx)				

(xx): theoretically feasible within a large frame project in which the patient history can to be followed during several years and across several acute hospitals.

TABLE 5. FEASIBLE EVIDENCE-BASED AND/OR HIGHLY RELEVANT CLINICAL QUALITY INDICATORS.

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
Stroke					
Number of patients with stroke undergoing ECG	CBO	Number of patients with a diagnosis of stroke	Number of patients with a diagnosis of stroke undergoing ECG during hospitalisation	Ia	Saxena R et al
Number of patients presenting with acute stroke symptoms that had an ECG in the ED	CMAJ				
L'ECG est réalisé dès le début de la prise en charge. Son analyse figure dans le dossier du patient.	ANAES				
Number of patients receiving oral anticoagulation/heparin in the acute phase of stroke	CBO	Number of patients with acute ischemic stroke	Number of patients with acute ischemic stroke receiving a prophylactic dose of anticoagulation/heparin'	Ia	Sandercock P et al
Percentage of patients with ischemic stroke with paralysis or other reason for immobility receiving appropriate prevention for VTE (SC heparin or pneumatic compression)	ICSI				
Number of patients with acute ischemic stroke and nonvalvular atrial fibrillation that was discharged with anticoagulant therapy unless contraindicated	CMAJ	Number of patients with acute ischemic stroke and atrial fibrillation	Number of patients with acute ischemic stroke and atrial fibrillation that was discharged with anticoagulant therapy	Ia	Saxena R et al
Number of male vulnerable elders with carotid artery symptoms and diagnosed with nondisabling stroke, and for whom the medical record does not document that the patient is not a candidate for carotid surgery, for whom a carotid artery imaging study is performed within 4 weeks	ACOVE	Number of patients with acute ischemic stroke	Number of patients with acute ischemic stroke for whom a carotid artery imaging study is performed	Ia	Cina CS et al
En cas d'infarctus cérébral un Doppler cervical et un Doppler transcrânien sont réalisés.	ANAES				
Les Doppler sont réalisés dans un délai inférieur à 48 heures.	ANAES				
Number of patients with acute stroke for whom carotid imaging was completed during hospital stay or documentation was made that a test has been	CMAJ				

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
arranged as outpatient after discharge					
Number of patients with acute ischemic stroke that was assessed for and prescribed a lipid-lowering agent if appropriate	CMAJ	Number of patients with acute ischemic stroke	Number of patients with acute ischemic stroke that was prescribed a statin	1b	Collins R et al
Number of patients with stroke receiving thrombolysis within 3h	CBO	Number of patients with acute ischemic stroke	Number of patients with acute ischemic stroke receiving thrombolysis	1a	Wardlaw JM et al
Number of vulnerable elders that is started on thrombolytic therapy for a stroke, for whom all of the following is true: a head CT or MRI should precede initiation of thrombolytic therapy; sulcal effacement, mass effect, edema, or possible hemorrhage should not be present on neuroimaging; time from symptom onset to initiation of thrombolytic therapy should be documented in the medical record and should not exceed 3 hours; absence of absolute contraindications to thrombolysis should be documented in the medical record; tissue plasminogen activator should be used; and National Institute of Neurological Disorders and Stroke exclusion criteria should not be present	ACOVE				
En cas d'infarctus cérébral, une thrombolyse par voie intraveineuse est mise en oeuvre.	ANAES				
La mise en oeuvre de la thrombolyse est effectuée dans le délai de 3 heures après le début de l'AVC.	ANAES				
Number of patients with stroke receiving thrombolysis	CBO				
Number of patients with acute stroke evaluated for tPA eligibility	CMAJ				
Number of patients eligible for tPA that received tPA, and within 1 h of arrival at hospital	CMAJ				
Percentage of eligible patients presenting with ischemic stroke treated with tPA	ICSI				

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
Percentage of patients presenting within 3 hours of stroke onset who are evaluated by a physician within 10 minutes of arriving in the ED	ICSI				
Percentage of stroke patients who are candidates for tPA with a door to drug time of less than 60 minutes	ICSI				
Number of patients with stroke undergoing assessment by physiotherapist within 48h after admission	NIP	Number of patients with acute ischemic stroke	Number of patients with acute ischemic stroke undergoing assessment by a physiotherapist/occupational therapist	< 1b	
Number of patients with stroke undergoing assessment by occupational therapist within 48h after admission	NIP				
Perinatal care					
Percentage of mothers with preterm labour who were given appropriate betamethasone during labor	ICSI	Proportion of mothers with preterm birth (<34 weeks)	Proportion of mothers with preterm birth (<34 weeks) that was given corticosteroids	1a	Crowley P
Percentage of mothers with preterm birth who were given appropriate betamethasone during labor	ICSI				
Antenatal steroids	BAPM				
Post operative wound infection after caesarean delivery	navigator ©	Proportion of caesarean deliveries	Proportion of caesarean deliveries with postoperative wound infection	1a	Smaill F et al
Percentage of caesarean sections where the woman receives prophylactic antibiotics	NICE	Proportion of caesarean deliveries	Proportion of caesarean deliveries receiving prophylactic antibiotics	1a	Smaill F et al
Rate of operative vaginal deliveries	CPSS	Proportion of deliveries	Proportion of operative vaginal deliveries	…	…
Cases of birth trauma	AHRQ	All liveborn births	Discharges with ICD-9-CM codes for birth trauma in any diagnosis field	1a	Johanson R
Cases of birth trauma with vaginal delivery	navigator ©				
Inpatient neonatal mortality	JCAHO Navigator © peristat	All liveborn neonates	All neonates who expire at the facility before the neonate becomes age 28 days	1a	Soll RF
Neonatal mortality	QIP				
Severe neonatal morbidity rate: respiratory distress	CPSS	All liveborn neonates	All liveborn neonates with	1a	Roberts D

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
syndrome rate			respiratory distress syndrome		
Cases of obstetric trauma (3rd or 4th degree lacerations) after instrument-assisted vaginal delivery	AHRQ	Proportion of instrument-assisted vaginal deliveries	Proportion of instrument-assisted vaginal deliveries with 3rd or 4th degree lacerations	1a	Johanson RB
Cases of obstetric trauma (4th degree lacerations) after instrument-assisted vaginal delivery	AHRQ				
Cases of obstetric trauma after vaginal delivery	navigator ©				
Prevalence of trauma to the perineum	Peristat CPSS				
Cases of obstetric trauma (3rd or 4th degree lacerations) after vaginal delivery without instrument assistance	AHRQ	Proportion of non-instrument-assisted vaginal deliveries	Proportion of non-instrument-assisted vaginal deliveries with 3rd or 4th degree lacerations	1b	Dannecker C
Cases of obstetric trauma (4th degree lacerations) after vaginal delivery without instrument assistance	AHRQ				
3rd and 4th degree laceration after delivery	JCAHO navigator ©				
Episiotomy rate	CPSS	Proportion of vaginal deliveries	Proportion of vaginal deliveries with episiotomy	1a	Carroli G et al
Induction of labour other than for defined indications excluding augmentation	ACHS	All deliveries	Proportion of deliveries with an induction of labor	< 1b	
Induction of labour other than for defined indications including augmentation in denumerator	ACHS				
Caesarean delivery rate	AHRQ Navigator © Peristat SPE CPSS QIP ICSI	Total number of deliveries	Number of caesarean deliveries	< 1b	

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
Primary caesarean delivery rate	AHRQ Navigator © QIP				
Overall CS rate and the percentage of CS performed for the four major determinants (presumed fetal compromise, failure to progress in labour, breech presentation, multiple pregnancy) and maternal request	NICE				
Number of caesarean sections in relation to the expected number	Prestatie-indicatoren				
Elderly care					
Number of vulnerable elders with dementia and depression that is treated for the depression	ACOVE	Number of vulnerable elders with dementia and depression	Number of vulnerable elders with dementia and depression that is treated with TCAs or SSRIs for the depression	1a	Bains J
Number of elder patients with a history of falling or considered at risk of falling that is observed for gait and balance problems and considered for interventions to improve strength and balance	NICE	Number of elder patients with a diagnosis of fall, gait- or balance problems, or polyneuropathy	Number of elder patients with a diagnosis of fall, gait- or balance problems, or polyneuropathy, that received physiotherapy	1a	Gillespie LD
Number of vulnerable elders found to have problems with gait, strength (for example, ≤4 out of 5 on manual muscle testing, or the need to use his or her arms to rise from a chair), or endurance (for example, dyspnea on mild exertion), that was offered an exercise program	ACOVE				
Number of vulnerable elders with decreased balance or proprioception, or increased postural sway, that was offered an appropriate exercise program and an evaluation for an assistive device	ACOVE				
Number of vulnerable elders that reported two or more falls in the past year, or a single fall with injury	ACOVE				

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
requiring treatment, for whom there is documentation that a basic fall evaluation was performed that resulted in specific diagnostic and therapeutic recommendations					
Number of elder patients following treatment for an injurious fall that is offered an assessment to identify and address future risk and tailored intervention aimed at promoting independence and improving physical function	NICE				
Number of elder patients presenting to a health care professional because of a fall or reporting recurrent falls in the past year that is offered a multifactorial falls assessment and is considered for individual multifactorial interventions	NICE				
Number of elder patients with recurrent falls or assessed as being at risk of falling that is considered for an individualised multifactorial intervention	NICE				
Number of vulnerable elders with heart failure and atrial fibrillation, that is treated with anticoagulation to achieve an INR of 2.0 to 3.0	ACOVE	Number of vulnerable elders with heart failure and atrial fibrillation	Number of vulnerable elders with heart failure and atrial fibrillation that is treated with anticoagulation	Ia	Saxena R et al
Number of vulnerable elders with heart failure, left ventricular ejection fraction of 40% or less and NYHA class I to III disease, that is treated with beta-blockers (unless documented contraindication)	ACOVE	Number of vulnerable elders with a diagnosis of heart failure	Number of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a betablocker	Ia – Ib	Lechat P et al; SOLVD, SAVE, TRACE, HOPE; Garg R et al
Number of vulnerable elders with symptomatic heart failure and left ventricular ejection fraction of 40% or less that is treated by an ACE inhibitor	ACOVE				
Number of vulnerable elders with asymptomatic left ventricular dysfunction and a left ventricular ejection fraction of 40% or less that is treated with an ACE inhibitor	ACOVE				
Number of vulnerable elders with a recent myocardial infarction or recent coronary bypass	ACOVE	Number of vulnerable elders with a recent myocardial infarction or	Number of vulnerable elders with a recent myocardial infarction or	Ia	Jolliffe JA et al

Original description	Source	Denominator	Numerator	Level of evidence	Reference(s)
graft surgery that is offered cardiac rehabilitation		recent coronary bypass graft surgery	recent coronary bypass graft surgery that is offered physiotherapy		
Total hip prosthesis					
Proportion of patients with deep venous thrombosis after THR	QIP	All patients hospitalised for a THR	Proportion of patients who develop a DVT during hospitalisation for THR	Ia	Handoll HHG et al
Proportion of patients with pulmonary embolism after THR	QIP	All patients hospitalised for a THR	Proportion of patients who develop a PE during hospitalisation for THR	Ia	Handoll HHG et al
Number of surgical site infections in patients undergoing THR	QIP	All patients hospitalised for a THR	Proportion of patients who develop a surgical site infection during hospitalisation for THR	Ia	Glenny A et al
Proportion of patients who receive thromboprophylaxis for THR	QIP	All patients hospitalised for a THR	Proportion of patients who receive thromboprophylaxis (heparin, LMWH, stockings) for THR	Ia	Imperiale TF et al
Proportion of patients receiving prophylactic antibiotic within one hour prior to surgical incision for THR	JCAHO QIP	All patients hospitalised for a THR	Proportion of patients receiving prophylactic antibiotics with first generation cephalosporins for THR	Ia	Glenny A et al
Proportion of patients for whom prophylactic antibiotics were discontinued within 24 hours after THR end time	JCAHO QIP	All patients hospitalised for a THR	Proportion of patients receiving at maximum a 24h dose of first generation cephalosporins for THR	Ia	Glenny A et al

APPENDIX 3: RESULS OF THE EXPLORATIVE STUDY

Boxplots are calculated on hospitals with minimum 10 stays. Dotted line is national rate.

Stroke: 8 indicators

- Proportion of patients with a diagnosis of stroke undergoing ECG during hospitalisation

Denominator: vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
Numerator: Stays from denominator with billing code 475086.

All hospitals

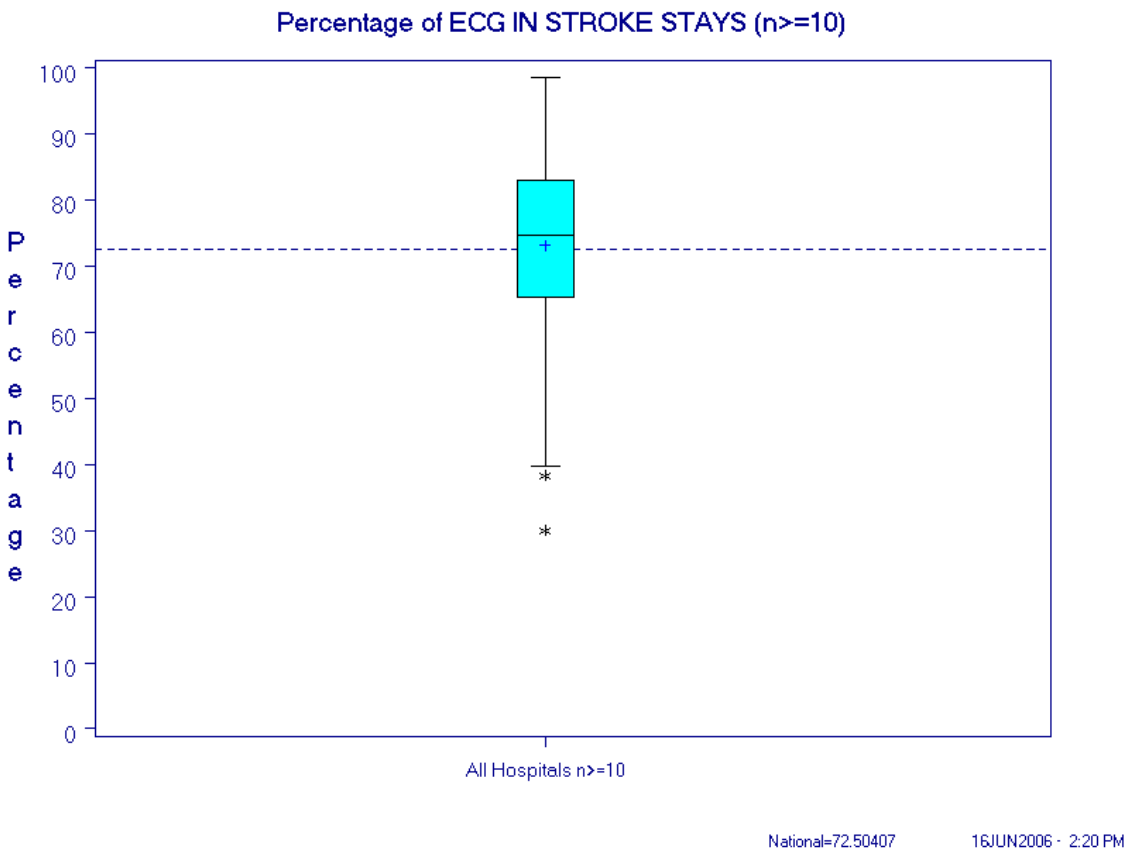
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_ecg	123	71.59	19.37	0.00	64.52	74.58	84.58	100.00
nb stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_ecg	114	73.15	13.87	30.00	65.22	74.64	83.04	98.48
nb stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

stroke	ECG	qi_stroke_ecg
12300	8918	72.5041



- Proprotion of patients with acute ischemic stroke undergoing assessment by physiotherapist/ occupational therapist

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))

Numerator: Stays from denominator with billing code from nomenclature article 7 (kine) or 22 (physio).

All hospitals

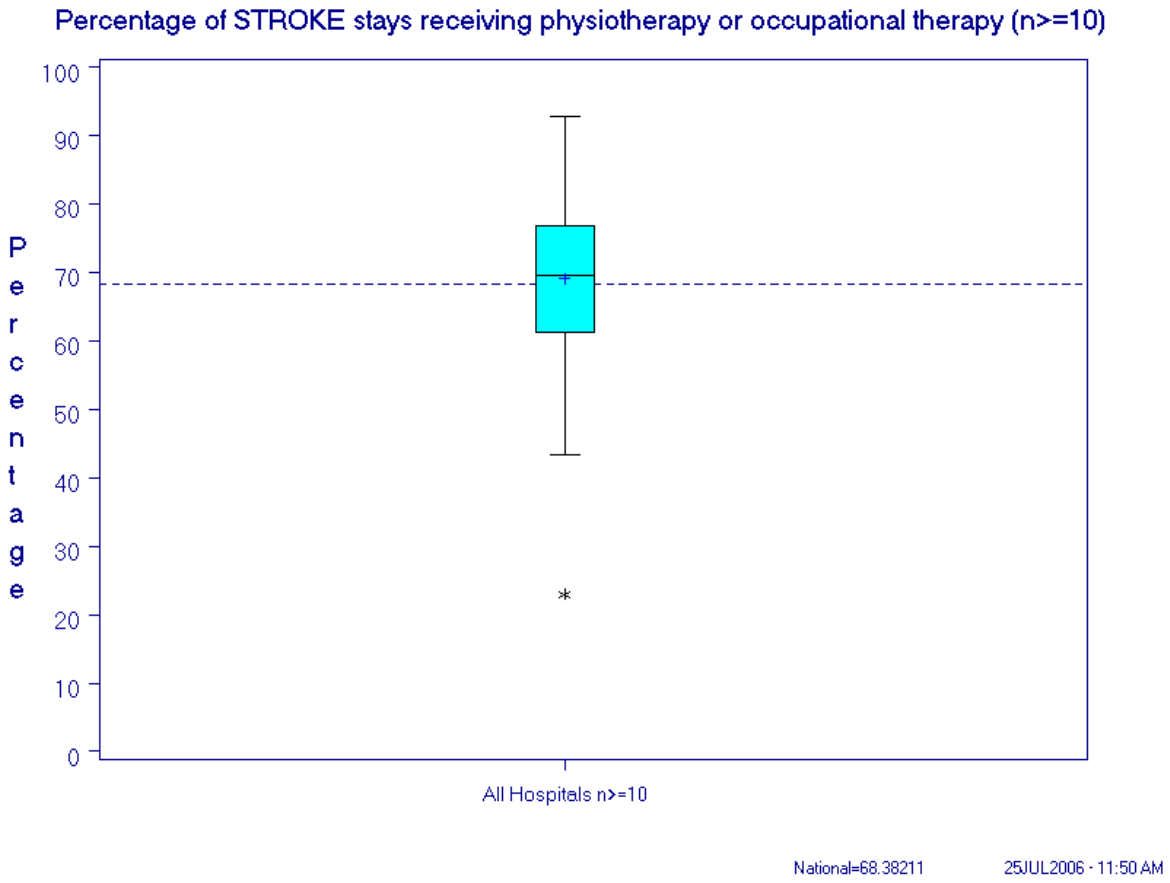
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_phykin	123	69.60	14.27	0.00	61.11	69.70	78.46	100.00
nb stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_phykin	114	69.21	11.36	22.97	61.21	69.65	76.80	92.86
nb stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

stroke	phyio or kine	qi_stroke_phykin
12300	8411	68.3821



- Proportion of patients with acute ischemic stroke receiving a prophylactic dose of anticoagulation/heparin

Denominator: vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
Numerator: Stays from denominator with prophylactic dose [a] B01AB01 OR B01AB04 OR B01AB05 OR B01AB06 OR B01AB09 OR B01AB10 OR B01AX05 .

All hospitals

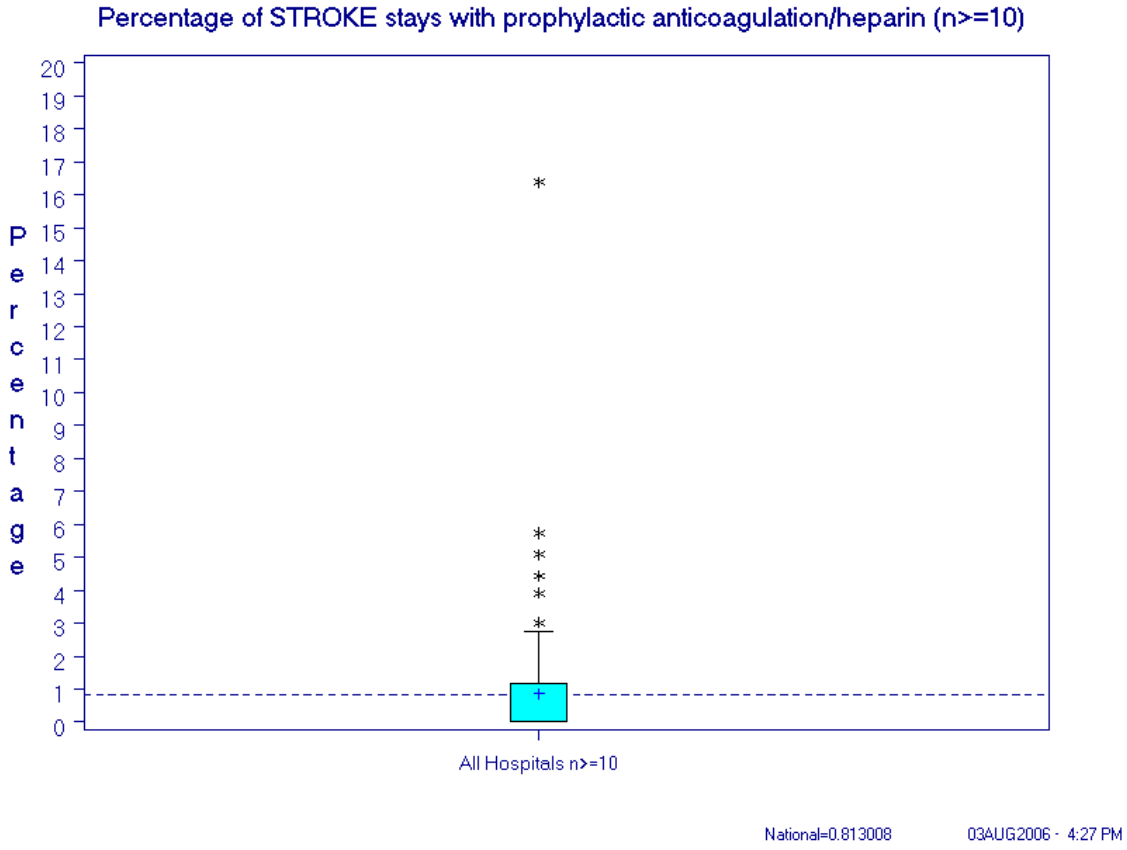
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_prophylacg	123	0.79	1.84	0.00	0.00	0.00	1.09	16.39
NB stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_prophylacg	114	0.86	1.89	0.00	0.00	0.00	1.17	16.39
NB stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

Nb stroke	+ prophyl. anticoagulation/heparin	qi_stroke_prophylacg
12300	100	0.81301



[a] Maximum prophylactic dose: B01AB01 (heparine, =< 10000 IE/dag), B01AB04 (Dalteparin, =<5000 IE/dag), B01AB05 (Enoxaparin, =<40 mg/d), B01AB06 (Nadroparin, =<5700 IE/dag), B01AB09 (Danaparoid, =< 1500 IE/dag), B01AB10 (Tinzaparin, =<4500 IE/dag), en B01AX05 (Fondaparinux, =< 2,5 mg/d)

- Proportion of patients with acute ischemic stroke and nonvalvular atrial fibrillation that was discharged with anticoagulant therapy

Denominator: vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
AND secondary diagnosis =427.31 atrial fibrillation
Numerator: Stays from denominator with diagnosis V5861 long term (current) use of anticoagulants.

All hospitals

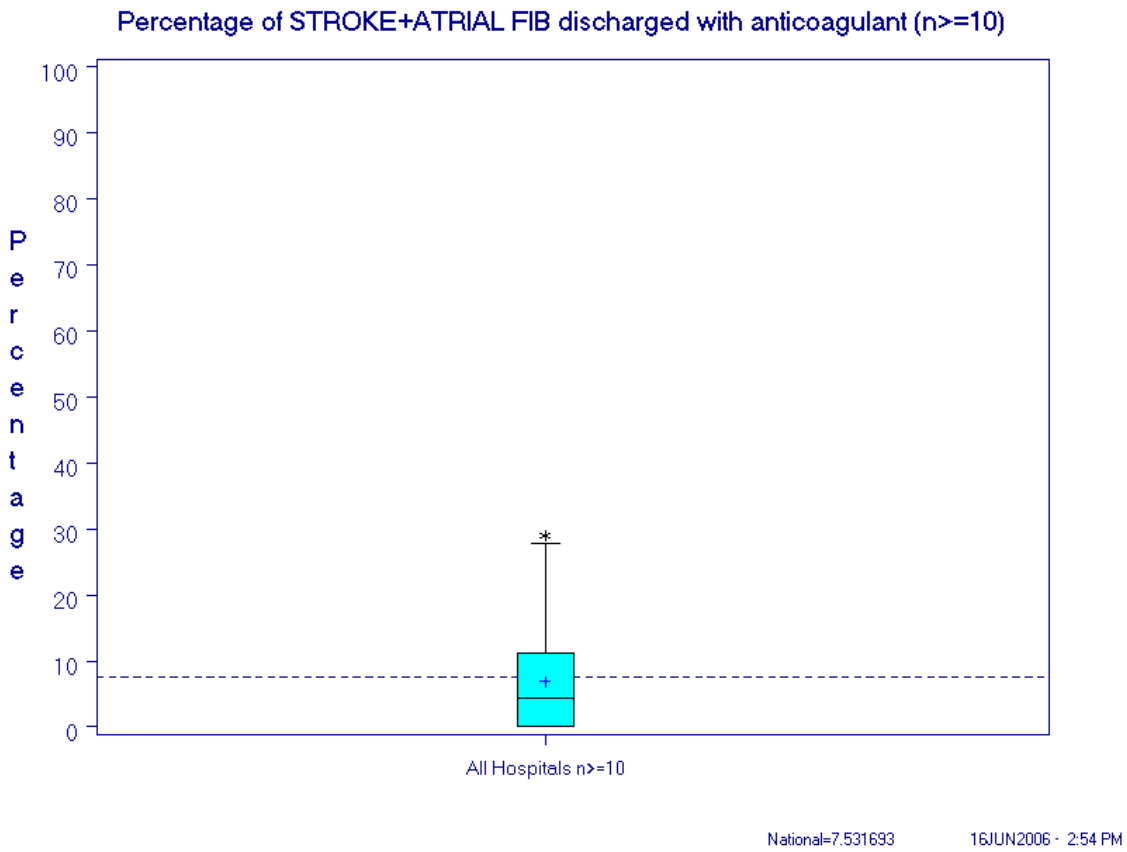
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_fib_dis	117	6.60	8.57	0.00	0.00	3.33	11.11	33.33
N atrial fibrillat.	117	22.92	15.21	1.00	12.00	21.00	30.00	83.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_fib_dis	96	6.95	8.23	0.00	0.00	4.36	11.11	29.03
N atrial fibrillat.	96	26.83	13.96	10.00	16.00	24.00	31.00	83.00

National

atrial fib.	discharge + anticoag.	qi_stroke_fib_dis
2682	202	7.53169



- Proportion of patients with acute ischemic stroke, and for whom a carotid artery imaging study is performed

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
Numerator: Stays from denominator with billing code 460320,460342 OR 459443 OR 454020, 454042.

All hospitals

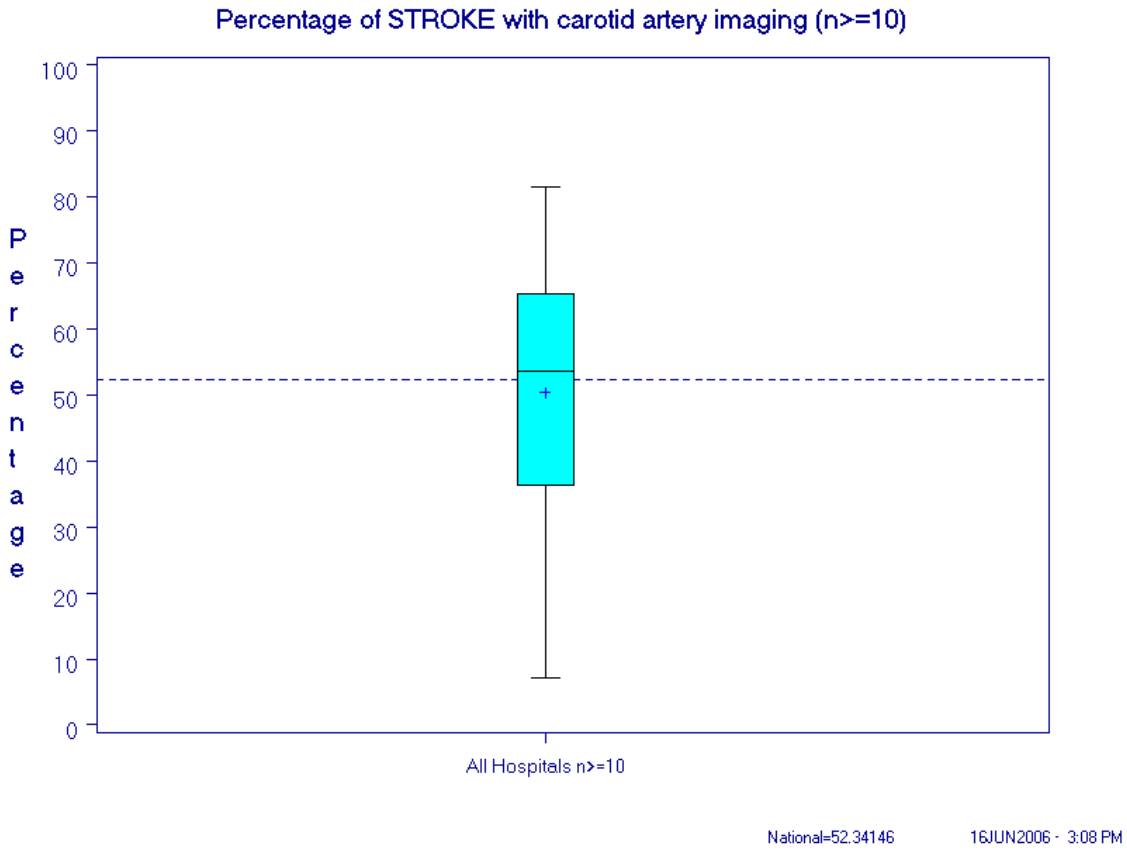
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_car	123	47.91	21.35	0.00	31.45	52.10	65.17	100.00
stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_car	114	50.32	17.86	7.14	36.36	53.51	65.25	81.55
stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

N stroke	carotid imaging	qi_stroke_car
12300	6438	52.3415



- Proprotion of patients with acute ischemic stroke that was prescribed a statin

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
Numerator: Stays from denominator with at least one product C10AA, C10BA OR C10BX.

All hospitals

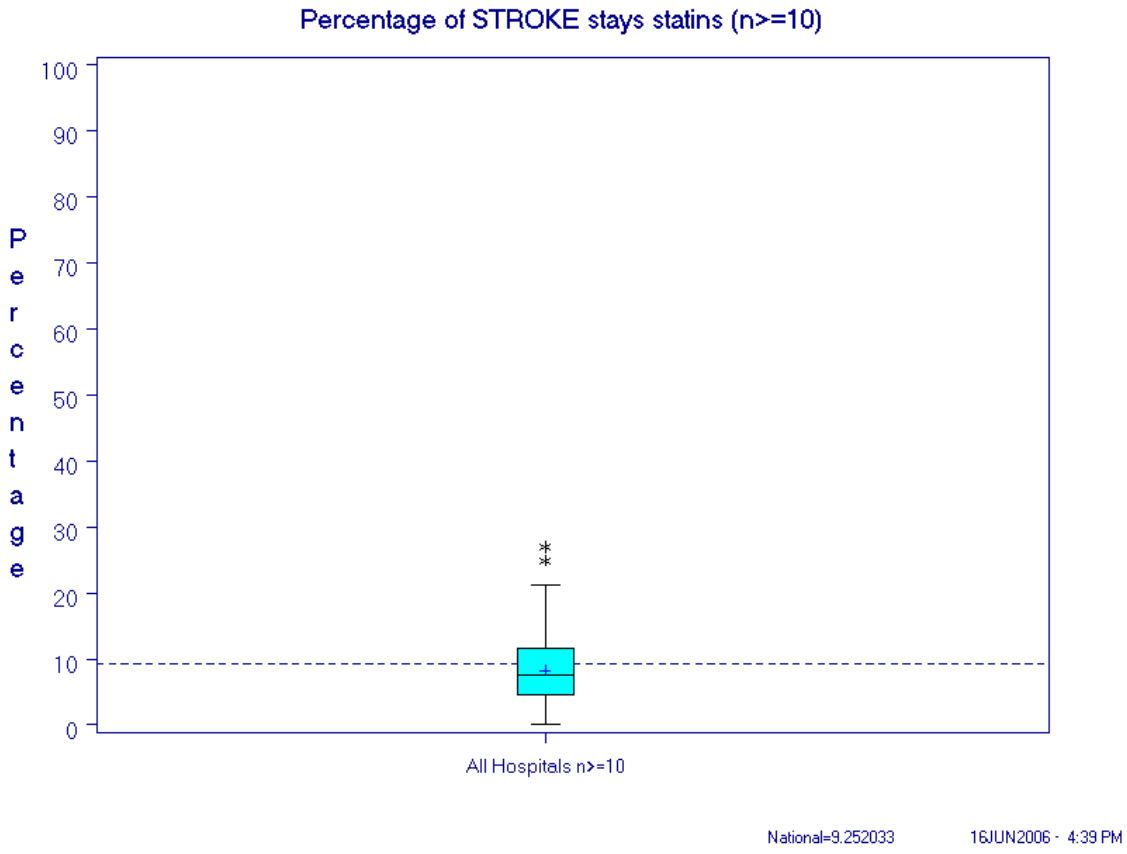
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_stat	123	8.20	6.35	0.00	3.64	7.41	11.59	33.33
Nb stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_stat	114	8.31	5.48	0.00	4.55	7.57	11.59	27.01
Nb stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

stroke	statin	qi_stroke_stat
12300	1138	9.25203



- Proportion of patients with acute ischemic stroke receiving thrombolysis

Denominator: vlag_kc="0" AND hosptyp1="H"
AND ((Principal diagnosis in (433.x1, 434.x1) AND APR-DRG 045 CVA w/ infarct) OR
(Principal diagnosis = 436 AND APR-DRG 046 non specific CVA & precerebral occlusion))
Numerator: Stays from denominator with at least one product B01AD OR procedure 99.10 injection or infusion of thrombolytic agent.

All hospitals

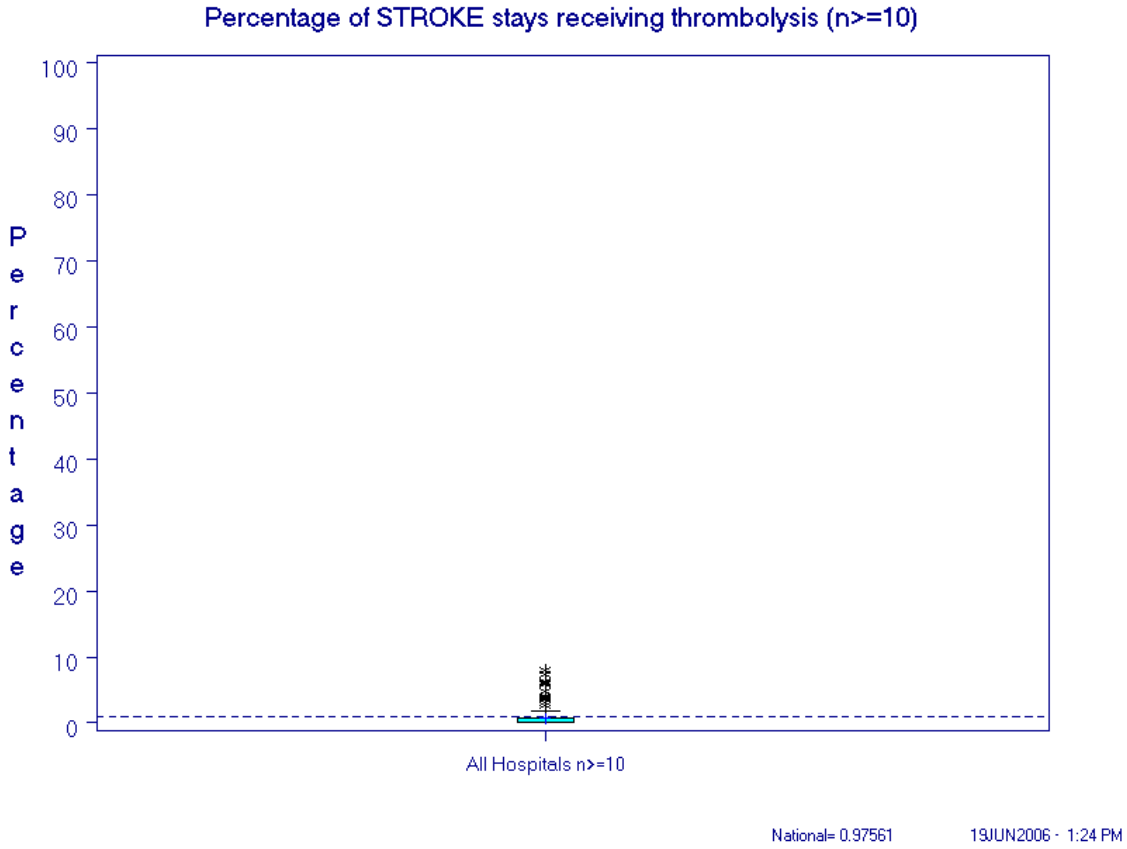
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_tl	123	0.72	1.58	0.00	0.00	0.00	0.80	8.05
Nb stroke	123	100.00	61.65	1.00	57.00	95.00	127.00	289.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_stroke_tl	114	0.78	1.63	0.00	0.00	0.00	0.85	8.05
Nb stroke	114	107.70	57.32	14.00	65.00	100.00	139.00	289.00

National

stroke	Thrombolysis	qi_stroke_tl
12300	120	0.97561



PERINATAL CARE: 12 Indicators

- Cases of birth trauma

Denominator: vlag_kc="0" AND hosptyp1="H"
AND MDC=15 AND principal diagnosis beginning with V3.
Numerator: D + sec. diagnosis 767 outside 767.3 and 767.4 (injury to skeleton).
NOT :
a/ subdural or cerebral hemorrhage (code 767.0) nor
b/ osteogenesis imperfecta (756.51) nor
c/ 765.00-> 765.08, 765.10 ->765.18 nor
d/ birthweight of less than 2,500 grams and less than 37 weeks gestation nor

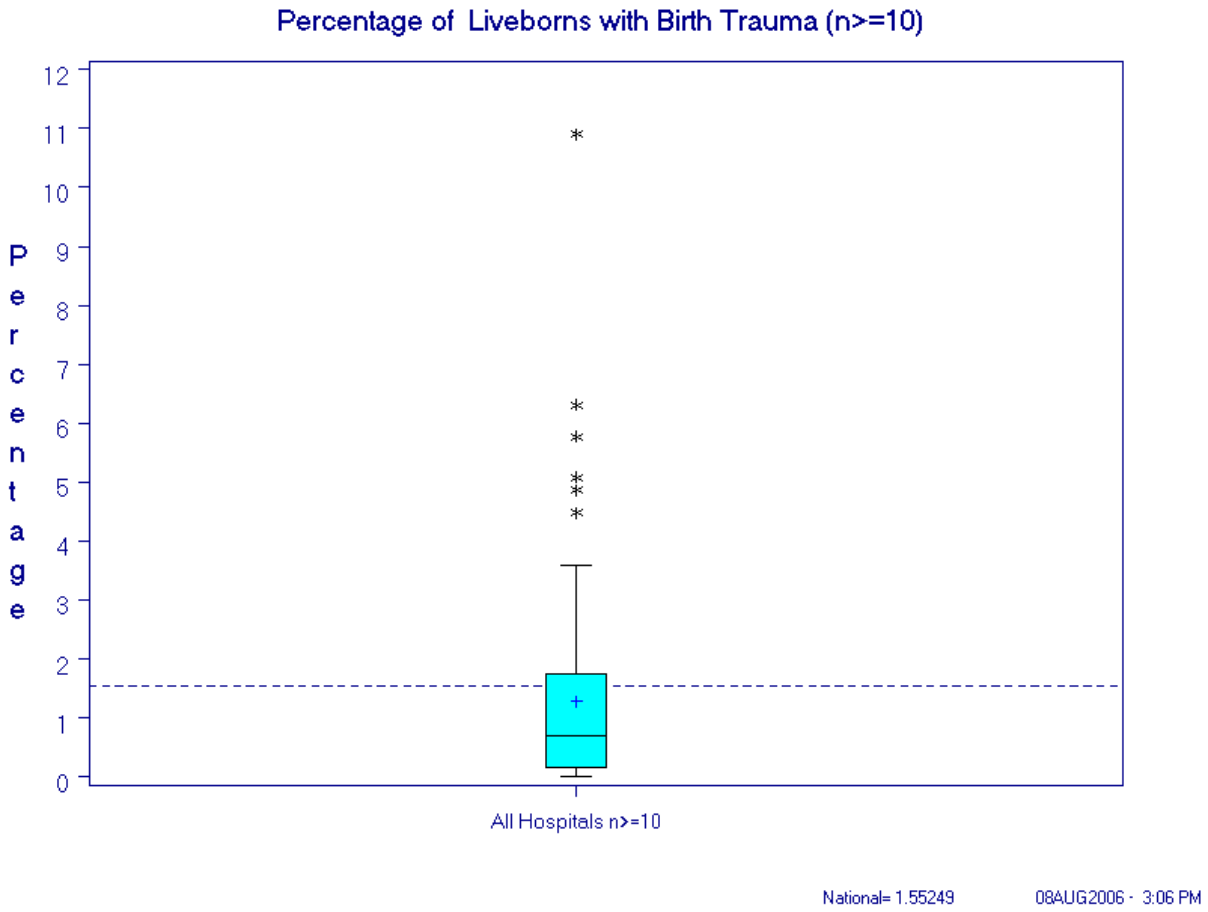
e/ 34 weeks gestation or less

All hospitals = All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_neo_trauma	108	1.28	1.65	0.00	0.18	0.71	1.74	10.91
Nb liveborns	108	1037.76	633.98	285.00	595.00	867.50	1254.50	3866.00

National

Nb liveborns	+ birth trauma	qi_neo_trauma
112078	1740	1.55249



- Inpatient neonatal mortality

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND MDC=15 AND principal diagnosis beginning with V3.

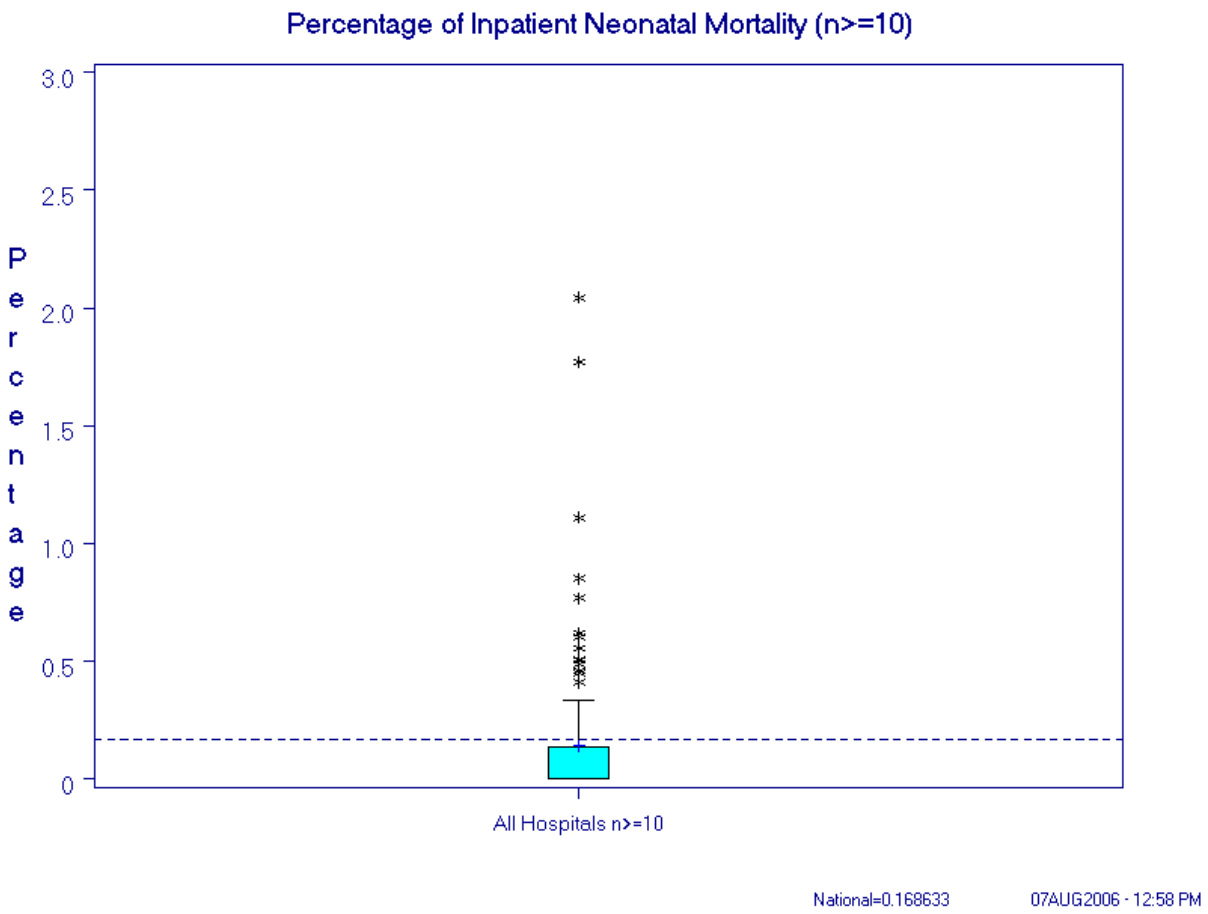
Numerator: stays from denominator aged age <= 28 AND dead at the end of stay

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_neo_mort	108	0.14	0.32	0.00	0.00	0.00	0.14	2.05
Nb liveborns	108	1037.76	633.98	285.00	595.00	867.50	1254.50	3866.00

National

Nb liveborns	Deceased <= 28 days	qi_neo_mort
112078	189	0.16863



- Post operative wound infection after caesarean delivery

Denominator: vlag_kc="0" AND hosptyp1="H"
AND APR-DRG = 540

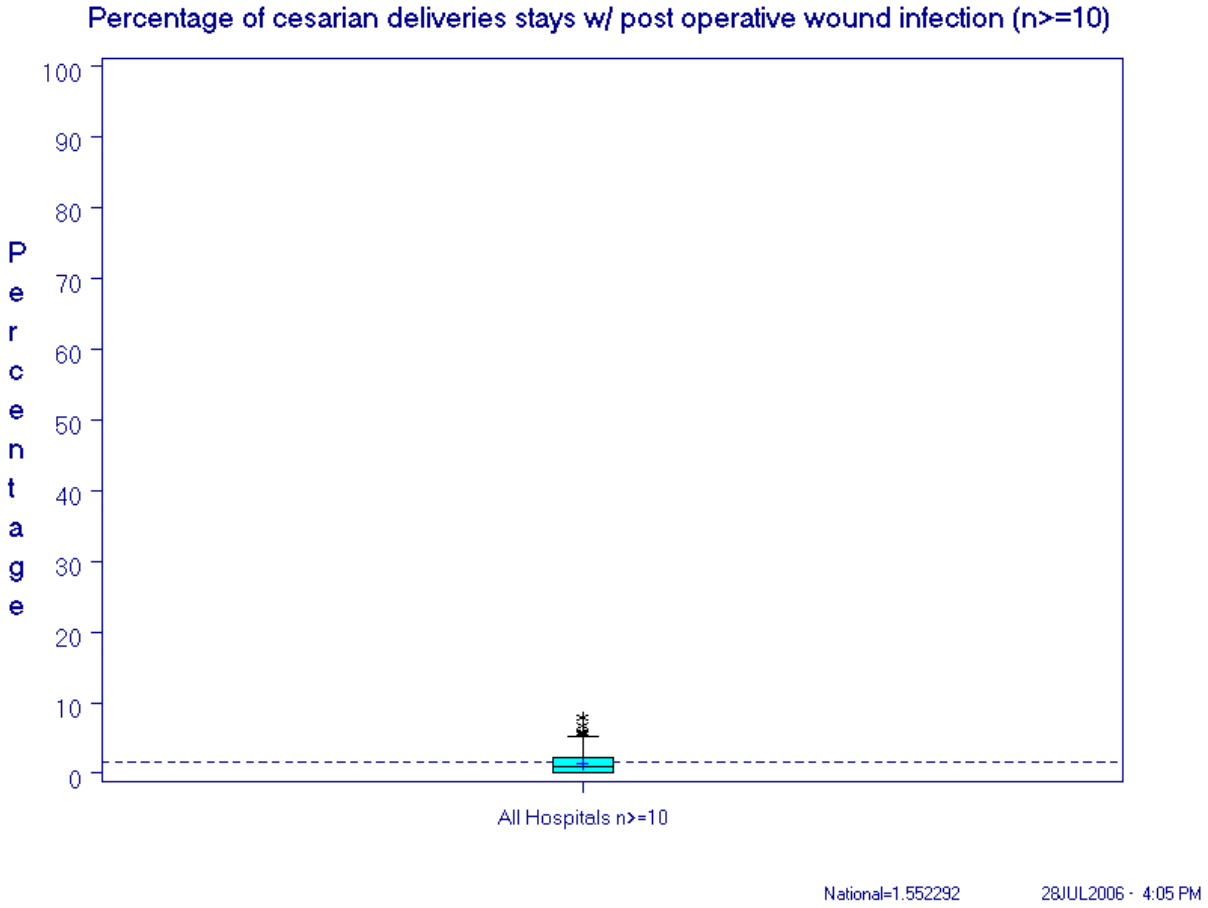
Numerator: stays from denominator with secondary diagnosis in (674.3, 998.59)

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_cesar_poi	108	1.44	1.63	0.00	0.00	1.04	2.20	7.95
Nb caesareans	108	177.16	116.51	34.00	95.50	149.50	207.00	766.00

National

Nb caesareans	+ post op infection	qi_cesar_poi
19133	297	1.55229



- Percentage of CS where the woman receives prophylactic antibiotics

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND APR-DRG=540

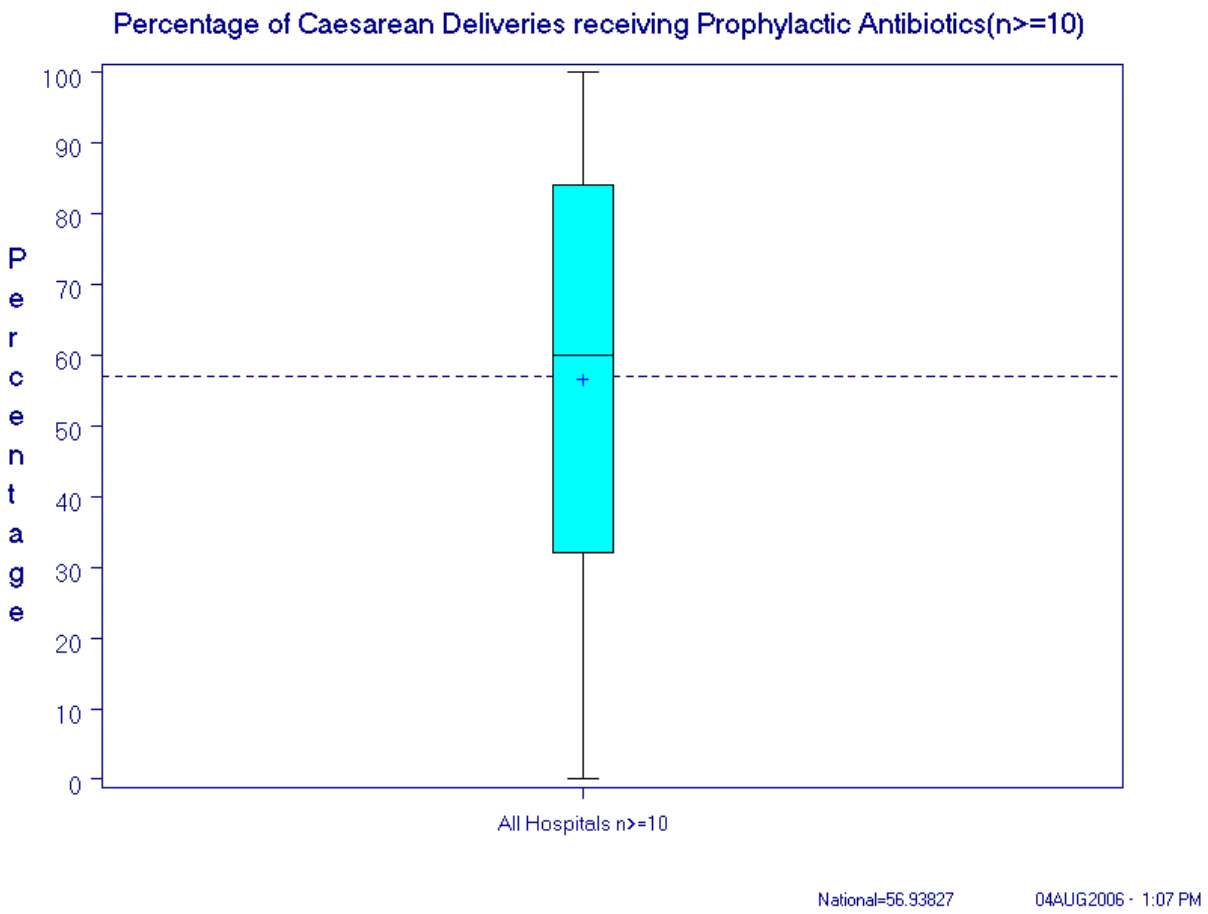
Numerator: stays from denominator with at least one product from ATC J01DB products + forfait ABprophylaxis (indication of perioperative period of administration)

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_cesar_ABpro	108	56.56	29.32	0.00	31.97	59.99	84.07	100.00
Nb caesareans	108	177.16	116.51	34.00	95.50	149.50	207.00	766.00

National

Nb caesareans	+ prophylactic AB	qi_cesar_ABpro
19133	10894	56.9383



- Rate of operative vaginal deliveries

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND APR-DRG in (541, 542, 560)

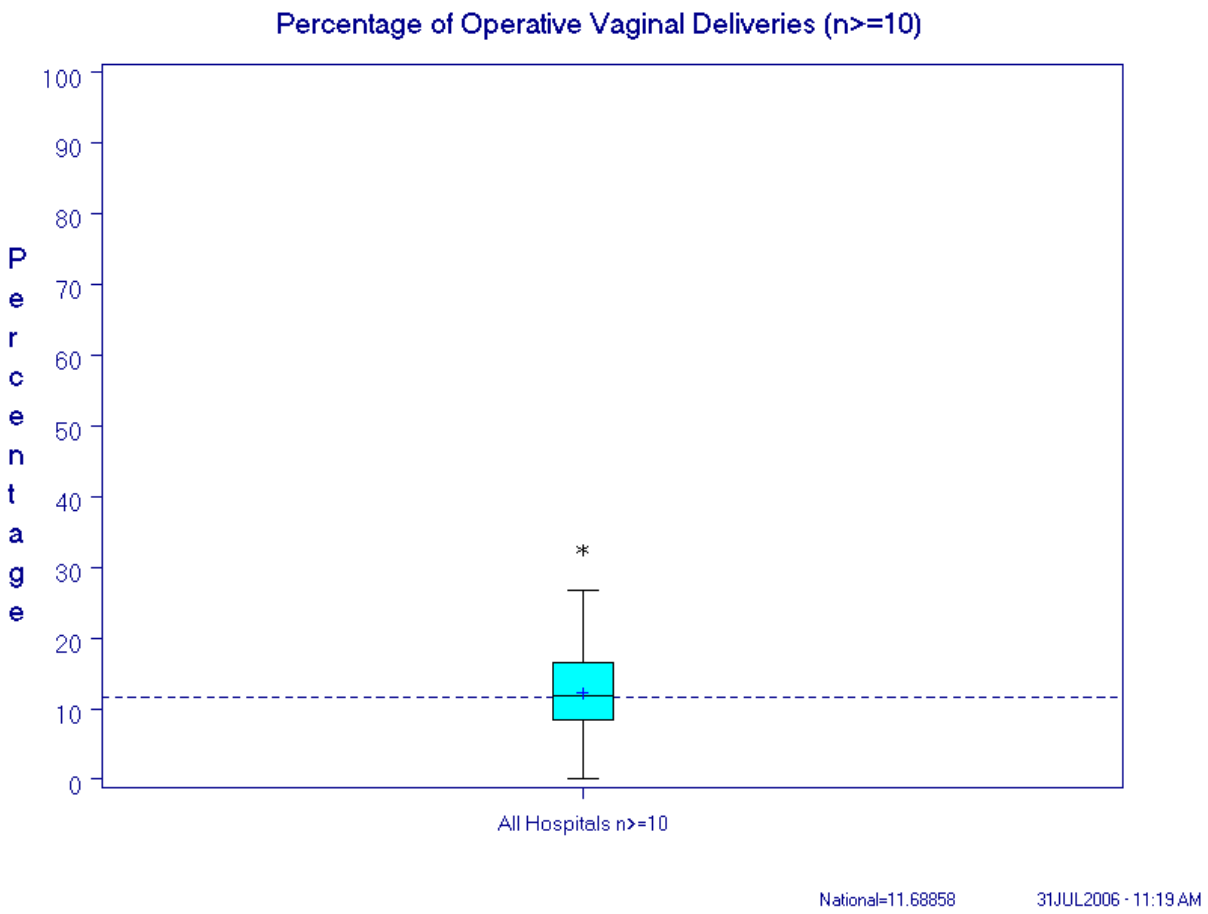
Numerator: stays from denominator with ICD-9-CM procedure beginning with 72.

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_vag_op	108	12.28	6.55	0.00	8.32	11.74	16.42	32.55
Nb vaginal del.	108	774.81	447.88	193.00	469.50	635.00	959.50	2673.00

National

Nb vaginal del.	Operative vag. del.	qi_vag_op
83680	9781	11.6886



- Severe neonatal morbidity rate: respiratory distress syndrome rate

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND MDC=15 AND principal diagnosis beginning with V3.

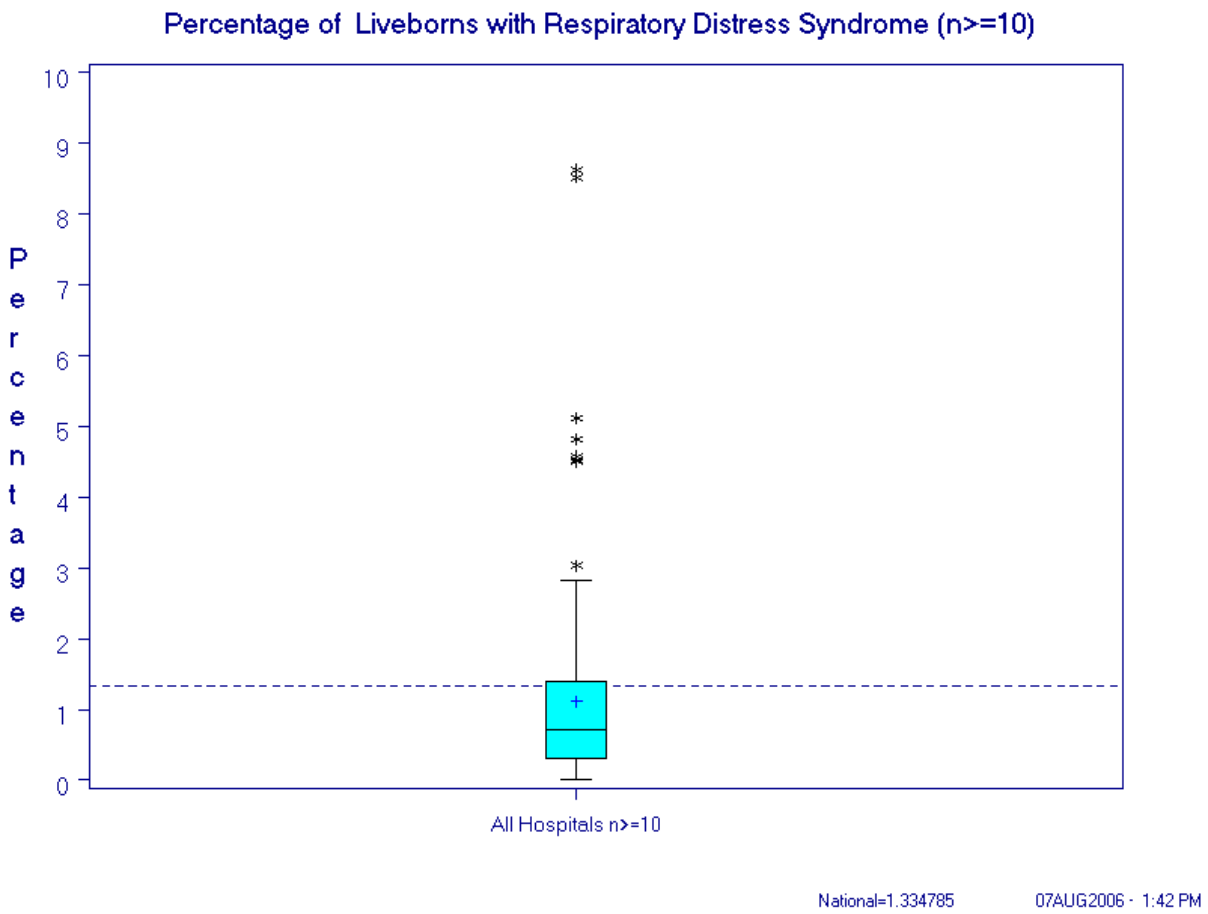
Numerator: stays from denominator with secondary diagnosis beginning with 769 respiratory distress syndrome rate.

All hospitals=All hospitals with min.10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_neo_rds	108	1.12	1.49	0.00	0.32	0.71	1.39	8.63
Nb liveborns	108	1037.76	633.98	285.00	595.00	867.50	1254.50	3866.00

National

Nb liveborns	+ RDS	qi_neo_rds
112078	1496	1.33478



- Cases of obstetric trauma (3rd or 4th degree lacerations) after instrument-assisted vaginal delivery

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND APR-DRG in (541, 542, 560)
AND procedure 72

Numerator: stays from denominator with at least one diagnosis in beginning with 6642 OR 6643

All hospitals

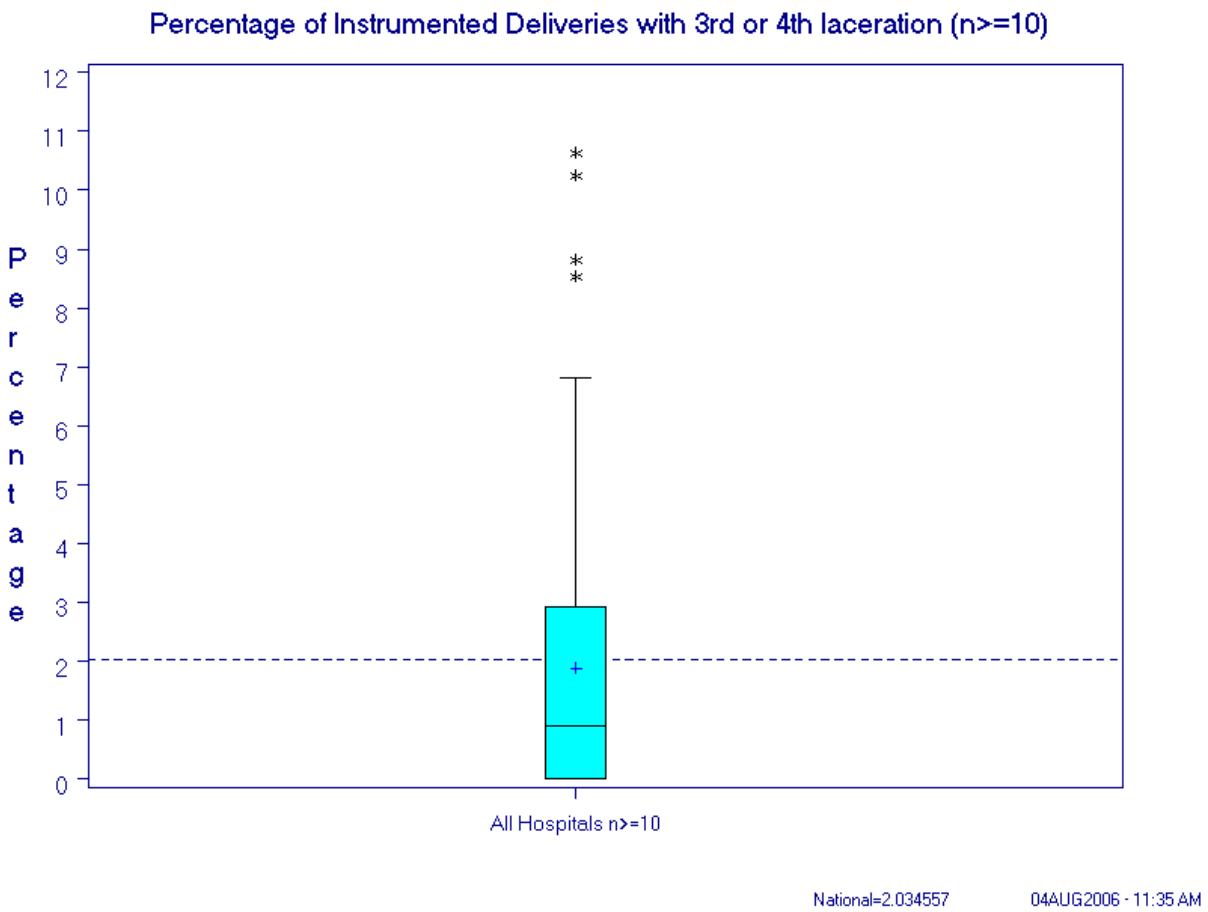
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_vag72_lacer	106	1.82	2.47	0.00	0.00	0.79	2.92	10.64
Nb Vag. Del. + 72	106	92.27	63.37	1.00	42.00	80.50	122.00	382.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_vag72_lacer	102	1.89	2.49	0.00	0.00	0.91	2.93	10.64
Nb Vag. Del. + 72	102	95.71	62.12	10.00	55.00	82.00	124.00	382.00

National

Nb Vag. Del. + 72	+ 3rd/4th d° laceration	qi_vag72_lacer
9781	199	2.03456



- episiotomy rate

Denominator:
vlag_kc="0" AND hosptyp1="H"

AND APR-DRG in (541, 542, 560)

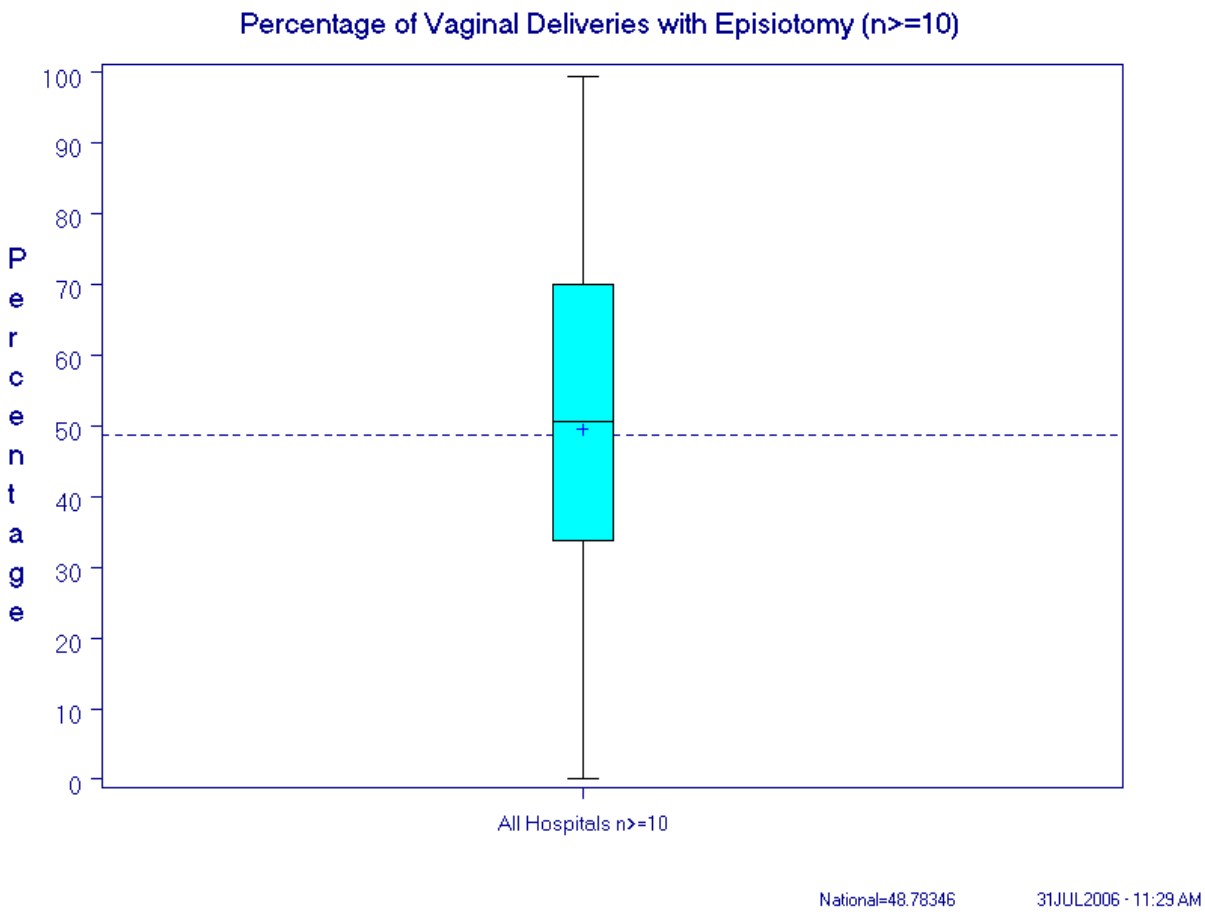
Numerator: stays from denominator with ICD-9-CM procedure in (736, 72.1, 72.21, 72.31, 72.71)

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_vag_epi	108	49.55	23.49	0.00	33.71	50.59	69.96	99.41
Nb vaginal del.	108	774.81	447.88	193.00	469.50	635.00	959.50	2673.00

National

Nb vaginal del.	+ Episiotomy	qi_vag_epi
83680	40822	48.7835



- Cases of obstetric trauma (3rd or 4th degree lacerations) after vaginal delivery without instrument assistance

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND (APR-DRG in (541, 542, 560)
NOT procedure 72)

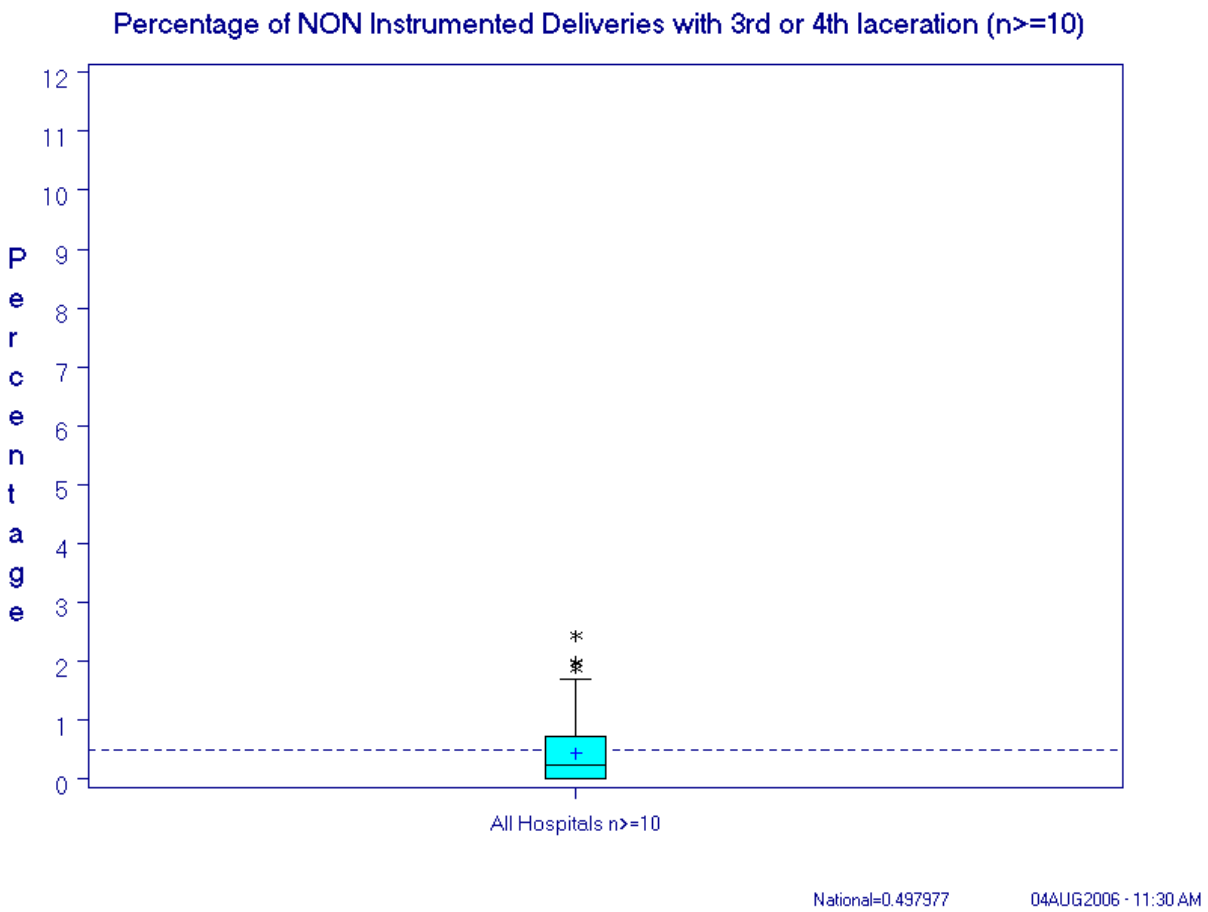
Numerator: stays from denominator with at least one diagnosis in beginning with 6642 OR 6643

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_vagno72_lacer	108	0.44	0.54	0.00	0.00	0.24	0.73	2.44
Nb Vag. Del. w/o 72	108	684.25	402.18	163.00	404.00	556.00	868.50	2291.00

National

Nb Vag. Del. + 72	+ 3rd/4th d° laceration	qi_vagno72_lacer
73899	368	0.49798



- Proportion of mothers with preterm birth (<34 weeks) that was given corticosteroids

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND APR-DRG in (540, 541, 542, 560)
AND weeks in PATBIRTH < 34

Numerator: stays from denominator with at least one product ATC4= H02AB (glucocorticoids)

All hospitals

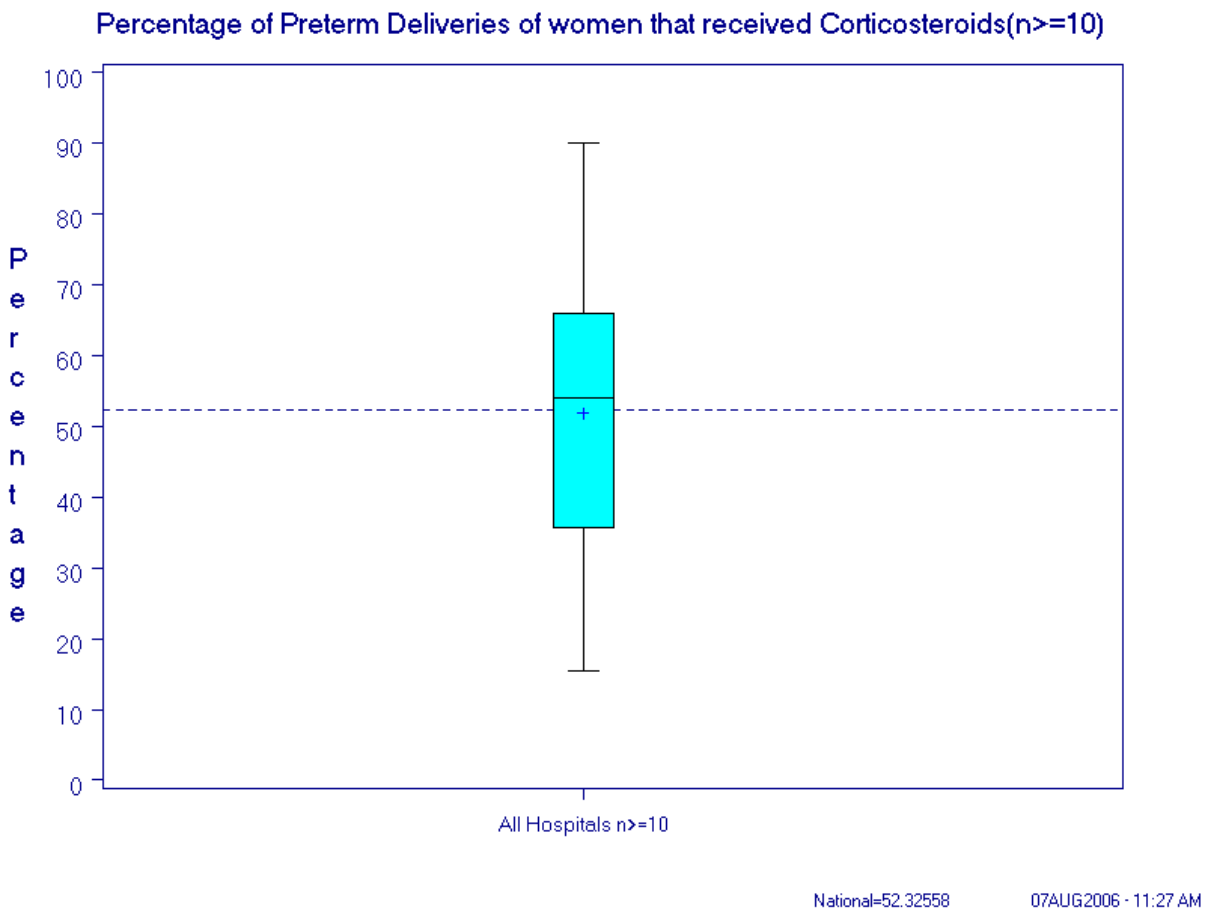
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_preterm_cortico	104	38.44	29.47	0.00	11.81	40.00	60.56	100.00
Nb Preterm Deliveries	104	11.58	16.28	1.00	3.00	5.50	10.50	78.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_preterm_cortico	32	51.84	19.71	15.38	35.75	53.94	65.94	90.00
Nb Preterm Deliveries	32	28.69	20.77	10.00	11.00	20.00	43.00	78.00

National

Nb Preterm Deliveries	+ corticosteroids	qi_preterm_cortico
1204	630	52.3256



- Caesarean delivery rate

Denominator:
vlag_kc="0" AND hosptyp1="H"

AND APR-DRG in (540, 541, 542, 560)

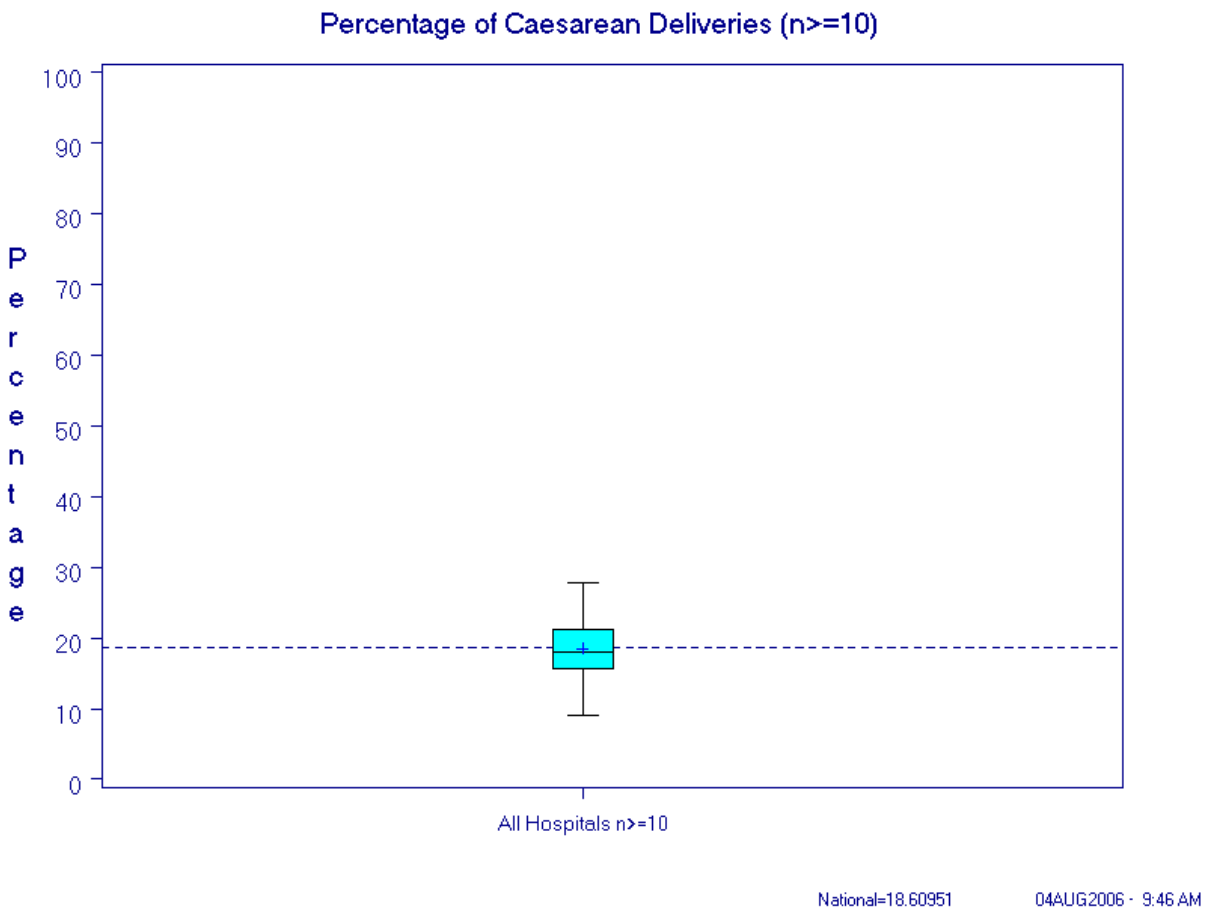
Numerator: stays from denominator in APR-DRG 540.

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_mother_cesar	108	18.51	3.83	9.07	15.68	18.07	21.10	27.77
Nb deliveries	108	951.97	554.54	245.00	557.50	800.50	1163.00	3250.00

National

Nb deliveries	+ caesarean	qi_mother_cesar
102813	19133	18.6095



- Proportion of deliveries with an induction of labour

Denominator:
vlag_kc="0" AND hosptyp1="H"

AND APR-DRG in (540, 541, 542, 560)

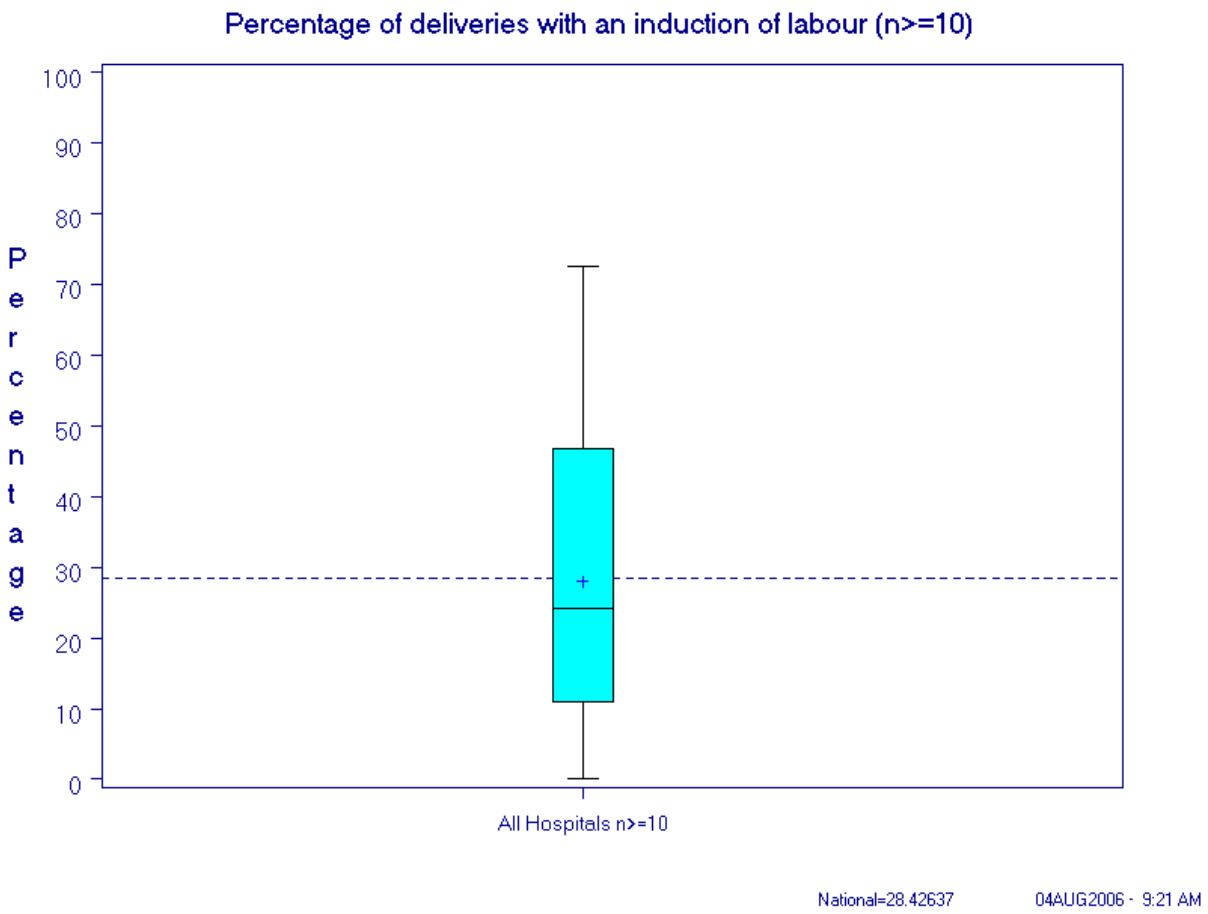
Numerator: stays from denominator with ICD-9-CM procedure beginning with 73.0, 73.1 OR 73.4

All hospitals= All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_mother_indu	108	28.03	21.15	0.00	10.98	24.25	46.83	72.51
Nb deliveries	108	951.97	554.54	245.00	557.50	800.50	1163.00	3250.00

National

Nb deliveries	+ induction	qi_mother_indu
102813	29226	28.4264



Vulnerable elders: 5 indicators

- NVE with dementia **and** depression that is treated for the depression with TCAs or SSRIs

Denominator: vlag_kc="0" AND hosptyp1="H"
AND age >= 65 years
AND (PLACE IN (6 ,7) OR DESTINATION IN (6 ,7))
AND (ANY diagnosis 290.21 OR 290.43 OR 290.13)

Numerator: stays from denominator with drugs from ATC = N06A
All hospitals

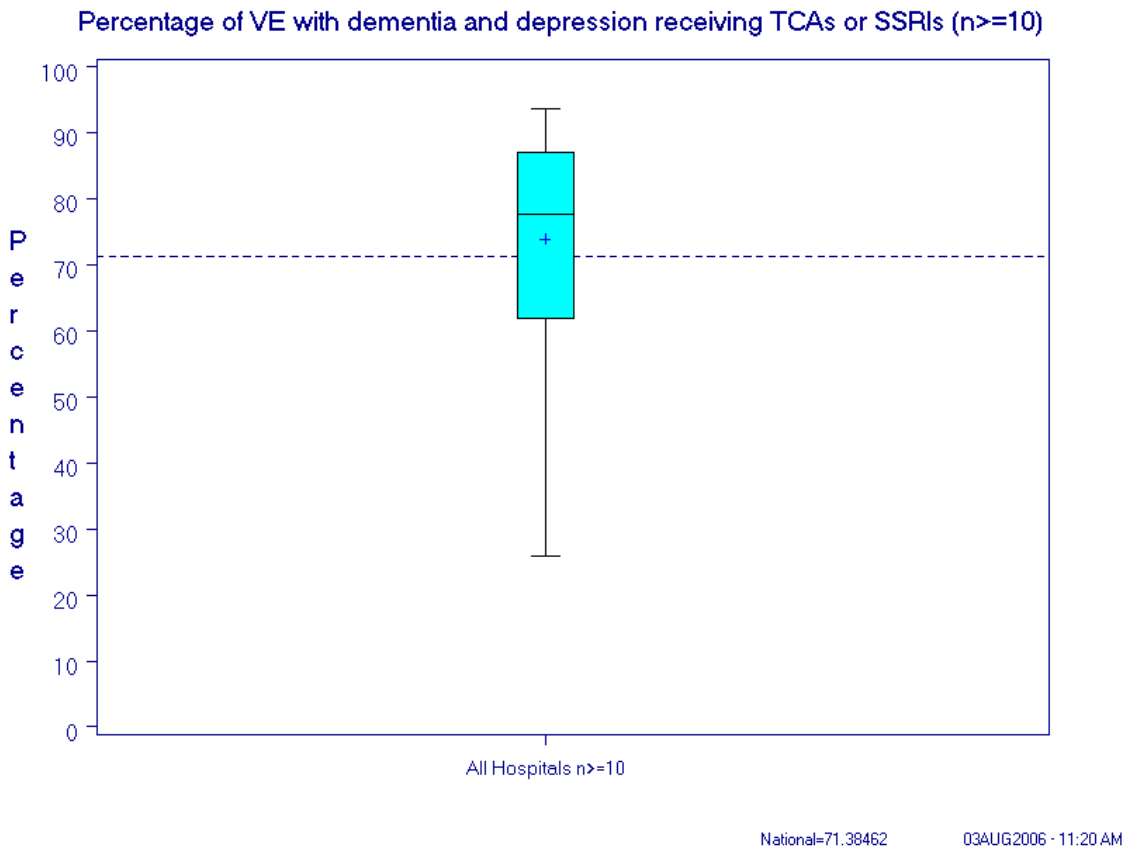
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_DEM_n06a	105	72.11	26.20	0.00	50.00	76.92	100.00	100.00
Dementia + depression	105	9.29	14.05	1.00	2.00	4.00	11.00	87.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_DEM_n06a	27	73.92	17.01	25.81	61.90	77.78	86.96	93.75
Dementia + depression	27	26.00	19.52	11.00	13.00	17.00	27.00	87.00

National

Nb Dementia + depression	+ N06A	qi_VE_DEM_n06a
975	696	71.3846



- Number of vulnerable elders with a diagnosis of heart failure and atrial fibrillation that is treated with anticoagulation

Denominator: vlag_kc="0" AND hosptyp1="H"
AND age >= 65 years AND (PLACE IN (6 ,7) OR DESTINATION IN (6 ,7))
AND (ANY diagnosis beginning with 428) AND diagnosis 427.31

Numerator: stays from denominator with drugs from procedure 99.19 injection of anticoagulant OR one product from B01AA , B01AB01 , B01AB04, , B01AB05, , B01AB06, , B01AB09 , B01AB10 , B01AC OR B01AX05

All hospitals

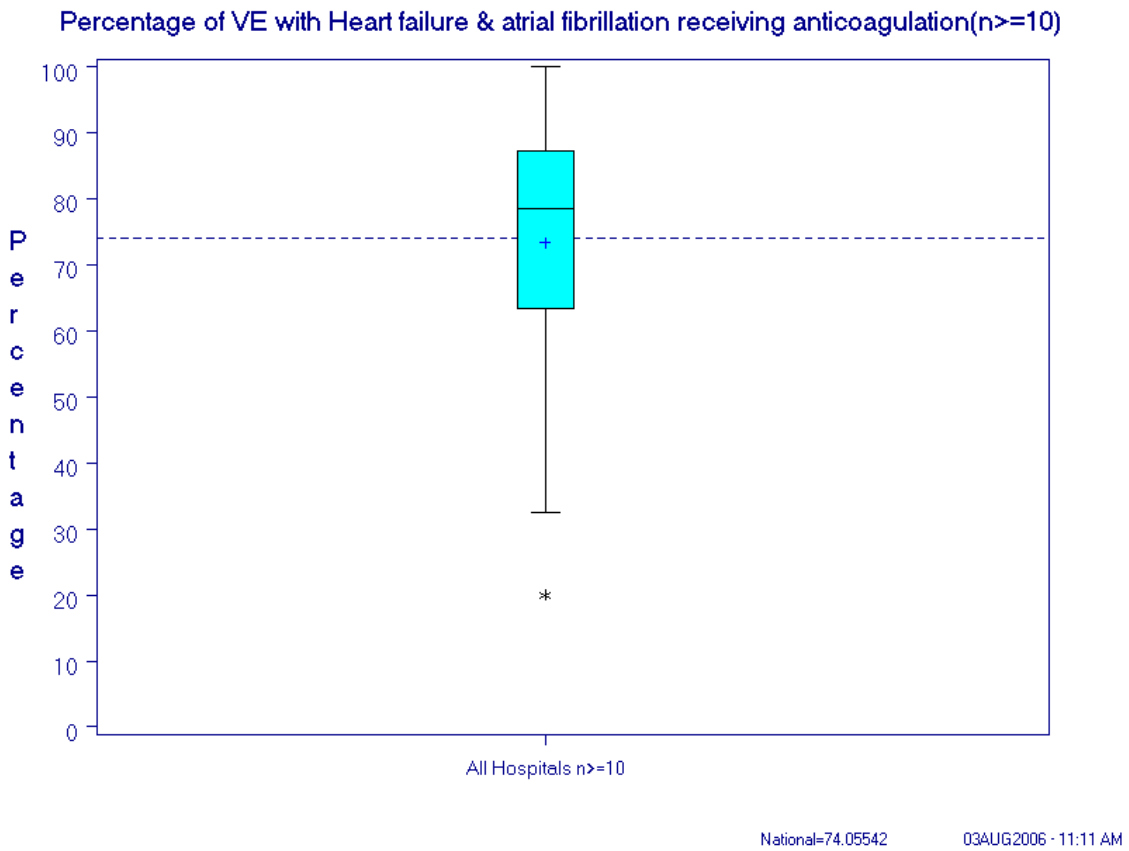
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_hfib_acg	138	69.92	24.47	0.00	60.00	76.20	87.50	100.00
Nb HF + atrial fib	138	23.01	19.79	1.00	7.00	19.00	32.00	99.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_hfib_acg	96	73.38	16.91	20.00	63.40	78.56	87.20	100.00
Nb HF + atrial fib	96	31.22	18.42	10.00	17.50	25.00	40.00	99.00

National

Nb HF + atrialfib.	+ anticoag	qi_VE_hfib_acg
3176	2352	74.0554



- Number of vulnerable elders with a diagnosis of heart failure that is treated with an ACE inhibitor and/or a betablocker

Denominator: vlag_kc="0" AND hosptyp1="H"
AND age >= 65 years
AND (PLACE IN (6 ,7) OR DESTINATION IN (6 ,7))
AND (ANY diagnosis begins with 428)

Numerator: stays from denominator with drugs from ATC = (C09A OR C09B) OR C07

All hospitals

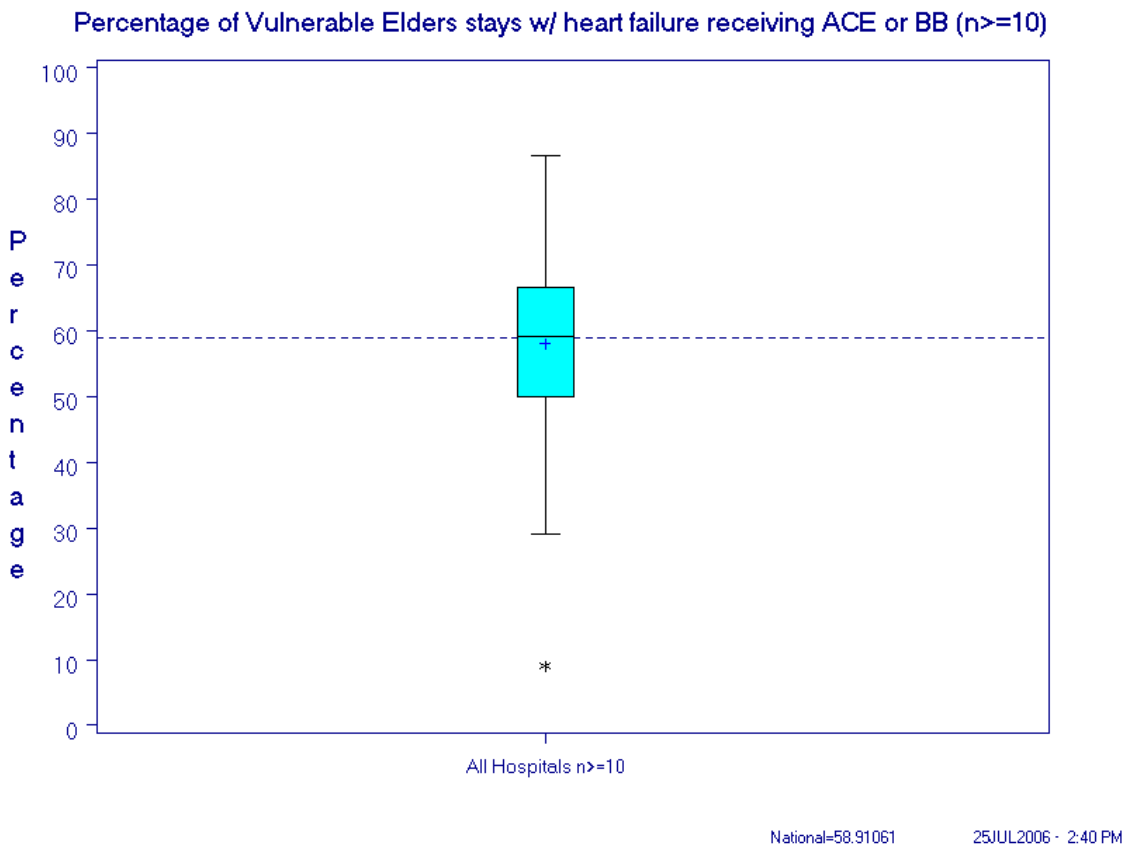
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_hf_acebb	143	59.20	14.80	0.00	50.00	59.46	68.15	100.00
Nb Heart Failure	143	61.88	50.52	1.00	19.00	52.00	93.00	246.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_hf_acebb	122	58.10	12.06	9.09	50.00	59.20	66.67	86.67
Nb Heart Failure	122	71.74	48.24	10.00	37.00	60.50	98.00	246.00

National

Nb HeartFailure	+ ACE or BB	qi_VE_hf_acebb
8849	5213	58.9106



- Number of vulnerable elders with a recent myocardial infarction or recent coronary bypass graft that is offered physiotherapy

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND age >= 65 years
AND (PLACE IN (6 ,7) OR DESTINATION IN (6 ,7))

AND (Principal Diagnosis beginning with diag. 410 OR billing code in (229622 OR 229585))

Numerator: stays from denominator with nomenclature articles 22 (physio) or 7 (kine)

All hospitals

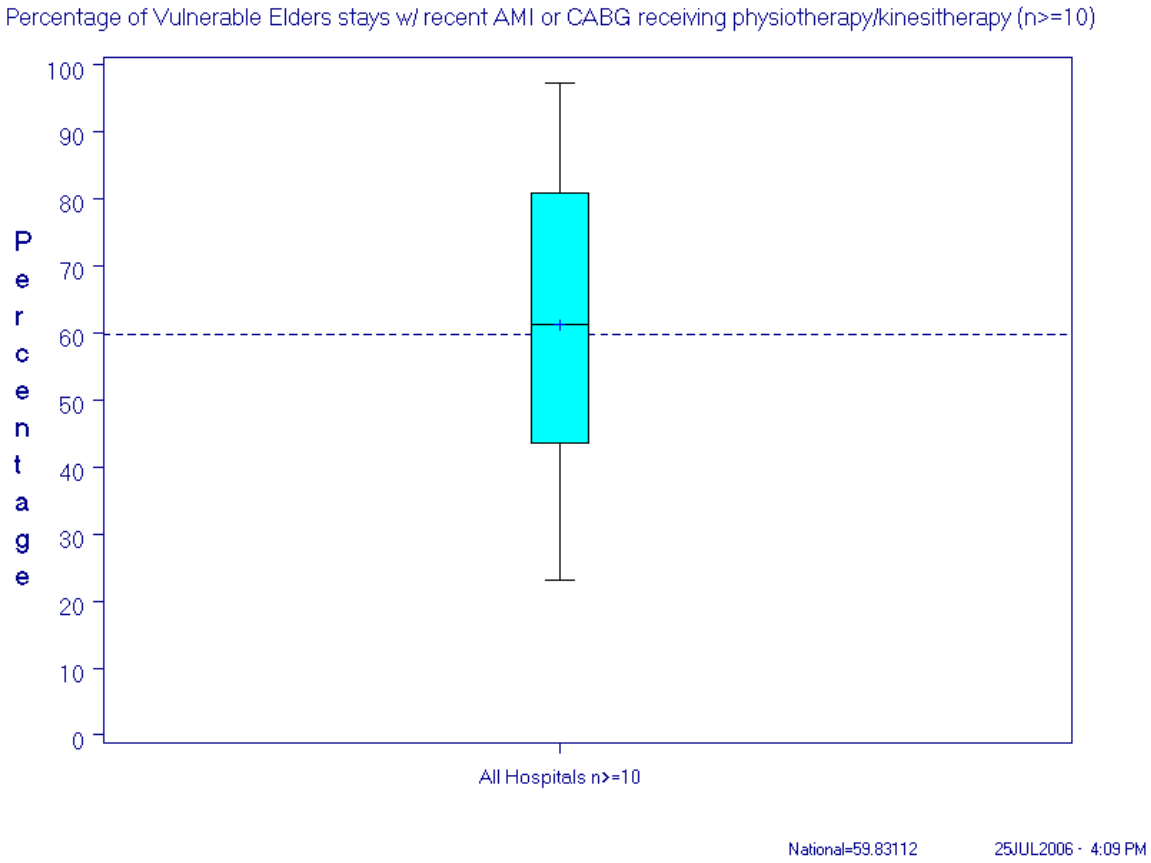
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_ami_phy	113	58.93	30.25	0.00	40.00	62.50	81.82	100.00
Nb ami or CABG	113	7.34	6.44	1.00	3.00	5.00	9.00	36.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_ami_phy	28	61.17	21.20	23.08	43.56	61.25	80.91	97.22
Nb ami or CABG	28	15.96	7.07	10.00	11.00	13.00	18.50	36.00

National

Nb AMI or CABG	+ physio/kinesitherapy	qi_VE_ami_phy
829	496	59.8311



- Number of elder patients with a diagnosis gait- or balance problems that received physiotherapy

Denominator: vlag_kc="0" AND hosptyp1="H"
AND age >= 65 years
AND (PLACE IN (6 ,7) OR DESTINATION IN (6 ,7))

AND (ANY diagnosis 719.7 OR 781.2 OR 781.3)

Numerator: stays from denominator with nomenclature articles 22 (physio) or 7 (kine)

All hospitals

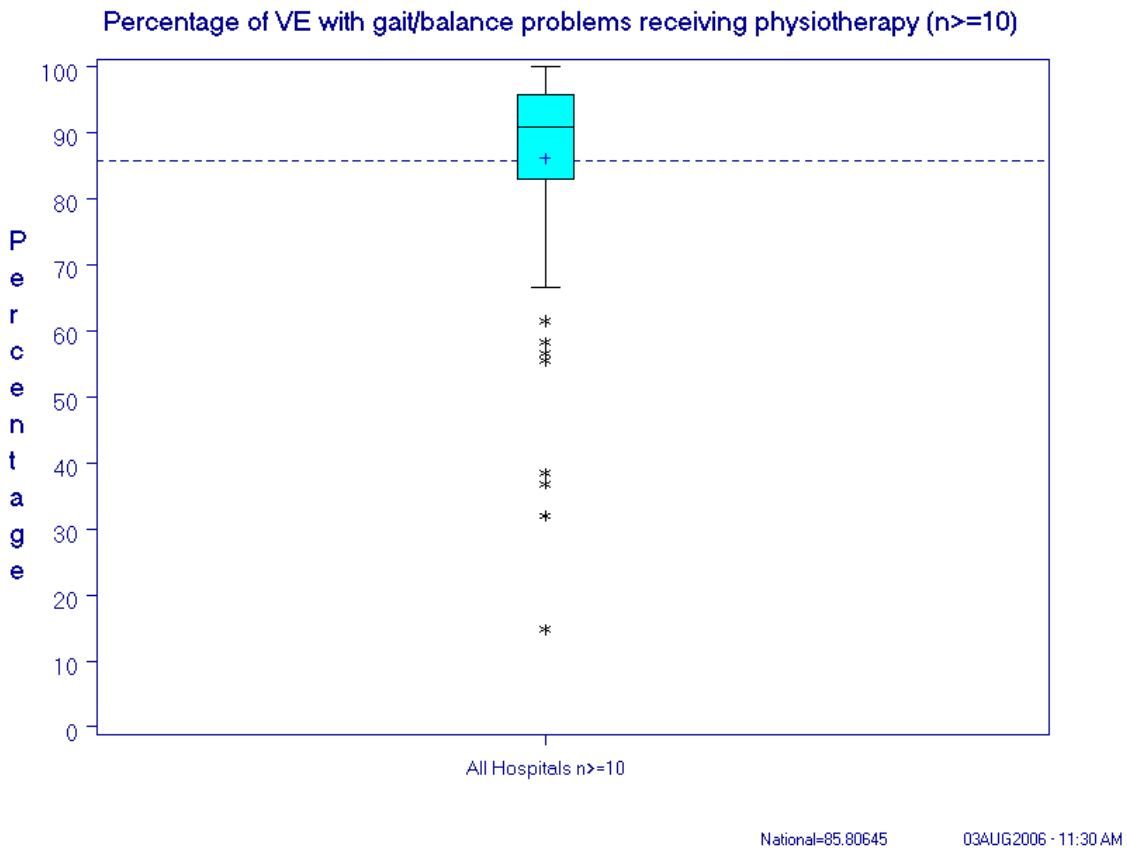
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_gait_phykin	141	86.40	15.66	14.81	82.61	90.91	97.44	100.00
Nb gait/bal problem	141	32.98	33.64	1.00	11.00	24.00	40.00	161.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_VE_gait_phykin	108	86.25	15.19	14.81	82.97	90.91	95.74	100.00
Nb gait/bal problem	108	41.71	33.91	10.00	19.00	30.00	48.50	161.00

National

Nb gait/bal problem	+ physiotherapy	qi_VE_gait_phykin
4650	3990	85.8065



Total Hip Prosthesis: 6 Indicators

- Proportion of patients with deep venous thrombosis after THR

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with secondary diagnosis ICD-9-CM beginning with 451.1.
All hospitals

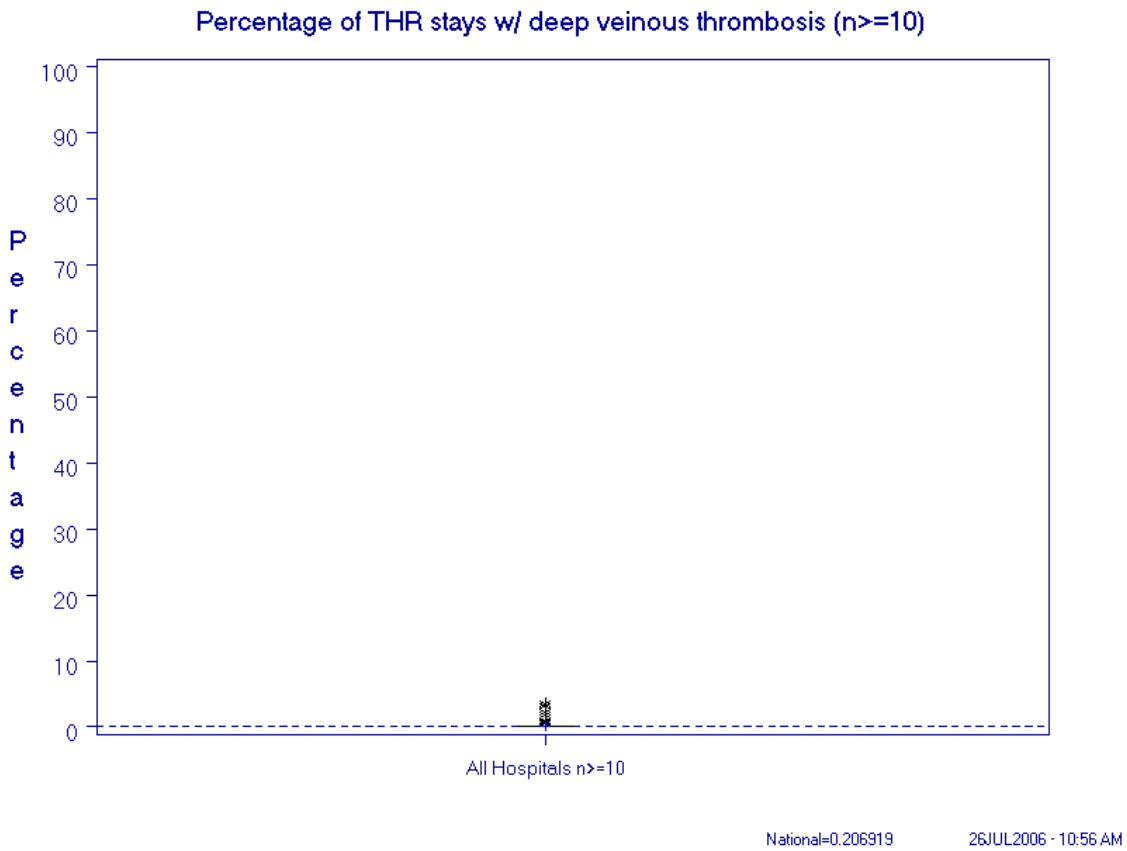
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_dvt	115	0.18	0.56	0.00	0.00	0.00	0.00	3.57
Nb THR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_dvt	112	0.19	0.57	0.00	0.00	0.00	0.00	3.57
Nb THR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	DVT	Phlebites	qi_hip_dvt	qi_hip_flebs
12082	25	51	0.20692	0.42212



- Proportion of patients with pulmonary embolism after THR

Denominator:
vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with secondary diagnosis ICD-9-CM beginning with 415.0 Acute cor pulmonale OR 415.1x Pulmonary embolism and infarction.

All hospitals

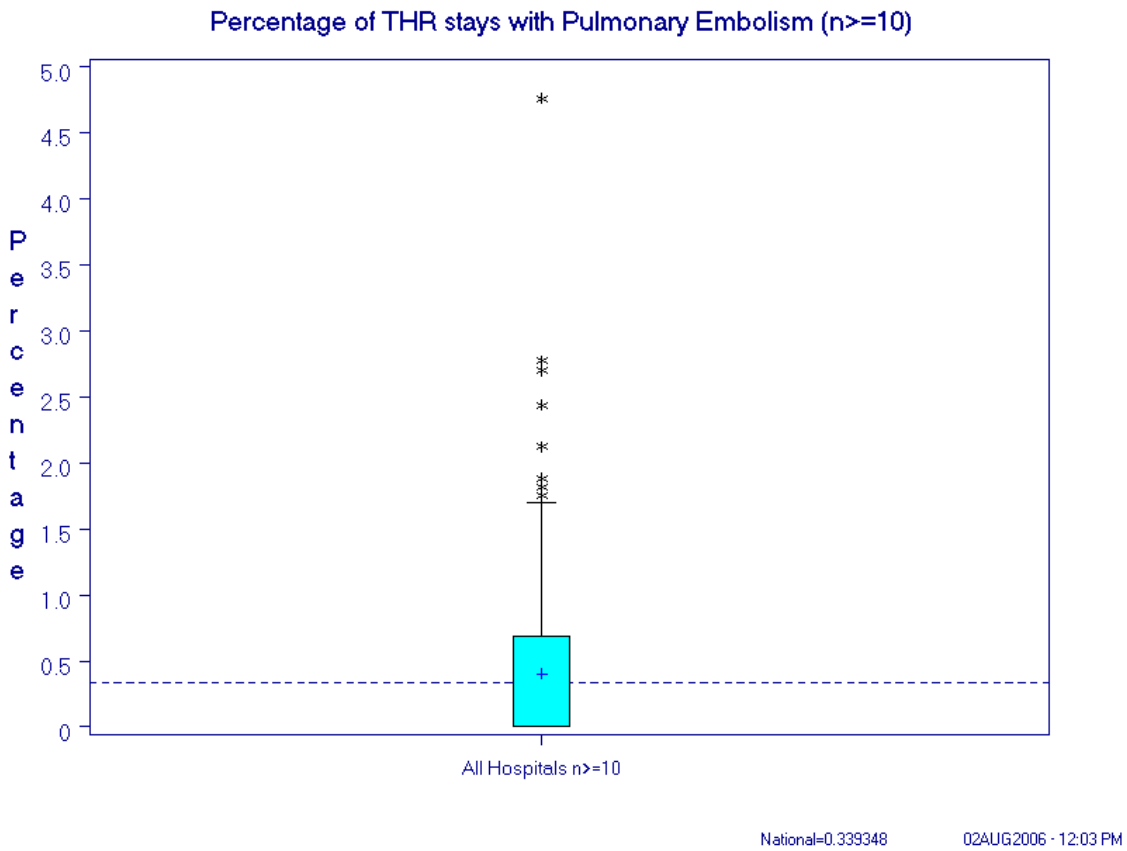
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_pulmo	115	0.39	0.78	0.00	0.00	0.00	0.65	4.76
Nb THR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_pulmo	112	0.40	0.79	0.00	0.00	0.00	0.69	4.76
Nb THR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	+ pulm. embolism	qi_hip_pulmo
12082	41	0.33935



- Number of surgical site infections in patients undergoing THR

Denominator: vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with at least one secondary diagnosis ICD-9-CM beginning with 996.6 OR 998.5.
All hospitals

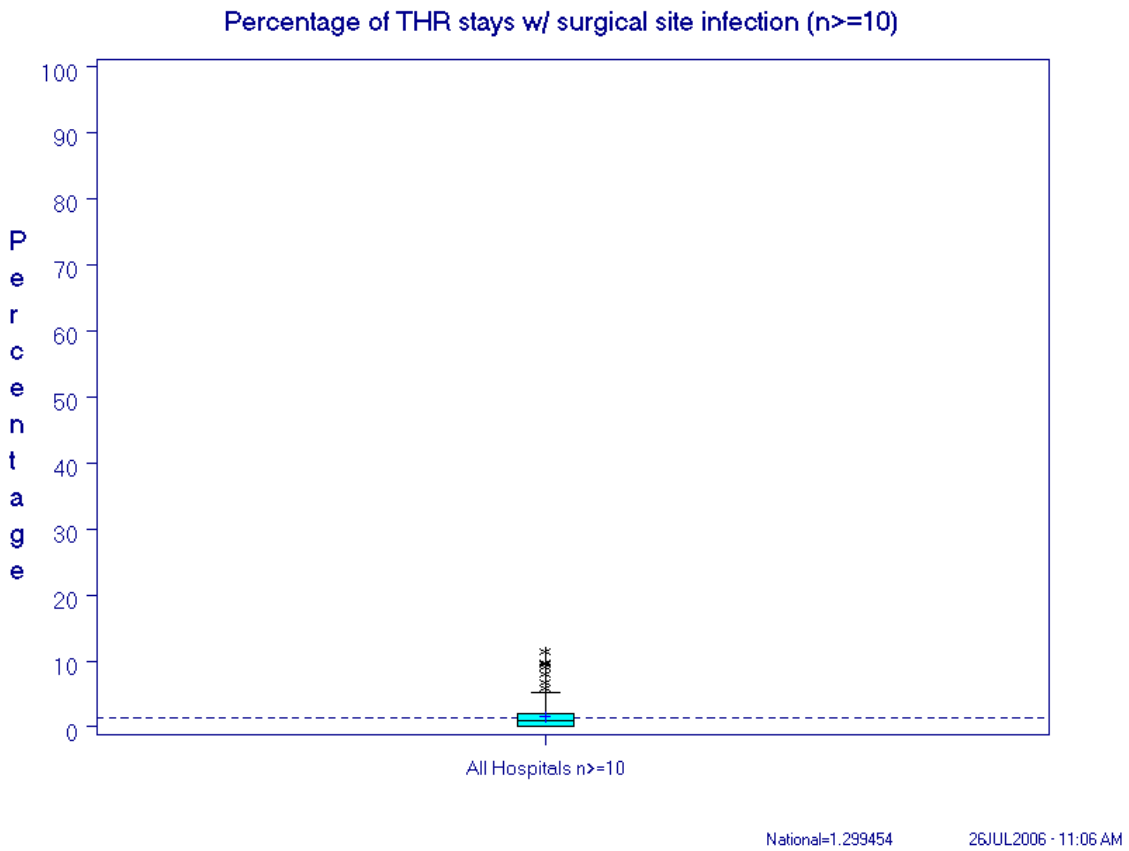
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_SSI	115	1.50	2.26	0.00	0.00	0.82	2.00	11.45
Nb THR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_SSI	112	1.54	2.27	0.00	0.00	0.91	2.09	11.45
Nb THR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	SSI	qi_hip_SSI
12082	157	1.29945



- Proportion of patients who receive thromboprophylaxis for THR

Denominator: vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with at least one product from ATC4 drugs B01AB *Heparin Group* (except B01AB02 *Antithrombin III)* OR ATC5 B01AX05 *Fondaparinux*

All hospitals

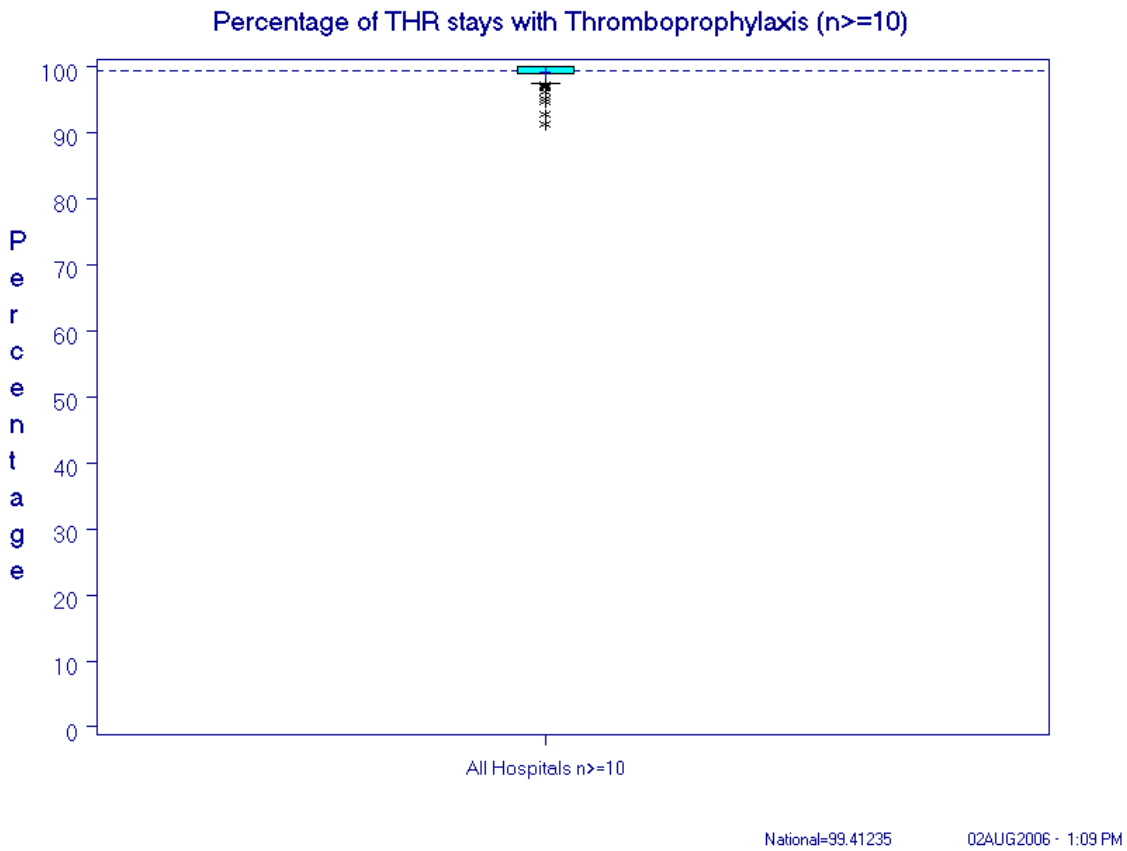
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_thrombo	115	99.22	1.55	91.30	98.94	100.00	100.00	100.00
Nb THR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_thrombo	112	99.20	1.57	91.30	98.92	100.00	100.00	100.00
Nb THR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	+ tromboprophylaxis	qi_hip_thrombo
12082	12011	99.4123



- Proportion of patients receiving at prophylactic antibiotics with first generation cephalosporins

Denominator: vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with at least one product from ATC4 J01DB products + forfait ABprophylaxis (indication of perioperative period of administration)

All hospitals

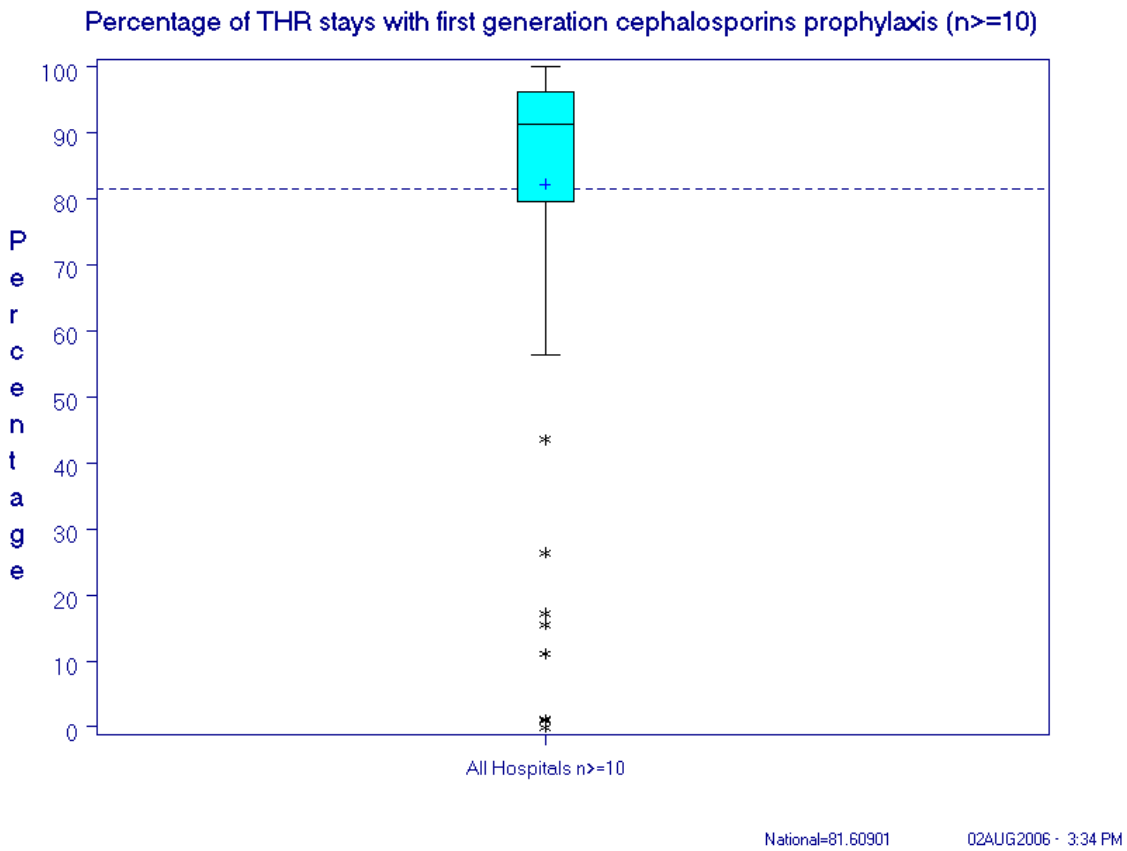
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephapro	115	81.75	25.63	0.00	79.25	91.12	96.36	100.00
Nb THR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephapro	112	82.25	24.71	0.00	79.62	91.32	96.30	100.00
Nb THR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	+ prophylactic cephalo I	qi_hip_cephapro
12082	9860	81.6090


Percentage of THR stays with first generation cephalosporins prophylaxis (n>=10)
Percentage
100
90
80
70
60
50
40
30
20
10
0
All Hospitals n>=10
National=81.60901
02AUG2006 - 3:34 PM

- Proportion of patients receiving at maximum a 24 h dose of first generation cephalosporins for THR

Denominator: vlag_kc="0" AND hosptyp1="H"

AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with max. 1 DDD of J01DB products.

All hospitals

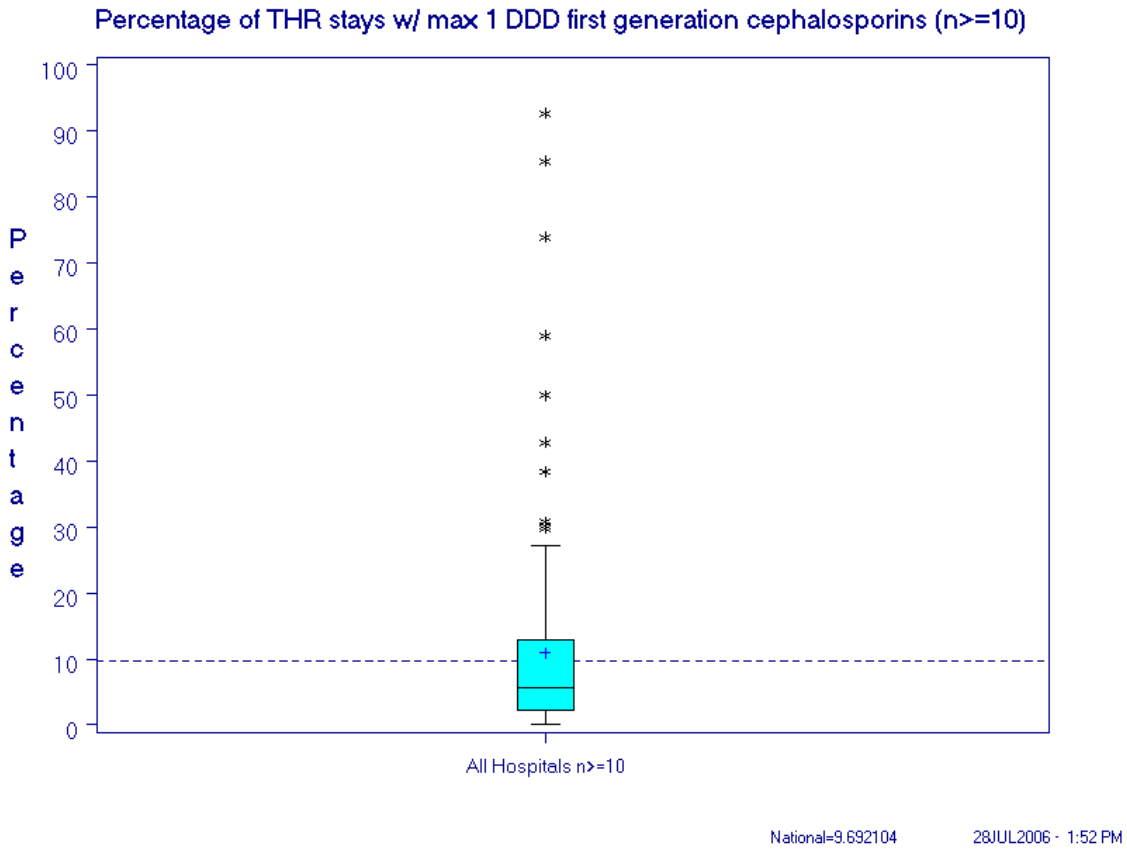
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephaDDD	115	10.66	15.92	0.00	2.17	5.50	12.70	92.68
Nbr tHR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephaDDD	112	10.94	16.04	0.00	2.25	5.72	12.80	92.68
Nbr tHR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	+ max 1 DDD Cephl	qi_hip_cephaDDD
12082	1171	9.69210



- Proportion of patients receiving at maximum a 24 h dose of first generation cephalosporins for THR : Version II

Denominator: vlag_kc="0" AND hosptyp1="H"
AND (ICD-9-CM Procedure=81.51 OR billing code 289085)
AND Principal diagnosis beginning with 715

Numerator: stays from denominator with max. 1 DDD of J01DB products. **WITH 1DDD=6000 mg for cefazolin**

All hospitals

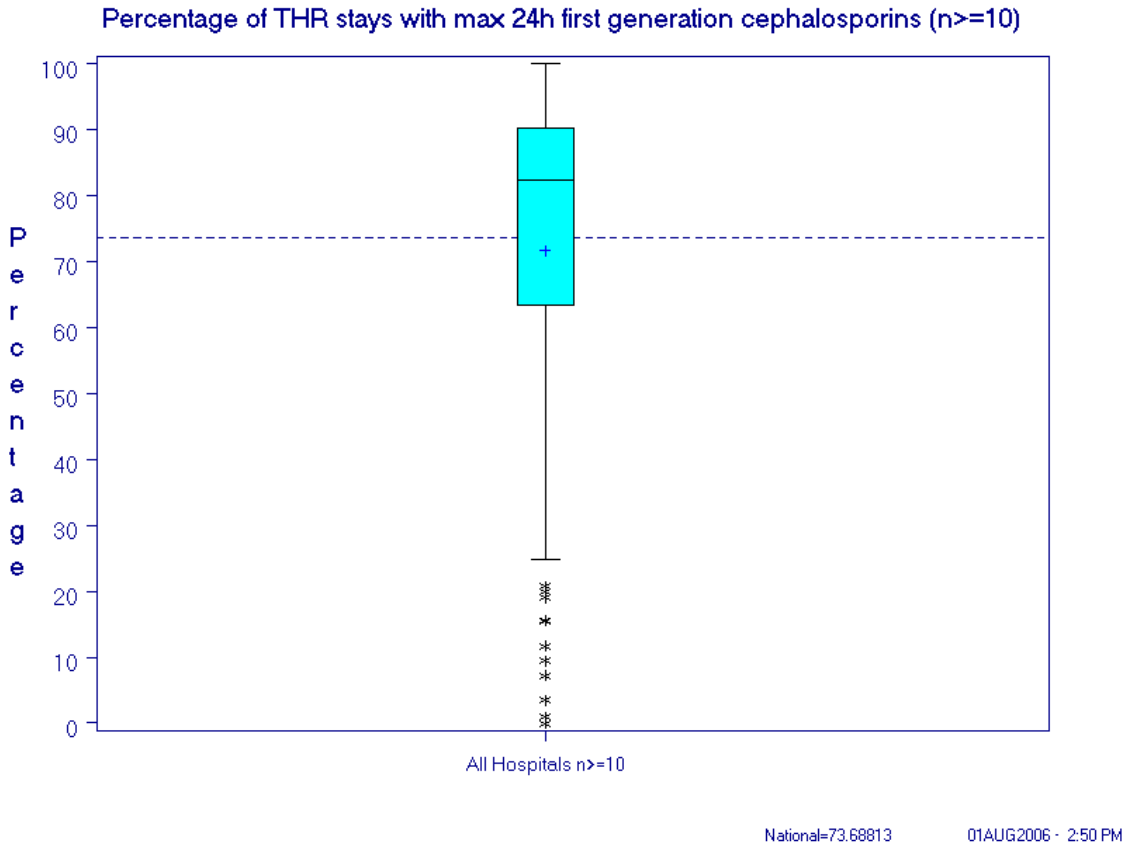
Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephaDDD	115	70.92	27.19	0.00	59.57	82.14	90.18	100.00
Nbr tHR	115	105.06	86.05	4.00	45.00	85.00	130.00	567.00

All hospitals with min. 10 stays

Variable	N	Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
qi_hip_cephaDDD	112	71.75	26.70	0.00	63.37	82.44	90.23	100.00
Nbr tHR	112	107.71	85.64	14.00	48.50	89.50	130.50	567.00

National

Nb THR	+ max 1 DDD Cephl	qi_hip_cephaDDD
12082	8903	73.6881



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