Getting insight by giving insight

Development of an instrument to benchmark the integral performance of intensive care departments

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Preface

"Getting insight by giving insight" refers to the aim of the project elaborated on in this thesis, enabling the intensive care departments to learn from each other. First, as teachers say the best way to learn something is to explain it to someone else, intensive care management can get insight in their own department by giving others insight in their department. This enhances the insight they have in their own organisation, because in order to inform others about strong and weak points in their organisation, they first have to map the knowledge of their own organisation. Second, collective learning only can take place, if the departments together give sufficient insight in their organisations to have enough material combined as a base for discussions. Bundling the combined knowledge and opinions and comparing the different data, can then lead to insight in practices and performances of the intensive care departments. Concluding, giving insight is of utmost importance to get insight and to learn about best practices and performances.

Not only the ICUs learned during the project. By trying to give the departments insight in their practices and performances, I got a lot of insight in the way these organisations function. I learned how to involve and motivate people, how to coordinate a project and how to design and use a benchmarking method. I could not have done this alone. I would like to thank Arjan van Hoorn for his support during the whole process and prof. dr. Jan Bakker for trusting me to think of a way to benchmark ICU performance. Prof. dr. ir Krabbendam and dr. ir. Visscher helped me to formulate the theoretical section and to write this report. They did stimulate me to keep improving my work. The Erasmus Medical centre was a perfect basis for my research, and I wish to especially thank the people and the successive interns of cluster 17, who helped me with practical matters and made daily attendance pleasant during the seven months of the project I attended to cluster 17 daily.

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Management Summary

Motivation

The intensive care is a relatively young department; it is only has been ten years the first ICUs were organized as stand-alone units. Intensive care is expensive: around 10 percent of the hospital budget is spend here, while only a small percentage of patients has to be treated on the ICU. With the rising pressure on hospitals to lower costs, the ICU has to deliver high quality care in an efficient way. Nevertheless, little information is available on how to optimally organize care on intensive care departments. Intensive cares do have a considerable amount of information about their patients, but they do not share information considering organizational set-up with each other. In this thesis, we develop an instrument to let the ICUs learn from each other in the area of ICU management by means of benchmarking. By giving insight in their organisational characteristics and reflecting on the provided data, the ICUs can develop more knowledge about good ICU management.

Developed benchmarking methodology

The developed methodology exists of the following phases. First, benchmark partners are chosen. Then, a stakeholder analysis is conducted to develop an understanding of the stakeholder groups having an interest in and an influence on the ICU. The third phase is to identify important processes on the ICU that could fit the concept of benchmarking and make a choice for a process on which the project is aimed. With the help of a developed questionnaire, in the fourth phase, information about patient streams through and system- and control characteristics of the participating ICUs are gathered. In phase 5 a performance indicator set is developed, of which the scores are gathered in phase 6. Phase 7 involves the analysis of the scores and making the link between contingency factors and scores on performance indicators. With this information, hospitals can then write and implement improvements. At last, the benchmark cycle is evaluated by the participants.

Results for benchmarking on the ICU

The partners involved in the benchmarking ICU project are all ICUs with a teaching licence, mostly part of a university medical centre. Salient stakeholders of the ICU are the IC nurses, staff, patients, referring physicians and the hospital board. The dominant coalition exists of the IC physician and the hospital board. Integral ICU management was chosen as the focus of our benchmark project, with the possibility to focus on more specific ICU processes later in the process. Through a literature review and interviews with stakeholder representatives, a unique set of performance indicators was developed. This indicator set measures, by means of structure, process, and outcome indicators, how the ICUs perform in the areas of quality of care, efficiency, and quality of work, representing the interests of the mentioned stakeholders. The remaining phases will be conducted in coming months.

Conclusion and recommendations

The research delivered a benchmark methodology especially fitted to the needs of the ICU to learn from each other. New is the active identification and involvement of stakeholders, leading to a performance indicator set that measures performance as perceived important by the stakeholders. The benchmark process leaded already to fruitful discussions between ICU managers about the strategic choices made and their implications to performance. The ICUs seem to have interesting differences in organizational arrangements, which could be a basis for learning from each other. In the near future, the first benchmark cycle can be finished, and already possible areas of focus for next cycles have been identified.

Content

Benchmarking on the ICU: learning not ranking!

Benchmarking IC

"No man is wise enough by himself" Plato

1 Introduction

In this chapter an introduction to the intensive care department and the benchmark project that will be conducted with the intensive care departments is given. It is motivated why there is a need for a benchmark instrument for the intensive care departments and recent movements in and around the organization of intensive care departments, leading to a grown emphasis on transparency and efficiency, are stipulated. The problem statement guiding the following research is formulated and important concepts to the project are defined.

1.1 Introduction to the ICU

First, we depict the intensive care department as it functions in the Netherlands. This will give a perspective on its functioning which will make clear in what kind of organization the benchmark project is started up.

1.1.1 The ICU: from open to closed format

At intensive care units, patients with disruptions of the vital functions are treated and monitored. The differentiated patient mix and specialized staff make it one of the most complex departments in the hospital. Critical care is a relatively young profession; although since World War II special areas in the hospital were designed for the most injured patients, only for a few years the ICUs have been moving from an 'open' to a 'closed' format. This means the ICU is now organized as a stand-alone department, with ICU specialists having formal responsibility for all treatments on the ICU. For most hospitals, this means that with the transition from an open to a closed format, the ICUs moved away from the influence of the referring specialisms they were once part of. This is reflected in the number of ICU departments that are rebuild or have planned to rebuild the IC department to integrate the specialized units into one general department.

Next to the changing role of the intensive care physician, other important issues concerning the role and responsibilities of the ICU are also in development. It is still recent there was made a distinction in ICUs with minimal resources (level 1) to highly equipped ICUs that must be able to handle all patients (level 3) (CBO, 2006). In the last two years, discussions were held concerning the number of beds that should be available and where (Hautvast et al., 2001), the criteria ICUs should handle around the admission and discharge of patients (NVIC, 2000), and the coordinating role in the region of level 3 ICUs concerning patient placement and transport (Inspectie van de Gezondheidszorg, 2005; NOVA, 2007). So, the intensive care in most hospitals operates in a dynamic playing field and is currently an organization in development.

1.1.2 Patients taken up on the intensive care

A level 3 ICU handles around 1500 to 3000 admissions each year, of patients with around 300 different diagnoses. Many of the patients are treated for a combination of multiple diagnoses. As defined in the Dutch admission and discharge guideline, in order to admit a patient an ICU physician must expect the patient to profit from the admission on the ICU (NVIC, 2000). ICU admission must provide value that cannot be delivered by general wards and must lead to an increase or at least stabilization of the health status of the patient. The patients are referred to the ICU by all kind of physicians, stemming from multiple places in the hospital.

Patients arriving to the ICU have covered different ways before arriving on the ICU[1]:

- A large part has undergone a procedure and comes from the operating room (OR), mostly via the recovery room. Surgery patients coming from the OR can be subdivided in *planned* or *elective* patients, of whom the surgery was planned and a place on the ICU could be reserved, and *urgent* or *unplanned* patients, who underwent an urgent procedure which was not planned on beforehand.
- Another part of the patients are *medical* patients, who did not undergo surgery in the 24 hours before ICU admission. They arrive on the ICU after having visited the emergency room (ER) or are (re) admitted from the wards after a worsening of their condition.

Both categories of patients can also be admitted to the ICU via the ICU of another hospital. In practice, patients are transferred between hospitals when they are too severely injured to be handled in the sending ICU. It is also possible that a patient is transported to another ICU because there are capacity problems on the ICU that has sent the patient to the admitting ICU.

The patients are treated and guarded by a team of specialized nurses and physicians assisted by highly technological equipment. ICU physicians are specialists (commonly internists, anesthesiologist or surgeons) that have followed an additional education of two years concerning intensive care medicine. Critical care medicine is not a medical specialism, but is called an area of interest. IC nurses also have had two years of extra education on top of their general nurse education. Both nurses and physicians are scarce, and many ICUs have to close beds because they cannot guarantee quality of care for more patients with their current staff capacity.

Common equipment of an ICU includes mechanical ventilation to assist breathing, dialysis machinery for renal problems; a web of intravenous lines, all kinds of tubes and pumps, drains and catheters; and a wide array of drugs to treat or sedate the patients and to prevent infections of the vulnerable patient.

1.1.3 Daily routines on the ICU

As described, the patient mix on the ICU is diverse, and all patients receive multiple different therapies. This results in a lot of different processes that take place next to each other and asks for flexibility of the workforce in combination with many skills. Besides taking care for the patient, in teaching hospitals also research is done and nurses and physicians are educated, on the bedside or in classes.

[1] Definition of patients categories according to the definitions used by the NICE foundation, http://www.stichting-nice.nl/DD3/servlet/mds?oid=69

Since processes on the ICU have grown by experience, and are not designed, daily routines vary in every ICU. For example, the way care is tuned between ICU nurse and physician or ICU physician and referring specialist varies in every hospital. Also, it depends on the hospital whether the individual staff members work for one, or for all of the different units of which the IC department exists. Differences also exist in the way the division of beds takes place. During the day, different departments and sometimes physicians from other hospitals call to ask a place on the ICU for their patient. On some ICUs, these request for beds are handled by one physician, on others it depends on the one who answers the phone. Most hospitals do have a protocol in which guidelines concerning the admission and discharge of patients are registered. It differs per hospital how much insight the ICU has in the predetermined question for beds. Most hospitals get the planning from the operating theatre in advance, but other patients are not foreseen in advance.

In most ICUs, three shifts are scheduled each day. Based on the level of the ICU and sometimes on the level of disease of the patient, there are 1, 2 or in the night 3 patients for which the ICU nurse is responsible. In the morning, ICU physicians and assistants, and depending on the hospital, also the nurses or some of the referring specialists, make a first round along the patients on the unit. Physicians set the treatment policy for each patient and communicate this to the responsible nurse. In the following hours, nurses provide care to the patients. Two main areas in patient care can be distinguished, namely, the processes related to patient medical care and those related to patient comfort (Hariharan, Dey, Chen, Moseley, & Kumar, 2005). Patient care exists of giving therapeutic interventions: for example, settling invasive lines, removing respiration tubes in deserving patients, and bedside procedures like monitoring the patient conditions. Furthermore, blood samples are taken for lab tests and patients are brought to the radiology department to make for example x-rays. Providing patients comfort is achieved by the appropriate use of sedatives and muscle relaxants, and by the attitude of the staff being friendly and keep the patient and their relatives informed. In the morning, physicians perform medical practices, speak with family of the patients, write patient reports or consult other physicians. Also, often ICU physicians are asked to consult elsewhere in the hospital or to visit the ER to help with diagnosing and transporting an emergency patient to the ICU. Around noon, most ICUs have scheduled a multi-disciplinary meeting in which the treatment policy of patients is discussed in a team of ICU and referring physicians, pharmacists, nurses, a laboratory worker, an ethicist and/or neurologists. Who exactly are present and if all or only part of the patients is discussed differs among the hospitals and depends on the patients on the unit. After the meeting, the treatment policy is adapted and the bedside care is continued. Around three and eleven, the new shift of nurses arrives and the transfer of responsibility for the patients takes place.

1.2 Developments leading to an emphasis on efficiency

In the past ten years, IC organizations have been experiencing several developments. As a result, many ICUs have changed their organizational structure or are still in a transition process. We introduce benchmarking as a way to guide improvements.

1.2.1 Need for efficiency of the ICU

Every patient needing intensive care should be entitled to a place on the ICU. But as explained above, the expensive technological equipment needed and the highly specialized staff make intensive care very costly: in general up to 10 percent of the hospital budget is spent at the ICU, while only around 5 percent of the patients treated in the hospital makes use of the ICU (Bakker, 2006). Therefore, the

number of beds on the ICU is restricted. Capacity problems exist on most ICUs, since budget and especially personnel is scarce and the demand for ICU beds for patients is often larger than then the available number of beds. In a research to the extent of this capacity problem in the Netherlands, almost 10% of the total number of patients needing a place on the ICU was rejected and had to be placed elsewhere because there was no capacity on the initial ICU that was approached (Hautvast et al., 2001). This illustrates the importance of the capacity problem. Efficiency of providing care, combined with high quality of care, is therefore important to pursue, so that the resources that are available can be used optimally to treat as much patients as possible in a responsible way (Reis Miranda, 1991). In this respect, a strict admission and discharge policy is also important, and IC physicians are working on this subject. Now the ICU has become not only a resource intensive environment, but also a centralized location in the hospital with well-defined borders, it is a natural place in the hospital to think about management and efficiency of care.

Investigating the efficiency of hospitals adheres to a national trend: since the population is aging and costs of care keep rising, the Dutch government, the public and insurers are pushing healthcare providers to become more efficient and transparent (see e.g. Better Faster Program, 2003). Not only economic reasons exist for the quest to improve performance; since patients in the hospital are vulnerable, they should be able to trust the hospital they lay in. It was argued by the Institute of Medicine that, while the amount of evidence-based knowledge about medicine is enormous, there is much to be gained in the quality of care actually provided to patients (Corrigan, 2001). This gap between the possible and the delivered care is known as the "quality gap" in healthcare. Where the government in previous years only controlled hospitals once every year through the Inspection of Healthcare, hospitals now have to give more and more information regularly. Already, hospitals have to give information about a set of hospital-wide indicators. In a recent letter, the Minister of Welfare indicated that it is his intention that in the coming years, intensive cares have to provide more information, since they take care of the most vulnerable patients (Klink, 2007).

Currently, there is no structured knowledge available about the differences and similarities in organization between the ICUs of the university medical centers. This is maybe due to the competition between teaching hospitals in the area of attracting staff and patients. The ICUs have no overview of existing differences in organization and organizational performance. Especially the ICU, with its complex patient mix and the network function within the hospital, is a department where many processes take place next to each other. Since most of these processes emerged from daily practices and were not designed for optimal performance, it is likely that some gains can be found in a research with respect to the best organization of an ICU.

1.2.2 Initiatives to improve quality

Several external parties try to contribute to transparency by publishing lists of quality indicators (Elsevier, AD, and others). A disadvantage of these lists is that they do not aim to provide information for the improvement of care, but try to inform people about the care provided at hospitals. The areas covered by these lists are mainly the outcomes of care, not how this care is provided, which makes it difficult for hospitals to identify ways to improve the quality of the care they provide. Also critics argue that the published lists often do no not use a valid method to calculate scores: they often assess patient or physician opinion, instead of measuring more objective indicators of quality. Furthermore, it is arguable whether it is possible to rank hospitals from high to low solely based on

indicator scores. This probably does not reflect the differences in patient diversity and difficulty of provided care that exist between hospitals and influence the ability of the hospitals to "score" on indicators. Therefore, these lists mainly provide value as a marketing instrument, and are not useful for helping to improve the quality or efficiency of care (Berg, 2003). Besides parties that publish lists of indicators, there are companies that perform benchmark investigations for healthcare institutions. A disadvantage of their approach is that the healthcare institutions do not really participate in the benchmark project, since they only have to deliver data and therefore do not develop a thorough knowledge about their own operations. To really improve efficiency and quality of care, initiatives from inside the hospitals have to be taken.

The hospital sector itself also took several initiatives to improve the quality of care on the ICU. To assure quality of care, the professional association of intensive care physicians took initiative to formulate a guideline to provide clarity concerning the organization of daily practices on the ICU (CBO, 2006). Local physicians wrote ICU protocols, based on national guidelines to standardize processes. Also, professional audits are held to evaluate the quality of the audited ICU. Professional audit committees visit ICUs of level III to grant or prolong education licenses. A large proportion of hospitals participate in the NICE foundation, which collects and analyzes indicators of quality of care and provides hospitals with their data compared to national averages. Furthermore, van der Voort and Keesman (2004) developed an indicator set to measure quality of care on the ICU.

None of these initiatives evaluates the ICU organization as a whole in a structured way with the aim to improve care. Guidelines are very specific for parts of the processes on the ICU. Audits do generally take place only once in every four years and solely look to the medical center's ability to educate. Furthermore, these reports remain often confidential so hospitals cannot learn from each other. The data provided by NICE do offer the possibility to compare the own hospital to the mean of all Dutch hospitals. Since there exist large differences between hospitals, comparing the score of the own hospital to the mean score of all these hospitals offers limited information. The indicator set of der Voort and Keesman (2006) is made only by physicians, while Edgar (2006) argues that a broader group of physicians, hospital boards and for example the inspection of healthcare should develop indicators and norms. As a result, the set of Van der Voort et al. focuses only on the medical side of performance, and does not involve measures for efficiency. All these measures offer some form of insight in a part of the ICU, but a general framework and methodology to measure and improve the integral ICU organization is lacking.

1.2.3 The use of benchmarking

Intensive care department heads of several Dutch medical centers have now expressed their interest to share knowledge with each other, to learn from each other's problems and solutions. They want to go beyond individual learning: they wonder how other ICUs within a comparable environment organize the provision of care. They want to explore the areas of ICU management they have organized well and the areas that can be improved. Maybe the same quality of care is reached within comparable ICUs, but the amount of resources used to obtain these results is lower for one ICU compared to another. Besides wanting to know in which areas they can learn from each other, ICUs wonder how their performance ranks in relation to comparable hospitals, not only on medical outcomes but also on organizational practices. This kind of information can be used to make management decisions, to improve the quality of the provided care and to validate budget decisions.

Learning from each other can be reached with benchmarking. The definition of benchmarking used here (and elaborated on in the definition section of this chapter) is the following:

Benchmarking is a continuous and systematical process used for generating steering information by the measurement and comparison of performance, with the objective of finding starting points to improve the own performance by implementing best practices (Poerstamper, Mourik-van Herk, & Veltman, 2007).

In 2005, the "Benchmarking OK" project was started. In this program, the eight Dutch academic operation rooms (ORs) investigated in which areas they could learn from each other, especially in the area of OR utilization and patient satisfaction. The project was successful in making it possible not only to show where differences in performance existed, but also which mechanisms could explain these differences and who to turn to when an OK department wants to improve its organizational practice in a certain area. But, even more important, the project succeeded in letting ORs speak with each other for the first time, and give insight in their organization. This project showed that, although benchmarking is often used for ranking, it could also be used as a basis for inter-organizational learning. The benchmarking steps developed for the OK can be used as a guideline for the benchmarking ICU process; since the ICUs want to learn from each other and are primary looking for infrastructural improvements, benchmarking is a proper method (Hayes, Pisano, Upton, & Wheelwright, 2006).

1.3 Problem statement

Summarizing the above, it can be stated that both external parties as well as the ICUs themselves see the urgency for a better understanding of structures and process of organizing care. However, although there are several initiatives to get insight in a part of ICU performance, there is no tradition of transparency and sharing of best practices between different hospitals. A framework for comparing and improving ICUs is lacking. Although some external parties try to make care more transparent, they do not succeed in giving more insight in the mechanisms leading to good quality of care. Benchmarking can be used to enable the ICUs themselves to get the insight in the structures, processes and outcomes they aim for.

1.3.1 Research objective

The aim is now, to design a benchmarking instrument to measure performance of the ICU. The following research objective can be formulated:

After participating in this research, the ICUs have a benchmark instrument for ICU performance measurement that can be used for inter-organizational learning in the area of organization and management.

The following more specific aims are served by this project:

- Enable the ICUs to meet and exchange information
- Provide the ICUs with insight in their own and other's organization
- Provide the ICUs with an instrument to evaluate integral performance

- Make accessible information concerning the link between organizational set-up and performance, this can serve as a basis for strategic choices

The value of the benchmark instrument to be developed can be determined by the level to which it helps the ICUs to learn from each other. By using the instrument and the model to evaluate current performance, and performance differences between them, the ICUs should be able to identify possibilities for improvement of their own departments.

1.3.2 Central research question

The central research question, following from the research objective, is how to enable the participating ICUs to use benchmarking as a means to learn.

What should a benchmark instrument look like, to benchmark the performance of the eight IC departments participating in this research, and how should the ICUs use it?

What we exactly mean with benchmarking and performance is elaborated on in the definitions section, paragraph 1.4.

The value of our research project will be the provision of an instrument and a model with which we can use the instrument, to enable the ICUs to learn from each other.

1.3.3 Research questions

To find an answer to the central problems, we break up the central research question in two questions. As stated above, benchmarking is a systematical process, so we need to find a method for the process of benchmarking:

1) With which methodology can we use benchmarking to enable the ICUs to learn from each other?

With answering this question, we find out what benchmarking exactly is, how it can be used in our project with the ICUs and which methodology we should use to perform benchmarking in this context. This information will provide us the basis for answering our second research question. Now we have defined the steps we have to take in the benchmark process, we can ask what we need to provide to the ICUs to enable them to undertake the project. The second question therefore relates to the instruments the ICUs need to perform benchmarking:

2) What instruments do the ICUs need to perform benchmarking using the developed methodology?

In chapter 2, we will try to find information helping us to answer the two research questions.

1.4 Definitions

In this paragraph, we clarify the concepts central to the research.

1.4.1 ICU performance

Our aim involves the benchmarking of ICU performance. Performance is a notion that can have multiple understandings and possible performance measures are almost unlimited. So how do we define performance of the intensive care departments? In this paragraph we describe our view on the way performance is defined in an organization.

In order to survive, all organizations have to constantly align their resources and capabilities to the needs of their environment. Although they are protected by several structures to prevent it from too much influences of the market, this also holds for hospitals and hospital departments. Hamel and Prahalad (1993) state that the wishes of the different stakeholders, internal or external to the organization, inevitably stretch the resources and capabilities of an organization from time to time. All organizations must therefore make choices in the needs they want to serve primary.

Scott (1995) suggests that organizations are political arenas in which different groups attempt to institutionalize the performance criteria that serve their interest. In any organization, the decision making process and the strategic choice for certain performance objectives is inevitably influenced by organizational politics. Pfeffer (1992) states that these kind of conflicts are resolved by bargaining among the different coalitions, in which some coalitions can exert more power than others. In other words, performance objectives found in an organization tend to reflect the interests of those who comprise the dominant coalition in a firm (Waggoner et al. 1999). We therefore should incorporate the opinion of the dominant stakeholders in the evaluation instrument of performance in one way or another, to ensure it represents ICU performance as perceived by the dominant coalition of key stakeholders. In section 3.1 we elaborate on the concepts of stakeholders and dominant coalitions, and explain how we can identify them and use them in the creation of a performance measurement system.

The stakeholder view of performance is well suited to hospitals. Their main aim is to provide care to those that need it. For the ICU, performance can therefore be described as the balancing of the demands of the several stakeholder groups:

"Performance is the degree to which the IC department is able to meet the demands of the important stakeholders"

1.4.2 Benchmarking

Gathering intelligence about the competitors of an organization to improve the own operations is hardly a new idea. Historically, industrial growth and development has been advanced by imitation of technology and business practices in countries around the globe. Started at Xerox at 1979, benchmarking as a formal practice was introduced. Benchmarking is described by Camp (1989) as the search for industry best practices that lead to superior performance. In the industry sector it is an important instrument: in the last decade, benchmarking constantly was one of the five most used management tools worldwide (Bain & Company, 2007). There are several reasons to use benchmarking: it can make it possible to assess the own position in comparison to others, it can provide starting points for learning and improvement and it can be used to increase transparancy. Also, if performed well benchmarking can give insight in the relation between management practices and performance (Poerstamper et al., 2007). The public sector uses benchmarking too, "to assess how services can be improved" (Ministerie van Binnenlandse zaken en koninkrijksrelaties, 2007). Another advantage of benchmarking, especially in the (semi) public sector, is the change of mentality it can cause: it forces organizations to look outside the borders of the own organization.

A limitation of benchmarking is often the focus on quantative data, resulting in a lack of understanding were the data came from and what they mean for the organizational processes. Without a notion of how the underlying processes work, it is hard to improve these processes. Benchmarking can also elicit losing the focus on customers or clients, when an institution focuses too much on improving the numbers. Examples of situations were a focus on short-term numbers can lead to, are employee burnout and errors and irritated customers and suppliers caused by a focus on financial goals (McNair & Leibfried, 1992).

Another limitation of benchmarking may be that many organization fail to implement improvements in processes properly. Proof of the effect of benchmarking on organizational improvement is lacking. Although benchmarking is a popular tool, when asked, only 4 percent of the public institutions knows how to adapt their procedures and systems to improve performance at the end of the benchmark process (Accenture, 2006) and an even smaller percentage also undertakes these actions. According to Freytag and Hollenson (2001), for example, in some companies the "not invented here" syndrome plays an important role in the inability to improve after benchmarking. Tactics not invented by the organization members themselves are perceived inferior by definition, which does make it a lot less likely that best practices from others are accepted. Another reason they mention why benchmarking is often not effective is resistance to change. Whether a best practice is good or not, change is always difficult since employees and managers, like all people, tent to resist a change, especially when it is imposed on them and when it requires a change in their view of the world, or mental schemes.

There are several definitions of benchmarking. Some of them stipulate comparison, others improvement and there are also definitions that point out learning as important aim of benchmarking. The Benchmarking OK project used the following definition as their working definition:

Benchmarking is a method to compare a function, activity or process of an organization with the best practices of other organizations, to use these to improve the own organization's ability to deliver excellent performance (Vries & Togt, 1995).

This definition links well to the aim of the study to compare academic ICUs to find best practices to improve the own performance. The definition given by the Dutch government is the following:

Benchmarking is the comparison of different (parts of) organizations with the central aim of learning from each other. Stated differently: the process of the systematical search for performances and the related processes and practices of participating organizations with the aim of learning from each other (Ministerie van Binnenlandse zaken en koninkrijksrelaties, 2007).

This definition adds the link between performances and processes to the definition of de Vries: with the comparison of performances only no insight is generated in the way these performances were generated, it is needed to study the underlying structures, processes and practices to be able to really learn from each other. Another notion in this definition is the aim of learning: the main goal of benchmarking is not directly improvement but first enable learning.

The last definition mentioned here is the one provided by Poerstamper et al. for benchmarking in a healthcare environment:

Benchmarking is a continuous and systematical process used for generating steering information by the measurement and comparison of efficiency and quality of performance, with the objective of finding starting points to improve the own performance by implementing best practices (Poerstamper et al, 2007*).*

Remarkable in this definition is that benchmarking is seen as a continuous process and not as a one-off event. Another notion in this definition is the multidimensional character of benchmarking: both efficiency and quality of performance are measured and compared, to avoid improvement actions in which efficiency is improved but quality declines, or the other way around, which is quiet essential, especially in the hospital sector. The definition stipulates that benchmarking is meant to generate steering information that can be used to improve the way input variables are used to generate outcomes. This avoids that benchmarking is seen as a process that only gives insight: the goal is to really use the results to change the way value is provided. The definition also gives a clue about how to improve: by using best practices to find starting point for improving the own performance.

1.4.3 Best practice

But what is meant with "best practice"? According to Wikipedia, the term best practice "generally refers to the best possible way of doing something" (Wikipedia, 2007). This definition is quiet vague. Prax (2000) gives us a better definition:

A best practice is every practice, knowledge or know-how, which showed its effectiveness or its value in (part of) a company and which is applicable to another (part of the) company.

He remarks that to be used as a best practice, it should be possible to transfer a practice to another part of the organization (or another organization, in the case of external benchmarking). However, there exists a lot of discussion concerning the copying of other company's best practices.

1.4.4 Discussion concerning benchmarking and best practices

First, one assumes that it is possible to "copy" a practice or process. However, often precisely those activities in which a company outperforms others exist largely of intangible competences, originating from years of experience. It is discussible whether it is possible to identify and copy exactly those practices that lead to the high performance aimed for. The biggest impediments to best practice transferring are often knowledge-related factors, such as causal ambiguity about the exact production factors and the interaction of those factors leading to success (Szulanski, 2000), and a lack of "absorptive capacity", which is described as an institution's ability to value, assimilate, and utilize new external knowledge (Crossan, Lane, & White, 1999).

Second, it is not said there exist only one way that is best. It is perfectly possible there are multiple pathways to high performance, and a "best practice" is only one of the many possibilities of achieving high performance. Improvement of the own methods can therefore be just as valuable as best practice copying.

The third limitation of best practice adoption relates to the strategic role of operations. Companies can achieve competitive advantage through operations by aligning their operations to the strategic choices they make (Chase, Aquilano, & Jacobs, 2001). When simply best practices of others are adopted, the role of strategic analysis and decision-making is reduced to the question who's improvement technique to adopt next. Therefore, the competitive advantage operations can provide will disappear (Hayes et al., 2006). Also, conditions for success will change. In a competitive environment, long-term success lies not only in the adoption of the right operational practices, but in the ability to adapt to changing environmental circumstances and to keep improving performance over time (Hayes et al., 2006). Where the practice first helped the donating company to outperform the competitors, their practice now has become the norm and lost its value as basis for differentiation, or providing unique competitive value. Of course, the company donating the knowledge has the advantage of the learning process it has gone through developing the practice, which will maybe help it to develop new competitive practices. The adopting firms do not have this advantage and will end up striving to adopt the next best practice. Also,

Lastly, a best practice is only best for the aim it is meant for. If companies have different strategic objectives, the processes leading to fulfill these objectives will be different. It is therefore important to have a clear view on the objectives of the institution before trying to copy best practices from others.

Concluding, best practices can be used as a starting point for improvement, but have to be treated as indications and not as solutions. First, one should judge how much the best practice actually contributes to performance. Also, one should critically assess whether the best practice is useful for improvement of the own performance, paying attention to the strategic goals, organizational culture and environment of the own organization. Even then, it is perfectly possible there are other, and maybe better, ways to improve performance.

1.5 Research framework and reading guide

In the following sections, we will first try to find information to answer our research questions by the use of relevant literature. We do this in two sections: first we develop a benchmark methodology with the help of literature on benchmarking and learning. Some phases will speak for itself, in others a model is needed as a basis with which to develop an instrument to describe for instance the people relevant to the ICUs or the performance of the ICUs. In that way, we distract from the literature a benchmarking methodology and models we can use as a basis for the instruments we need to execute the phases of the methodology.

Following, in the methodology section, we will describe how every step in the benchmark process should be executed. In this section, of each phase the phase objective, the phase link with theory and the methodology of the phase is elaborated on. For each step, we use the models identified in the theoretical section as a basis for the instrument we will use in the benchmarking IC process. The result is a detailed benchmarking methodology especially fitted to the ICUs.

We then start up a pilot benchmarking cycle to receive feedback on the validity and reliability of the developed methodology and instruments, and gather data using the developed instruments for

evaluation of the participating ICUs. The results section describes the results of using the instruments on the ICU: it covers both the data delivered by the ICU and evaluates the benchmark process.

In the last section of our research, we discuss the developed methodology and instruments and give recommendations for further use.

The research framework displays the important parts of this thesis (figure 1).

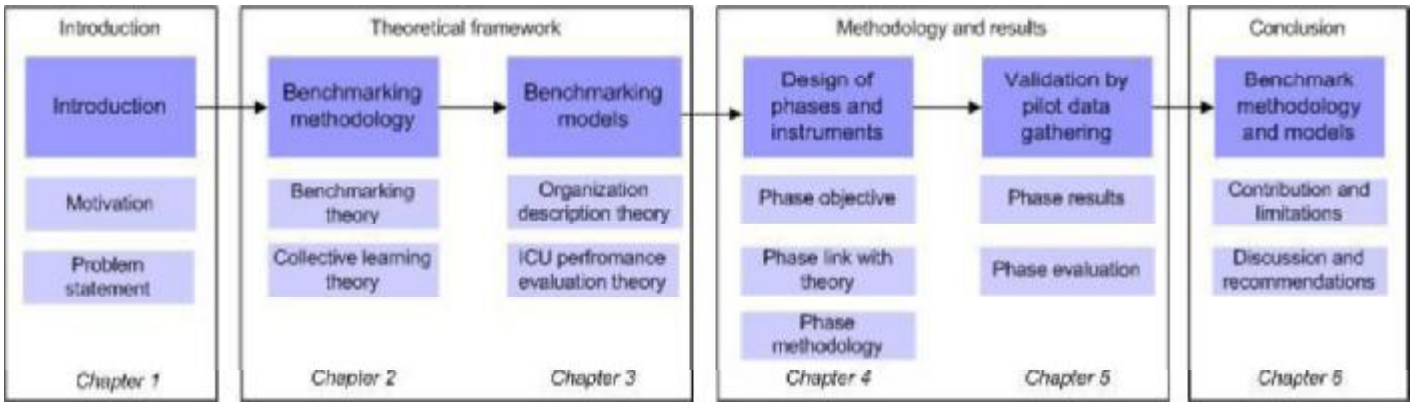

Figure 1: Research Framework

2 Theoretical framework 1: Developing a methodology for benchmarking of the ICU

As described in the last section, to be able to benchmark the IC departments, we have to understand and find a methodology for the process of benchmarking. Therefore, in the first part of this chapter, we elaborate on the types of benchmarking projects and the methodology of benchmarking. Also we ask ourselves, whether we can use benchmarking in a hospital environment. To this purpose, we examine some assumptions underlying benchmarking, to deduct some requirements to our benchmark model and methodology. Since the aim of our project is to enable inter-organizational learning, we than examine the link between benchmarking and learning. We give an overview of organizational learning theory and look to how we can adapt our benchmark methodology to the aim of letting the ICUs learn from each other.

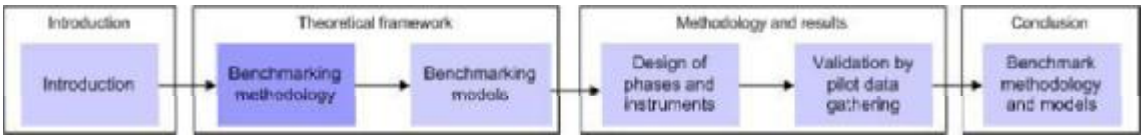

Figure 2: Place of section 2 within the research framework

2.1 Classification of benchmarking projects

Not all benchmarking projects are the same. Goals, principles, the nature of the group with whom benchmarking is performed and the level of analysis differ per project. The type of benchmark project one wants to conduct has an influence on the methodology and the type of model to use. Therefore, in this paragraph, we elaborate on common benchmarking classifications and reflect on the place of the benchmarking IC project.

2.1.1 Types of benchmark projects

Classification of benchmark projects can be done according to the following criteria (Poerstamper et al., 2007):

Goal and benchmark principle. The goals institutions want to reach with the use of benchmarking are plenty. Finding best practices to improve the own operations, legitimating the strategy,

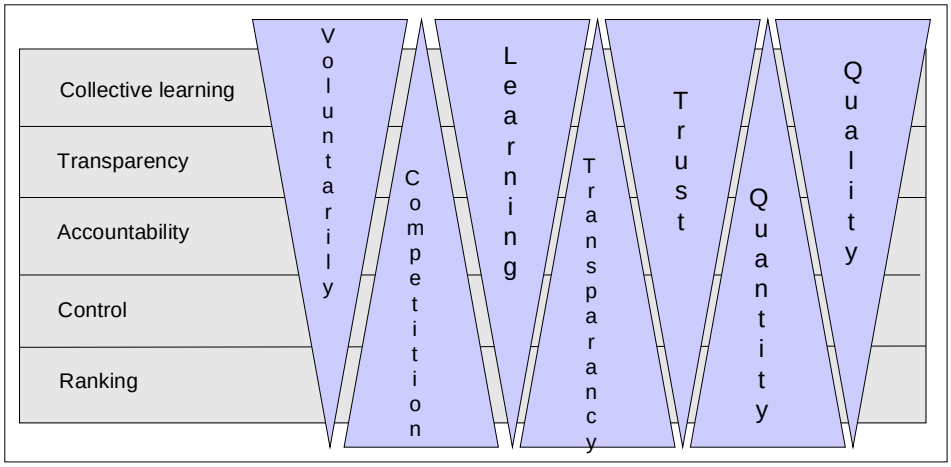

Figure 3: Goals of benchmarking (Dutch government position on benchmarking, 2004)

evaluating the performance in comparison to others, examining the strengths and weaknesses, learning from each other and testing whether the institution complies to certain norms are a few examples of goals companies try to reach with benchmarking (www.kwaliteitsmeter.nl). Although one benchmark project can cover multiple goals, the goal of the project has implications for the benchmark process.

Different goals will sometimes have conflicting implications for the benchmark process (figure 3). Because of conflicting goals, it is important to decide beforehand what the goal of benchmarking is and to make clear and take explicit measures to arrange the process in an according way. For example, a benchmark with the goal of ranking will happen in a climate of competition and will involve quantitative comparisons. Benchmarking here is based on performance comparison.
Contradictory, when the goal is to learn from each other like our project, the benchmark process will have to take place in a climate of trust, it should be based on voluntary participation and the focus is likely to lie on qualitative measures. Also, it would be appropriate to not focus on performance comparison only, but try to link performance to organizational structures and processes.

Subject. *What* we want to benchmark is dependent on the goal of benchmarking:

- Performance benchmarking is making a comparison of pure key figures or other performance measures
- Process benchmarking goes beyond performance measures and compares how business processes are performed, not only how well they are performed.
- Strategic benchmarking is the comparison of strategic decisions and dispositions at a higher level.

Selecting a different subject will naturally lead to other gained knowledge. Of course, subjects can overlap: it is possible that, while benchmarking processes, conclusions about performances and strategy can be drawn based on the acquired knowledge.

Comparison group. Against whom can you benchmark? Four kinds of comparison groups are described in literature (Anderson, 1995):

- Internal benchmarking. Comparison against sub-structures within the same organization.
- Competitive benchmarking, comparison against the best direct competitors.
- Functional benchmarking, comparison against organizations that are not necessarily a competitor, but that perform related tasks within the same technological area or business.
- Generic benchmarking, comparison against the best, regardless of industry or markets

The level of analysis. The level of analysis can be a whole company, but also a department, a process or a certain function of the institution. This has consequences for the level of detail that can be reached.

Usage of norms. Benchmark projects can also be distinguished based on the type of benchmark they use: pre-defined objective norms or, in the absence of such norms, other more subjective norms (Klages, 1996). When no general accepted norms are available, it is common to take the performance of the best performing participant as benchmark (Poerstamper et al., 2007). This has the limitation

that if the performance of the best participant is close to that of the other participants, benchmarking will not deliver spectacular results.

Research method. The benchmark can have different structures. The level of involvement of the participants depends on the research method chosen. The benchmark project can be performed by the institutions itself or by an external company, which will make the effort required from the participants lower since they can profit from the methods and standards used by the external company (Poerstamper et al., 2007). This will likely also lower the expected benefit of the project, since the process of benchmarking itself delivers the participating institutions valuable knowledge concerning their own organization, their ability to learn, and the way the results of the benchmark project need to be interpreted and used. Since our goal is learning from each other, it is important to involve the ICUs as much as possible in the process.

2.1.2 Combining goals, subjects, level of analysis and research method

In theory, all combinations between goals, research method, subject and comparison group can be made. Nevertheless, it is better to adjust these to each other.

Using the above-mentioned typology to describe benchmarking on the ICU, we come to the following categorization (table 1). As stated before, the main aim of the benchmarking project is learning from each other in the area of ICU management. After the project, the participating ICUs will have more knowledge about integral IC management, which they can use to improve their own performance. We aim to reach this by making a collective comparison of structure and control characteristics, in combination with performance indicators. These performance indicators should not only measure outcomes, but also the way the organization tries to accomplish these outcomes; so process indicators should also be involved. A group of teaching ICUs conducts the benchmarking project, which makes the benchmark group external (outside the own organization), but with comparable functional partners. The level of analysis is primary the ICU: although its place in the hospital and the borders of the ICU with other departments are also described, our primary focus is the ICU itself. Performance can be compared with norms when available, if not only with each other. The research method is active: the ICU*s* themselves have an active role in the choice of indicators and processes to be benchmarked. The method is also fact based: the ICU*s* have to found their claims with facts. As stated in the theoretic section, the active role the ICU*s* have to play will stimulate to think about their own performance and facilitate the learning process.

Table 1: Benchmarking ICU Profile (based on the classification scheme of PriceWaterHouseCoopers)

Classification criterion	Benchmarking ICU
Goal	Improving integral performance
Benchmark principle	Collective learning
Subject	Structure, processes and outcomes
Comparison group	Functional benchmarking against external industry group: other organizations, same business and function
Level of analysis	Intensive care department
Usage of norms	Comparison with each other instead of norms; development of norms possible in later stage
Research method	Interactive and fact based

2.2 Benchmarking within a hospital setting

There are several aspects in a hospital environment that differ from the industrial sector that can have an influence on the process and results of benchmarking. Some characteristics of the value providing process in healthcare differ from that in most industries: for example, the provision of health care brings a lot of uncertainty, health care processes can often not be easily interrupted, health care is a service that cannot be stored, health care provision can have radical consequences on the life of patients, and clinicians posses a considerable amount of professional autonomy (Houdenhoven, Wullink, Hans, & Kazemier, 2005). Other differences between financial oriented companies and the quality-oriented hospitals are the large number of interfaces between the patient and the hospital and the level of external legislation around the provision of care. This can have consequences on the process of benchmarking. Since benchmarking as a method is developed for industrial firms we should check whether the assumptions underlying benchmarking are valid for the hospital sector. It may be that to use benchmarking in a hospital, some special care should be given to the benchmarking process to make sure the results expected can be met.

2.2.1 Assumptions underlying benchmarking

To test whether the assumptions underlying benchmarking are valid in the hospital environment, the following assumptions, as identified by Wareham and Gerrits (2004), are discussed for the hospital sector:

- **Homogeneity of organizations.** To apply knowledge of one organization in another assumes some degree of homogeneity between the two organizations. Since hospitals are complex organizations, attention should be given to the degree to which the participating IC units are comparable. One large cause of variability between hospitals, the variation in patient mix, should be investigated to be able to argue whether the hospitals operate in comparable environments. As stated before, intensive care departments are relatively young and not standardized. Therefore, similarities and differences in organizational set-up should be clearly established early in the process, to make it possible to take these into account in later phases of the project.
- **Universal yardstick.** Identifying best practices implies the existence of some kind of absolute measurement method with which performance of the different participants can be measured in a standardized way. This implies that to benchmark, we have to develop an instrument that is accepted and understood by all participants. Ideally, we could then compare the performance of the participants with this method to a well-established norm. In the words of Mainz (2003), "The final stage in measuring health care quality is applying a standard of quality that embodies acceptability of a particular performance or outcome rate". Therefore, we should look to the history of ICU quality measurement to find accepted measurements of (a part of) ICU performance that we can use in our benchmark instrument. Although there is no standard for integral ICU performance available yet, we will definitely be able to use some material of other research to ICU performance. In the absence of established norms, providers can only be compared mutually to determine relative quality of care. Therefore, the aim of this project should not be to check whether each ICU complies with a norm but to relate performances relatively to each other, considering the relevant differences in set-up and environment. We have to realize that it may not be possible to benchmark against a standard, but mutual comparison can also deliver us much information.

- **Transferability.** Benchmarking assumes that practices that are successful in one organization can be applied in another organization and will provide similar results. Wareham et al. (2004) argue, as stated earlier in the elaboration on best practices, that it is almost never the case that practices can be duplicated. But it is part of the learning experience to understand whether identified practices could conflict with existing organizational structures and cultures (Fernandez et al, 2001). An advantage of benchmarking in a hospital is that medical tasks are largely standardized by means of the professional education staff and nurses have received. However, since the organizations are all relatively young and in different stages of growth, this does not count for their organizational practices. Therefore, in our research it is important that relevant similarities and differences of the ICUs are described, in order to be able to judge whether it would be possible to transfer practices from one hospital to the other. The issue of transferability is somewhat contradictory to the subject of diversity; to profit from benchmarking, variation in the participating institutions is needed to ensure there are differences in processes. The art of benchmarking is to find partners that operate in a comparable environment and are subjected to comparable conditions, but have differences in the way they have organized their business to serve their objectives.
- **Alienability and stickiness.** Alienability refers to the question whether knowledge can be extracted from its context. If hospital practices that lead to good performance are largely based on tacit knowledge, this knowledge may be difficult to transfer to other hospitals. 'Stickiness' is described as a coefficient of the effort that is needed to successfully transfer a practice from the source organization to the receiving organization (Szulanski, 2000). A co-operating knowledge donor and a willing and able knowledge recipient facilitate a successful transfer process. To ensure learning can take place in our project, we therefore should create an environment in which this is possible. We will come back to this subject later in this section.
- **Validation.** Pointing to a best practice presumes one can measure which practice is best. Where in the industry sector it is often common practice to measure performance, in hospitals this is less embedded in culture. We should pay attention to validation on two subjects in our research: the data that we gather should be valid and reliable, and the performance indicators we are going to use to evaluate performance also have to be both valid and reliable.

  Regarding to the data, we should therefore make sure the questions we ask are clear and cannot be interpreted in multiple ways. Also, we have to ensure that the data we get from the hospitals is reliable: it should be gathered in a structured way and checked for inconsistencies. Regarding the validity of the performance indicators, we should check the literature to find indicators that are already validated to ensure we use a valid and accepted instrument. However, we will probably also have to construct new performance indicators. To validate those, we should make use of the knowledge of the participants.

2.2.2 Implications for the methodology of benchmarking on the ICU

Concluding, we can state that if we want to use benchmarking on the ICU, we have to take some provisions to let it work. We have to design our benchmark model and method in such a way that the above-mentioned limitations are processed in the benchmark methodology we develop.

First, we should include a step in the process in which we make it possible to assess how comparable the ICUs are concerning the patient streams they have to handle and the organizational environment in which they operate. For interpretation of the performance differences, it is important to have an idea about, for example, the availability of a medium care department in the hospital and the number of hospital beds per each ICU bed. Furthermore, the questionnaire we will use must be able to give us starting points for describing differences and similarities in organizational set-up to get an idea of the transferability of practices. We will have to keep this in mind when designing a model.

Second, the performance measurement model should incorporate indicators that are accepted by the ICU stakeholders, so we should take a close look to earlier research that is done to the measurement of ICU performance. This is especially important for medical indicators, to which a lot of research is done.

Third, it is important to pay attention to the way we are going to gather data. Since not all hospitals do gather patient information in a reliable way, we should assess for each hospital how reliable the information is they deliver. Regarding to the benchmark instruments we design, we should try to let the participants validate them by incorporating several feedback rounds in the research process.

Lastly, we should pay attention to creating an environment that stimulates learning. Therefore, in the next paragraph, we look to some models concerning stimulating collective learning.

2.3 Facilitating collective learning

In this paragraph, we describe what collective learning is and look at methods usable to facilitate collective learning. First we describe shortly what learning is and how inter-organizational learning takes place. To do this, we use the framework developed by Crossan, Lane & White (1999), that helps us to understand how learning in and between organizations works. Then, we mention how learning in the benchmark project can be enabled, by naming implications for our methodology and model.

2.3.1 Inter-organizational learning

Learning happens when knowledge is processed and the range of potential behaviors increases (Huber, 1991). Learning occurs at two levels: the learning of new knowledge and accompanying this process, the abilities of dealing with this knowledge improve. Consequences of one's past actions are better understood and new mental models are formed when knowledge is acquired. This means, that learning has two components: the acquisition of knowledge and the enhancement of learning capabilities (Inkpen, 2000). The acquisition of new knowledge is called single-loop learning. The resulting better insight is called double loop learning (Argyris & Schon, 1978).

When knowledge is transferred from the individual to the collective level, this is called organizational learning. Following, learning can also take place between organizations: this is inter-organizational learning. Crossan et al. (1999) distinguish four social and psychological micro-processes, linking learning at individual, group and organizational levels:

Intuiting is "the pre-conscious recognition of the possibilities inherent in a personal stream of experience". The process can affect the intuitive individual's behavior, but it only affects others as they attempt to interact with that individual. *Interpreting* is "the explaining of an insight or idea, to oneself or others". The intuitive idea is made explicit by means of language. *Integrating* is "the

process of developing a shared understanding and coordinated action through mutual adjustment". Dialogue and joint action are crucial for the development of this shared understanding. *Institutionalizing* is the process of embedding new knowledge into the organization's systems, structures, procedures and strategy.

So far, this model describes how learning within an organization, or intra-organizational learning, takes place. Our goal is to let the separate companies learn from each other. To this end, Holmqvist (2003) defines inter-organizational learning as learning between organizations where there (initially) is a low degree of interdependency. Jones and McPherson (2006) add the component of inter-organizational learning to this framework by defining a fifth process: *intertwining* of knowledge (figure 4).

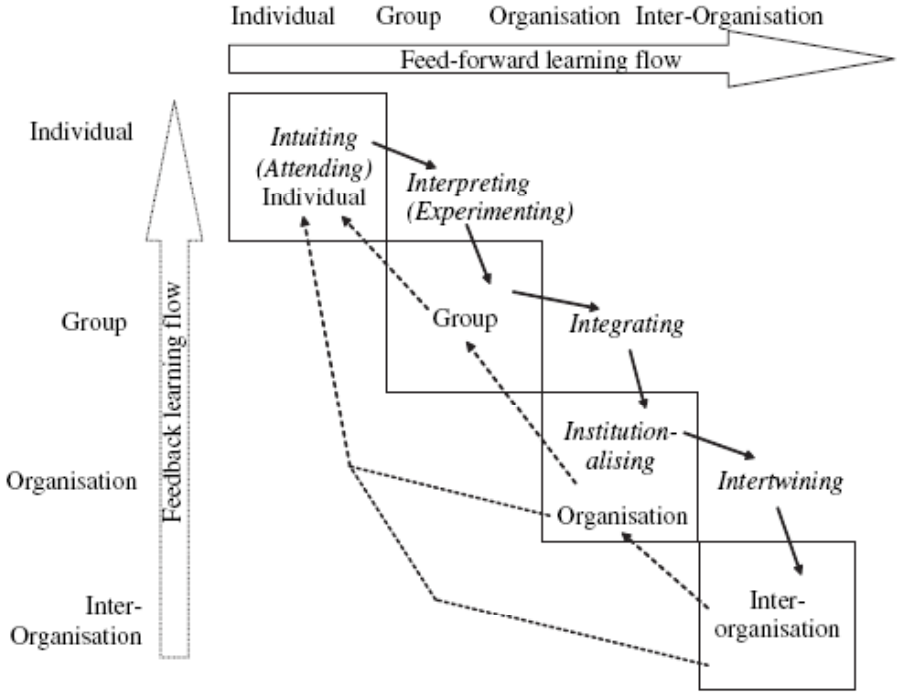

Figure 4: framework for learning on multiple levels (Crossan et al., 1999)

It indicates active engagement between the firm and its external knowledge network and implicates that learning mechanisms are at the interstices between organizations and not just within organizational boundaries. It can be achieved by transferring knowledge from one organization to the next, as well as by creating new knowledge through interaction between the partners. How are intra- and inter organizational learning related? Holmqvist (2003) argued that while intra-organizational learning often leads to exploitation of the available experience, while inter-organizational learning can deliver new insights and can lead to exploration. To engage in the process of intertwining knowledge, *collective learning* can be used. We define collective learning as learning that happens when people learn from the knowledge of others through a shared process. In this respect, benchmarking can be seen as such a process, making collective learning operational. Enabling collective learning with the use of benchmarking does then require that benchmarking is a "shared process" and that the participants are really involved in the different phases. They should have an active role in the developments and choice of different parts of the instrument.

2.3.2 Conditions for successful collective learning

Now we have explained the place of collective learning in the knowledge management theory, we will try to find theories explaining how we can make collective learning successful. Larsson, Bengtsson, Henriksson, & Sparks (1998) state that successful learning in alliances depends on the transparency and receptivity of the partners. Transparency is the degree to which one partner gives others access to the own build-up organizational knowledge, and receptivity is the degree to which knowledge provided by the partners is taken up. In collective learning between organizations, there exists a tension between collaboration and competition, called the inter-organizational learning dilemma by Larsson et al (1998). This stems from it being rational for an individual organization to adopt the strategy of maximizing individual learning, by taking the most knowledge with the least effort, in other words, be very receptive but not transparent. This is especially true if the partners are direct competitors. At the same time, the total value of the joint learning is reduced by the relative withdrawal of effort of the partners. Another problem is that some partners may adopt a strategy of only delivering minimal effort: giving some transparency but lacking receptivity. These partners will not maximize the learning potential. Therefore, to maximize learning one should take efforts to increase both transparency as well as receptivity (figure 5).

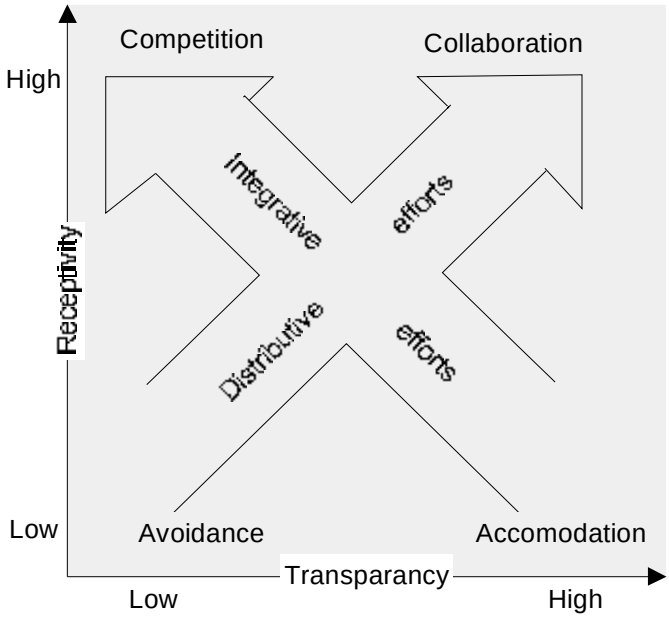

Figure 5: Individual strategies for inter-organizational learning (Larsson et al., 1998)

In literature, we can find the following concerning receptivity. The concept of absorptive capacity (Cohen & Levinthal, 1990) can be used to define factors stimulating receptivity of the partners. Absorptive capacity is an institution's ability to value, assimilate, and utilize new external knowledge. Basically, this means that to acquire and internalize knowledge from another organization, one should first have a certain level of knowledge about how the own operations function (Cohen et al., 1990). Learning capacity indicates a firm's ability to comprehend and assimilate new knowledge, which would allow the recipient of knowledge to learn from others. To learn, a certain level of absorptive capacity is needed, but the learning process it selves will increase this capacity by the process of double-loop learning explained above: by sharing and talking about knowledge capabilities of dealing with this knowledge are enhanced. Another proposition concerning receptivity is that the greater the value and relevance of the knowledge of the partner, the greater the motivation will be to start knowledge acquisition efforts (Inkpen, 2000). Therefore, it is important that the aims of the process are shared and clear from the start of the project on, there is a commonality of interests and participants are motivated to learn. Practically, we can enhance receptivity by involving multiple persons per organization; so participants can talk about and reflect on the acquired knowledge and work together to use this knowledge in their own organization. Also, we can stimulate receptivity by making it easier to interpret knowledge, with the help of instruments.

Transparency of the participants is more likely to be reached when they trust each other and the process (Lane & Lubatkin, 1998). Two things can stimulate trust between the partners. The first is a long-term orientation, which increases the motivation for every partner to not take actions against the partners to avoid splitting up before the long-term goals are reached (Bleeke and Ernst, 1991, Heide and John, 1993). Another means to ensure trust between partners is to establish safeguards against cheating (Lane et al. 1998). These means are mainly important in the beginning stage of the partnership, since the partner relationship develops and trust is, if everything goes fine, empowered by the process of working together (Gulati, 1995).

To learn how we can ensure trust in the process, we look to the findings of Kim and Mauborgne (1997). They argue that while people do, of course, care about the outcomes of a process, the way these outcomes are reached have a huge effect on the commitment and trust they have in the outcomes. A "fair process", which stimulates trust and commitment between the partners, has the following features as described by Kim et al.:

- Engagement means involving the relevant individuals in the decisions that affect them, for example by asking for their input and allowing them to discuss the merits of another's ideas and assumptions. Discussion sharpens the thinking process and allows for learning.
- Explanation means that we should ensure everyone understands why decisions are taken. This allows people to accept decisions, even when their own idea is rejected. It also serves as feedback, enabling learning.
- Expectation clarity requires that when a decision is taken, the new rules are set clearly. Everybody involved should have a clear idea about what is expected of him, what the new goals and milestones are and which responsibility rests on whom. In this way, everybody can focus on his own task.

Many literature resources point to the essential role of top management support in ensuring engagement: should go beyond making money, time and resources available and must be committed to the process and spread the importance of the project (Karlf, Lundgren, & Froment, ; Poerstamper et al., 2007; Szulanski, 2000)

2.3.3 Implications of collective learning conditions to our project

Now we have described how inter-organizational learning takes place and how we can enhance transparency and receptivity, we can distract some conditions for successful benchmarking on the ICU. Under this conditions, intertwining of knowledge can take place.

To increase receptivity, we should select partners carefully. These partners should have a similar background in measuring performance, to assure there are no big differences in absorptive capacity. Multiple persons per ICU should be involved so the basis for each organization does not depend on one person, and discussion can take place not only between organizations but also within. Partners have to be motivated to participate, so the aims of the project should be clear to all participants and should add to the own interests. Also top-management should provide support to underline the importance of the project. Hereto, we should early in the process assess what interests the ICU managers have and how we can fit the process to their requirements. Also early in the process, we should ensure interests are shared, and the aim of benchmarking is clear to all partners. Furthermore, instruments that make gathering and interpreting knowledge concerning the own

organizations easy should be developed. Hereto, a questionnaire especially fitted to the ICUs can be used, assessing system- and control characteristics of each hospital needed to understand the nature of each intensive care department.

To increase transparency, a climate of trust should be created by adopting a long-term orientation, therefore it should be made clear that benchmarking is a recurring process in which cycle after cycle can be gone through. Also, measures against "cheating" have to be taken. In the first instance, a verbal agreement can be used to assure data will not be shared with others than the participants and data stay in the possession of the providers. Later in the process, a contract containing detailed agreements concerning anonymity of the participants can be signed. For enabling transparency, we also have to make use of an instrument to make it possible interpret information from each organization. To this end, we can use the same questionnaire that we provided to the ICUs to order their own information. The participants also have to be engaged in every phased of the project to ensure their commitment to and "psychological ownership" of the project. To this end, relevant stakeholders should be engaged in developing the instruments we will use during the project. This will take more time than using predefined sets, but will make sure the instruments fit to the participants and will increase the sense of ownership.

Concerning enabling a fair process to take place, it is first of importance to engage in project management. Phases should be defined clearly, with expected end results and expectations of the participants. For the IC process, this is somewhat difficult in because the participants are not fully committed to the project from the start. Nobody has to participate and the hospitals have to be tempted to commit themselves to the project. Nevertheless, a clear methodology and project plan should be available to establish clarity of the aims of each phase. This prevents sticking to, for example, defining definitions of indicators, for too long. It should be ensured participants are informed about the way outcomes have to be interpreted and how they can be translated to improvement measures. After each phase, participants should decide whether they want to continue with the project or not to ensure motivation.

2.4 Developing our benchmarking methodology

Now we have described what benchmarking is, have ascertained benchmarking can be used in our project and have examined how we can stimulate collective learning, we can choose a methodology.

2.4.1 The benchmarking process

There are many models that describe the steps we need to take to benchmark. Although they differ in several aspects like the number of phases and the phase they put most emphasis on, they all distinguish the following parts (Poerstamper et al., 2007):

- A preparation phase in which the aim of the project is set, partners are selected and an instrument is chosen
- An implementation phase in which data are aggregated, validated and analyzed
- A feedback phase in which the results of the analysis are given and best practices and opportunities for improvement are given

Benchmarking is a cyclic process that does not stop after the feedback phase. Its goal is to show opportunities for improvement and therefore, the feedback to the participants should contain starting points for performance improvement.
These improvements can then be implemented and evaluated with a next benchmarking cycle. The "benchmark wheel" emphasizes the cyclic nature of benchmarking (Figure 6). As stated before, the hospital sector differs from the industrial sector in several aspects. Van Hoorn, Van Houdenhoven, Wullink, Hans & Kazemier (2006) adapted the general benchmarking method to the use of benchmarking in hospitals. They emphasize that in the healthcare sector:

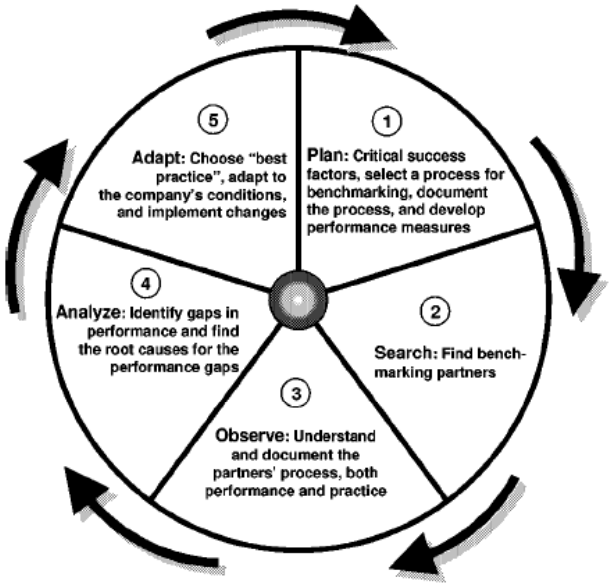

Figure 6: The benchmark wheel (Andersson, 1999)

- Learning from each other is a priority; benchmarking should mainly be used to share knowledge in a safe environment
- Knowledge of the participating organizations is needed before comparable performance indicators can be developed
- It is important to ensure the performances of the partners are comparable

The model they described therefore differs from that of other models, in that early in the process, relevant processes and characteristics of each participant are described. According to the authors, the early mapping of these contingency variables can help later on in the process in explaining the differences in performances of the participants and at the same time, helps to create a safe environment since early in the process data are shared and learning from each other is started (van Hoorn et al., 2006). Their model consists of the following steps:

1. Choice for a comparable process
2. Choice for comparable partners
3. Description and analysis of process and contingency variables
4. Development of comparable performance indicators
5. Choice for performance indicators by stakeholders
6. Unambiguous and integral measurement
7. Analysis of performance differences
8. Developing improvement plans
9. Implementation

It seems this methodology is a good basis for our methodology. It was designed for a hospital environment and incorporates some of the conditions we formulated. For example, it involves a step in which a description of the different organizations is made, as we also want to ensure similarities and differences in ICUs are clear. Also, it involves measuring performance with performance indicators chosen by stakeholders.

2.4.2 Selecting processes and partners

The starting point in this model is the idea of one organization to benchmark the whole or part of its organization against another organization or department. The choice for the department to benchmark is therefore made by this initiating department. However, in the model of van Hoorn (2006), this department also makes the choice for the processes to benchmark. Since for benchmarking between hospital departments it is important to involve every partner in every step of the benchmark process (as explained in paragraph 2.3.2), the choice is made to, in our methodology, first select partners with comparable departments and then, with all the partners, select the specific processes to benchmark. In this way, the partners of the initiator have a voice in the proce3sses that will be benchmarked and will be more motivated to participate.

2.4.3 Incorporating stakeholders

The model of van Hoorn et al. (2006) does not yet involve a step to name the stakeholders of the organization. It is, as stated in the section on learning, important to engage the relevant stakeholders from the start on in the project. As stated in the introduction, the opinion of stakeholders is important in determining performance of an organization. And to ensure the instrument we developed is accepted in the participating organizations, we should identify the dominant coalition in ICUs. Their opinion should have an influence on the processes of the organization to benchmark and the relevant organizational characteristics. Also, they should approve of the performance indicator set. Therefore, we add a step at the beginning of the process, after selection of the partners, so we can assess their opinion as early in the process as possible (Selecting partners is done from the perspective of the initiating organization, so the other partners are not known yet which makes stakeholder identification difficult):

1. Perform a stakeholder analysis

2.4.4 Performance indicator selection by stakeholders

If we know who the stakeholders of the organization are, we can involve them in the development of the performance indicators, instead of letting them only make a choice for a proposed set of indicators. This is logical, since we have stated that performance is defined by the ability to satisfy stakeholder needs. When measuring performance, the stakeholders should therefore have a role in the composing of the performance indicators. Step 4 and 5 are therefore combined into one step:

5. Development of a comparable performance indicator set in conjunction with the stakeholders

In the model of van Hoorn et al. (2006), analysis of organizational variables takes place before development and measurement of performance indicators. This is opposed to other models in which first performance measurement takes place, after which explanations for performance differences are sought for in organizational variables. Finding variables explaining for these differences is than easier and more detailed and relevant variables can be gathered. As explained, Van Hoorn et al. (2006) found it important to first know how the partner organizations look like before performance variables were identified. This does serve the opportunity to, literally, get to know each other and establish a climate of trust. As this reasoning fits to the literature concerning learning, we will also first gather system- and control characteristics of the organizations. However, after measuring the performance variables, it is important to check whether the right contingency variables were found. If necessary, additional information has to be gathered to make it possible to perform a thorough

analysis of performance of the participants and link the findings concerning the output of the ICUs to the way they arrange their resources.

Furthermore, the last two steps in the model of Van Hoorn et al. (2006) are the development and implementation of improvement plans in the organizations. However, these plans have to be developed and executed by the organizations itself, not by the benchmark group, and are therefore combined into one step in the benchmark cycle.

2.4.5 Evaluation of the benchmark cycle

In our opinion, one important step is missing in the benchmark cycle: to learn also from the process of benchmarking, and evaluate the used instruments. A performance measurement system should be evaluated and improved after use, to ensure the portfolio of performance measures is updated and measures the kind of performance that it is desired to measure (Waggoner et al., 1999). This phase is added to the other phases.

2.4.6 Adapted benchmarking methodology

The benchmark methodology we will use is, after the changes elaborated on above, the following:

1. Choice for comparable partners
2. Perform a stakeholder analysis
3. Choice for a comparable process
4. Description and analysis of process and contingency variables
5. Development of a performance indicator set with the stakeholders
6. Unambiguous and integral measurement
7. Analysis of performance differences
8. Developing and implementing of improvement plans by the hospitals
9. Evaluation of the benchmark cycle

In the methodology section of this thesis, we will describe how the steps have to be executed. Looking at the different steps, step 4 involves the mapping of the characteristics of each organization. In the next section, we look to models we can use for this purpose. Furthermore, step 5 consists of the development of comparable performance indicators. This is a critical step in the process, since the success of the project depends on the quality of the benchmark model we will use to measure and compare performance. If we do not measure the right areas of performance, or use indicators that are not valid or reliable, the results of our analysis will not be accepted by the participants.

2.5 Conclusion methodology development

In this chapter, we have developed a methodology for the benchmark project. We have looked to the different types of benchmarking projects and defined our project. It was discussed whether the assumptions underlying benchmarking were valid in the hospital sector, and it became clear that we have to make some adjustments to the method we use to make sure benchmarking will deliver results for the intensive care departments. Then, we looked to theory concerning learning in order find out under which conditions successful collective learning can take place. We have found out, that in order to learn in a inter-organizational group, two things are important: each participant has to be transparent and give insight in its operations to the others, and each participant has to be receptive, or able and willing to take up information provided by the others. We have described ways

to increase both receptivity and transparence and described implications of the learning theory to the methodology we want to use in the project. Based on these implications, and the theory concerning benchmarking methodologies, we have developed a methodology for the benchmarking project. In nine phases, the initiator of the benchmark project can identify stakeholders, find partners and choose a subject. Then, the characteristics of the different organizations are described and a performance indicator set is developed, after which performance of each organization is measured.

To be able to execute the benchmarking methodology, we have to develop some instruments that can be used in the several phases in which we want to measure something of the ICUs. Therefore, in the following section 3, we look to former research regarding ICU performance and find models we can use as a basis for instruments used for analyzing stakeholders, describing characteristics and measuring performance. In section 4 we can then describe how we want to conduct each benchmark phase, using instruments based on the models described in section 3.

3 Theoretical framework 2: Selecting models for the phases in the benchmarking ICU methodology

Now we have developed a benchmarking methodology, we have to find ways to conduct each step in the benchmarking ICU project. Hereto, we describe some theoretical models that can be used as a basis to develop instruments to use in the several phases. We describe the stakeholder positioning grid models for developing a stakeholder analysis instrument in phase 1. For the characterization of each ICU in phase 4, we look to models that can be used for describing an organization. In step 6, performance of the ICUs will be measured and we need a framework for the performance indicators we will use here. Since developing the performance indicator set is a key element in the design of the benchmark instrument, we first look to former research regarding ICU performance to find elements that can be used to evaluate ICU performance in our research. We then formulate requirements for performance measurement model and make a framework in which we can later fit the performance indicators.

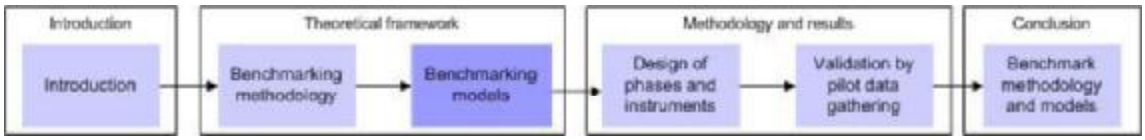

Figure 7: Place of section 3 within the research framework

3.1 Phase 2: stakeholder analysis

In healthcare, the roles, activities and power of the different interest groups are quiet complex. As we have argued, stakeholders define what is performing well and we should incorporate a stakeholder analysis to assess who the stakeholders of the organization are and what their interest in the ICU consists of. Also, we have elaborated on the need to involve the people in the organization in the process of benchmarking. Since we cannot involve all people, we will have to make a choice to involve those that are important to the organization.

3.1.1 The dominant coalition of an organization

In literature, so called dominant coalitions, as defined by Cyert and March (1963) are those stakeholders that have authority, and exert a large influence on the direction the organization takes. Each coalition seeks allies, builds alliances and It is important to involve the dominant coalition in the development of the benchmark instrument to make sure that it will be accepted by them. But how do we recognize the dominant coalition of an organization?

The dominant coalition is important to the organization since it is dependent on them because they control the strategic contingencies important to the survival of the organization (Hickson, Hinings, Lee, Schneck & Pennings, 1971). As they define it, an organization exists of several subunits of people that are allotted tasks to cope with uncertainty and help the organization survive. The subunits differ in the level of importance they have to the organization according to the following factors:

1. The degree to which a subunit copes with uncertainty
2. The extent to which subunits are substitutable
3. The centrality of the subunit in workflows and between other subunits.

Thus, power depends on the contingencies a stakeholder manages. The dominant coalition will exist of those subunits that cope with a lot of uncertainty, are difficult to substitute and are central in the workflow of the organization.

The dominant coalition of today is not necessary that of tomorrow. For example, Hickson et al. (1971) give a particular example of a hospital: Uncertainties that first only could be dealt with by a physician, are now handled by technology such as x-rays and transferred to routine subunits such as inoculation programs. This reduces the level to which physicians deal with uncertainty and therefore decreases their power. Research to the optimal treatment of diseases, can make available detailed treatment plans, which do not have to be executed anymore by a physician but can be handled by for example a nurse. In this way, substitutability is increased, and again power of the physician decreases. Summarized, the power of a subunit is dependent on three factors that have a relation to the degree to which the subunit copes with strategic contingencies for the organization. These factors are not steady but dynamic, and therefore the level of power of a subunit can fluctuate.

3.1.2 The stakeholder typology of Mitchell (1997)

Although this theory concerning dominant coalitions in organizations helps us to explain why some groups do possess more power in an organization than others, the identification of these groups remains difficult since the three factors mentioned are difficult to make concrete. Therefore, we look to the theory of Mitchell (1997), who helps us to position the several groups in an organization and gives us a better idea on where to look for the dominant coalition we want to involve in our project.

Freeman (1984) describes a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objectives". Clarkson (1995) adds to this definition a distinction between primary stakeholders, who are essential to the survival and wellbeing of the organization, and secondary stakeholders, with whom the organization interacts but who are not essential to the firm's survival.

To understand exactly which stakeholders are important to the organization, Eden and Ackermann (1998) developed the power versus interest grid. This grid categorizes the stakeholders into four groups: Players who have both an interest and significant power; subjects who have an interest but little power; context setters who have power but little direct interest; and the crowd which consists of stakeholders with little interest or power. Mitchell et al. (1997) describes a similar theory to distinct between important and less important stakeholders (figure 8).

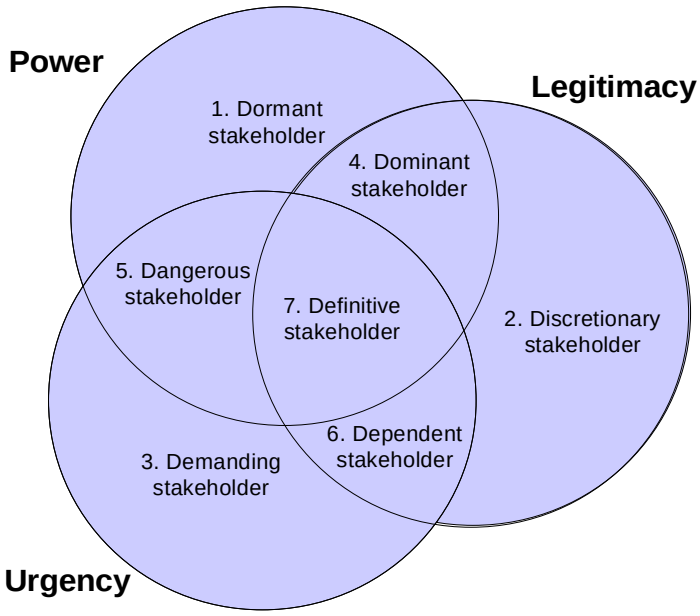

Figure 8: stakeholder positioning model (Mitchell, 1997)

According to them, the position of the stakeholder is based on the possessing of one or more of

three relationship attributes: power, legitimacy and urgency. They distinguish seven categories of stakeholders based on these attributes. *Power* relates to the ability to influence social actors in such a way they do something that they otherwise would not have done (Pfeffer & Salancik, 1974). *Legitimacy* is the defined as the assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchmann, 1995). *Urgency* is the degree to which stakeholder claims call for direct attention (Mitchell, Agle, & Wood, 1997). The more of each attribute a stakeholder possesses, the more important, or salient, the stakeholder is to the organization. Dormant, discretionary and demanding stakeholders are not that important, since there are other stakeholders demanding more attention of the management. Dominant, dangerous and dependent stakeholders will, depending on the combination of the attributes, play a more active or passive role and get more management attention. The last category of stakeholders, the definitive stakeholder, possesses all of the three attributes and is the most important category of stakeholders to the organization: the satisfaction of this stakeholder will have a direct influence on the success of the organization.

Implications of the typology of stakeholder groups on performance assessment are clear: in order to perform well, the stakes of highly salient stakeholders have to be managed well. Succeeding to serve the interests of these stakeholder groups is the key to high performance. Stakeholder positioning is dynamic: due to changes in or in the environment in the organization, the salience of a stakeholder can change.

A limitation of current stakeholder theory is that it is not very fine-grained. It describes large stakeholder groups such as employees, customers and the government, and ignores the different interests within these groups. This has the danger that one might think that mapping of the stakeholders gives an understanding of relevant positions and interests, while these may be more complicated than expected. We should therefore try to check whether the opinions of the stakeholders we interview match with findings in literature.

A second limitation is that the stakeholder positioning model does not go beyond mapping of the stakeholders. Little is clear about the interplay of the different interests of different stakeholder groups and the effects of these on the organization. When several groups of stakeholders are involved, there will certainly be conflicting interests, complicating the decision making process. Therefore, while stakeholder theory may help us to get an idea of the relevant groups having a stake in the organization, it does not provide the answer on how these stakeholders affect performance. This is a problem in our research, since it decreases our ability to describe the transferability of best practices.

With the stakeholder positioning typology, we are able to assess who the stakeholders of the ICU are and what is their position. The opinion of the important stakeholders will then be the basis for our performance measurement model.

3.2 Phase 4: analysis of process and contingency variables

This paragraph handles models that can function as a basis for describing the process and contingency variables of the participating ICU organizations.

3.2.1 The transformation process model

A model we can use as a basis for ICU description is the transformation process model (Slack, Chambers, & Johnston, 2001). It can be used to get more insight in the nature of the operations of organizations, is often used in industrial companies but also applicable to hospitals and gives us insight in the different areas we have to describe to characterize an organization.
All operations produce goods or services by devising processes, which transform the state of something to produce outputs. It describes how inputs arrive and by means of a process are transformed into outputs, which satisfy certain needs of the customers of a company (figure 9).

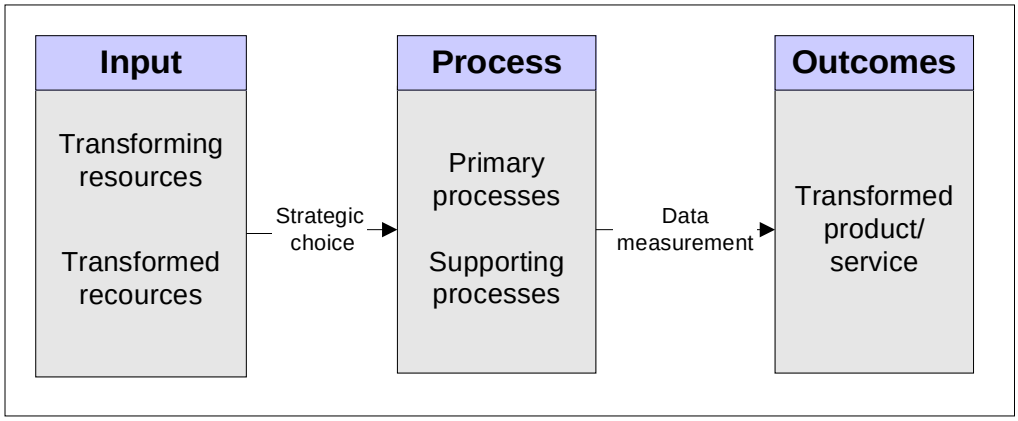

Figure 9: The transformation process model (Slack et al., 2001)

Input transforming resources are all resources that are used in the process. Two types of input are common in all operations: facilities like buildings, equipment, and technology and staff, the people that work in an organization. Input transformed resources are the resources the operation takes in. Examples are materials, information and customers. Input transforming resources are structured in a certain way, aligned to the strategic intentions of the company, to make it possible to have a process. The transformation process is the process in which the transforming resources mutate the transformed resources into outcomes that have a to the customers of the company desirable feature.

In this process, the properties of the transformed inputs are changed in such a way they are more valuable to the customer of the company. *Outcomes* are the end results of the process that add value to the stakeholders, the desired consequences of the transformation process. In a service organization like a hospital, the outcomes of the process are not concrete products but changes in the state of the patient, as opposed to the state the patient would be in when he would not have visited the hospital.

The transformation process model can be very useful to us, since it can help us to characterize the ICU in general in a structured way and fits the level of analysis we have defined, namely the ICU itself, and the subject of our project we have defined, being both the structure, processes and outcomes of the ICU.

Using the transformation process model to describe the ICU, we perceive the ICU as a unit with the incoming patients and information more or less as beginning and the discharged (or deceased) patients, with a certain health status, as an end (figure 10).

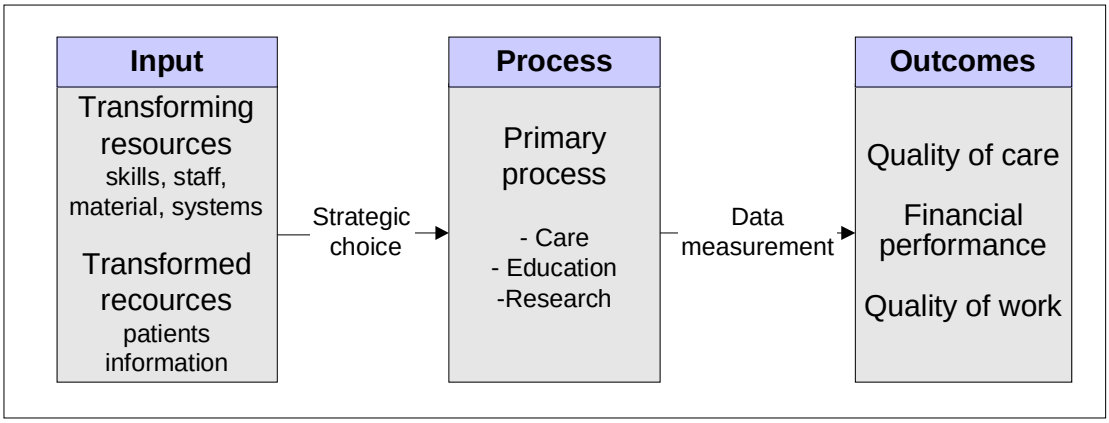

Figure 10: Transformation model applied to the intensive care department (adapted from Slack et al., 2001)

This model can be used as a basis for the categories of questions of which the questionnaire will consist with which we want to develop to assess the process and contingency variables of the ICU.

3.2.2 The patient streams model

The most important input transformed resource of the ICU is, of course, the patient. For ensuring assessing the similarities and differences between the several ICUs, insight in the patient stream going through each department should therefore be offered. For this purpose, we can make a model depicting the patient streams around the ICU (figure 11) .

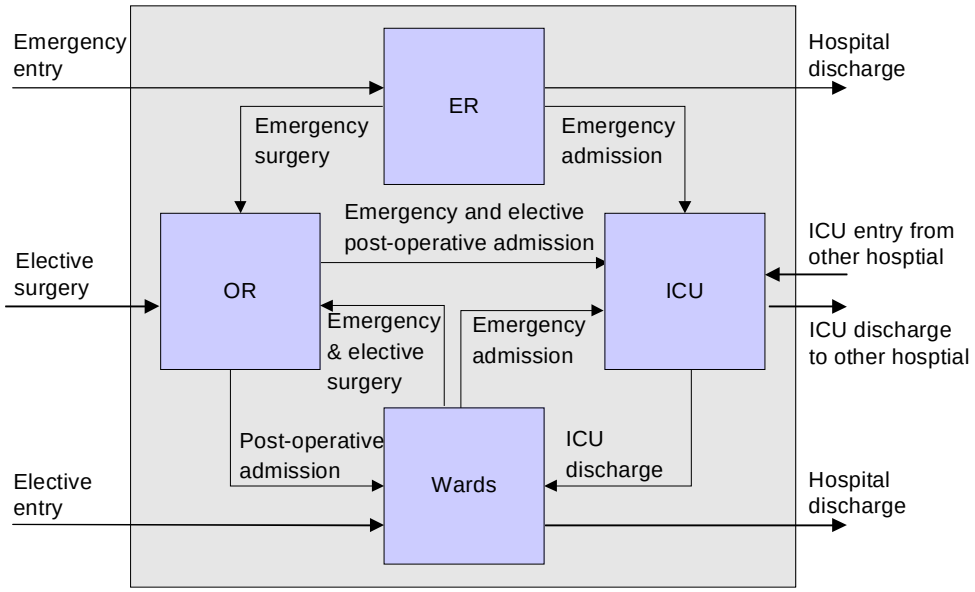

Figure 11: ICU within the hospital: patient stream chart

3.3 Phase 6: development of a performance indicator set

Now we have a basis for description of the ICU organization, we can look at the way we want to measure the performance of the ICUs. Since we are not the first trying to measure and improve performance of the ICU, before we construct a framework for our indicator set we look at former research, to assess what we can apply to our own work. Since the early nineties, efforts have been made to capture ICU performance, to compare it to others or to a standard and to find starting points for improvement. In the following section, a short history of ICU performance measurement is given to see what we can learn from the past.

3.3.1 A short history of IC performance evaluation: what can we learn from the past?

As the organization of ICUs as separate organizational entities started in the United States in the early nineties, it became easier to investigate how this department could be organized the best. This was due to the better-defined borders of the ICU and the concentration of responsibility, resting with one group of physicians instead of multiple specialisms.

Two kinds of evaluative approaches to the ICU can be distinguished from literature. In the first approach, outcome prediction models are constructed. The second approach tries to identify contingency factors having an impact on ICU performance. Both approaches can give us information usable for developing our own framework. A literature review was conducted to find articles concerning ICU performance measurement, of which the methodology is described in appendix 1.

3.3.1.1 Outcome prediction models

The first approach tries to relate an outcome of a specific ICU, to the expected outcome of that ICU. With an outcome prediction model, it is possible to predict the expected outcome on an important indicator when certain variables are known. Characteristics of the patient's health status are the input of the model, and the expected outcome, on for example length of stay or mortality rate is calculated by means of an algorithm based on a large quantity of patient data. The hospital's mean on this particular outcome can then be compared to that of other hospital's mean or to the standard of the instrument. The gain of these models is that they make it possible to evaluate the own performance in one important area, controlled for differences in patient mix. Examples of this approach are the development of the APACHE II, III and IV standardized mortality rate (SMR), and the SAPS-II, TISS and NEMS workload scores. Limits of this approach are that these methods only represent one aspect of care, and therefore lack to give a good representation of performance, since performance is broader than the one aspect of care one outcome indicator can represent (Rotondi, Sirio, Angus, & Pinsky, 2002). A second disadvantage is that these methods do not point to the components of care that have to be improved to improve outcomes. A third shortcoming is that using an ICU outcome indicator limits the evaluation of care to the ICU only. Care provided in other departments of the hospital is not evaluated. That is contradictory to the role of the ICU, which is always part of a larger care process. And since this method measures only one aspect of performance, it will not be able to represent the interests in the ICU process of different stakeholders important to the ICU. For example, a low standardized mortality rate does not say anything about the availability of beds, which is valuable to referring specialists. Some authors tried to overcome some disadvantages by combining two types of outcome measures representing different aspects of performance, like SMR and standardized resource use to represent quality and efficiency (Rothen et al., 2006). But although the outcome prediction models can give us important information of the ICU,

to appraise and compare integral ICU performance, broader measures are needed than one or two outcome indicators.

3.3.1.2 Studies identifying contingency variables

As stated above, the outcome prediction models have in common that they are not developed to provide starting points for improvement of care. The authors following the second approach try to identify variables that have an influence on different aspects of ICU performance. If these variables are changeable, they can be used to improve performance.

The first author elaborating in this research area was Donabedian (1982). He proposed quality of care is determined at several levels, like the technical level, including factors like knowledge and skills, and interpersonal level, like informed consent and privacy. One of the early investigators of ICU performance, Shortell, build on these different levels and constructed a questionnaire relating to leadership, organizational culture, communication, coordination, problem solving/conflict management, and team cohesiveness (Shortell, Rousseau, Gillies, Devers, & Simons, 1991). Zimmerman et al (1993) conducted an attempt to link management and organizational factors to performance. They discriminated good and bad performing ICUs, measured by mortality rate, and used regression analysis to find variables relating to performance. They hypothesized culture, coordination, leadership, communication and problem solving would have an effect on the performance of ICUs. Data from 42 American ICUs, some with an extremely high, and some with an extremely low mortality rate, were compared. Unfortunately, they were not able to distinguish ICUs with superior risk-adjusted survival by bad performing ICUs with their structural and organizational questionnaires. They concluded the ICU is too complex to catch performance with just these variables. These authors all assumed performance could be divided in several functional areas that can be measured with indicators.

In Europe the EURICU'S project was conducted from 1989 on, which was the first study to adopt a systematical approach: the ICU was perceived as having an input (a patient with clinical conditions at the arrival on the ICU), throughput and output (a patient with clinical conditions at the moment of discharge of the ICU) system. These study made clear that huge differences in outcomes, like mortality rates and resource use, existed between European countries. Also, they found the clinical outcome of patients was significantly associated to organizational variables like organization commitment, results oriented culture and predictability of workflow.

In the same line of thinking lays the work of Pronovost, Miller & Dortman (2001). Their aim was to develop a set of quality indicators for the ICU, per category as described by Donabedian (1982). They described the following steps to develop a set of indicators (Pronovost, Miller, Dorman, Berenholtz, & Rubin, 2001): first, they conducted a literature review to identify structure and process variables that were associated with improved ICU outcomes. Then, they made a selection of variables based on some conditions (like the outcome had to lead to an improved performance). A second selection served to choose outcome indicators. After specifying the who, what, where, when and how of each indicator they validated the reliability and validity of the indicators. They aggregated the final indicators in four sets: outcome, process, access and complication measures. Another gain this study provided is the link that was made between improving quality of care and efficiency of care (textbox 1). A limitation of this study is that only physicians, and no other stakeholders of the ICU, selected the final set of outcomes.

In the Netherlands, faced by the intensifying attention for performance measurement, the professional association of intensive care physicians also developed an indicator set to measure quality of care, based on a literature review of the RIVM and the guidelines of the CBO. They selected eleven structure, process and outcome indicators according to the method of the Agency for Healthcare Research and Quality (AHRQ) in the United States. Their goal was to provide hospitals with a set of indicators that could either be used internally for giving indications of improvement or externally for benchmarking with other ICUs. That makes this set useful for our study. A disadvantage of this set, again, is the lack of involvement of other stakeholders of the ICU next to physicians, and the resulting focus on medical outcomes of care. Also, feasibility was no hard condition for their indicator set, causing it to involve indicators like quality of life that are still difficult to measure.

Textbox 1. *Although there often exists a tension between providing quality of care and being as efficient as possible, these two do not always rule each other out. Pronovost et al (2002) show us the link between both improving quality and efficiency with one measure. Take, for example, the use of appropriate sedation. When sedation is interrupted daily to check whether mechanical ventilation is still needed, ventilator days decrease by 33%, which decreases the number of complications and the length of stay. So, the quality of the provided care increases. Also the cost of care decrease. Knowing the number of ICU admission per year and the marginal cost of an ICU day, the following example of an average American ICU shows us the cost we can cut:*

Opportunity to improve at Anywhere ICU	
Mean performance of appropriate sedation	64%
Excess days of mechanical ventilation	864 days
Excess ICU days	1260 days
Excess cost in dollars	$1,512,000

3.3.1.3 Conclusion ICU performance evaluation and implications for our model

In literature, since the nineties much attention has been given to appointing performance indicators to the ICU. Some researchers focused on predicting one "ultimate" outcome using patient or hospital characteristics, other tried to identify variables responsible for shifts in performance to find leads for performance improvement.

These studies provided us several insights. First, they identified multiple indicators of (medical) performance and researched the validity of many of those. We will use these later to assess performance in our study. Second, Pronovost et al. (2001) provided us with idea that the aim for efficiency and quality of care are not contradictive, but often go side-by-side, which is important since we want to perform research to integral ICU performance. Third, the indicator set developed by the CBO, is an excellent instrument to measure quality of care, an important part of the performance we want to measure. Furthermore, the triad model of Donabedian (1982), used as a basis for the CBO indicator set, is a good basis for involving not only outcomes but also organizational aspects in the evaluation of care. Lastly, the body of literature concerning criticism on performance measurement provides us with some boundary conditions for our benchmark instrument, like the importance of face-validity, the importance of feasibility and the combination of both completeness and compactness.

It is also possible to find some gaps in the body of knowledge concerning ICU management. With the exception of performance related to patient satisfaction, the literature on ICU performance is primarily concerned with performance from the perspective of staff dedicated to the ICU. Literature

combining the interests of multiple stakeholders is scarce. Since we define performing well as being able to manage the demands of the stakeholders of the organization, we have to incorporate stakeholder opinion in our performance indicator set.

Although some authors performed research to the resource use of intensive care units, most emphasis was placed on evaluating medical outcomes. Except for the EURICU'S study in the eighties, no studies to the efficiency or effectiveness of the whole IC department were performed. Since our aim is to evaluate integral ICU performance, we will have to expand our indicators to other areas besides the medical one.

3.3.2 Developing a performance measurement framework

Now we have looked to former research, we can develop a framework for our performance measurement model. As stated we want to:

- Incorporate stakeholder opinion in the selection of performance variables
- Cover integral ICU performance
- Not only look to outcomes but also to input and processes

To this aims, we describe two models we combine into a performance indicator framework.

3.3.2.1 The triad model of Donabedian

Hereto, we can use the triad model of Donabedian (1982) to develop a set of performance indicators. He stated that to fully understand the performance of a healthcare department, we have to consider three kinds of indicators: structure, process and outcome variables in conjunction. The idea is that there exist a link between the three, in such a way that the probability of achieving a desired outcome is greater when the right structure is adopted and the patient receives a particular process of care (Pronovost et al., 2001).

Structure indicators (how care is organized), refer to health system characteristics that affect the system's ability to meet the health care needs of individual patients or a community (Mainz, 2003). Structural indicators describe the kind of resources used by a health organization to deliver programs and services, and they relate to the presence or number of staff, clients, money, beds, supplies, and buildings. With the structure variables as the basis of the organization, a hospital decides how to use these resources to provide care and reach other organizational objectives. These structure variables resemble the input transforming resources mentioned by Slack (2001), in the sense that the structure variables indicate how the transforming resources are arranged.

Process indicators (what providers do), consist of a series of activities undertaken by the personnel on the ICU. With process we mean the care process that takes place between the care provider and the patient (Donabedian, 1982). This does not only incorporate medical interventions but also, for example, logistics like transportation. In teaching hospitals, performing research and giving education are also part of the primary process. Process variables indicate how the process described in the transformational model is organized.

Outcome indicators (what happens to patients) include the results of the provided care: the consequences of the structure and process variables. Examples are the satisfaction of patients and staff, treatment effects and number of complaints. There is an enormous amount of data we can measure to compute outcomes. Outcome variables provide us with information about a certain aspect of care: for example, the number of patients treated each year tells us something about the efficiency of the ICU. In that way, they give us information about the outcome of the transformation process as described in the transformation model (Slack et al., 2001).

3.3.2.2 Areas of ICU performance

Hospitals do have the main goal of providing quality of care to their patients, doing this in a somewhat efficient way, with a high quality of labor. A hospital that only cures patients, but does not pay attention to the work environment or financial aspects, is also not likely to survive. As stated before, research to ICU performance is mainly centered in the medical area. But according to van Hoorn et al (2006), hospital performance finds place in three important areas (figure 12). This comes close to the aim of evaluating "integral performance" as we stated.

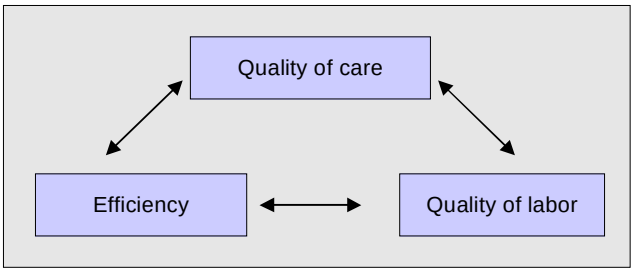

Figure 12: three areas of quality of care (Van Hoorn et al, 2006)

Although making this distinction is useful showing us quality of care exists of multiple factors, this distinction is somewhat superstitious, since there are many relations between these three components of quality of care. Also, the perception of what quality of care is can change: for example, maybe in some years sustainability may be an important topic too. It is the perception of stakeholders that determines how well the organization attains the goals that are set. For measuring performance, we should therefore research the stakes and interests of the people having a relation to the organization and measure how well the organization manages these stakes.

3.3.3 Combing the models in a framework for performance indicators for ICU evaluation

When we combine these two models into a framework for the performance indicator set we want to use, it looks the following:

	Quality of care	*Efficiency*	*Quality of labor*
Structure			
Process			
Outcomes			

Figure 13: Framework for performance indicator set

In this way, nine areas are shaped that have to be filled with performance indicators to represent performance. Structure, process and outcome indicators measure performance of the ICUs. The structure performance indicators evaluate how each hospital uses its resources. Process performance indicators evaluate the processes we want to look to and the outcome performance indicators give us an idea of the degree to which quality of care, efficiency and quality of work that are reached. These performance indicators stretch the areas of quality of care, financial performance and quality of work. Key stakeholder groups should each be represented by a sufficient number of performance indicators representing their interests in the relevant blocks. For example, the interests of the hospital management as stakeholder of the ICU are likely to be found in the efficiency blocks. Patients find their interest most likely back in the area of quality of care and employees in the quality of labor section and quality of care section.

But what exactly is a performance indicator? The OECD has defined an indicator as a 'parameter, or a value derived from parameters, which points to, provides information about, and describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value' (OECD 1994). Somewhat more condensed, performance indicators are a selection, or combination, of variables that aim to define some or all aspects of a performance (Hughes & Bartlett, 2002). They reflect the degree to which a certain performance is attained.

In literature, we can find the following boundary conditions with which individual indicators have to comply to give a good representation of performance (table 2).

Table 2: Boundary conditions for the individual and the set of indicators

Individual indicators [2]	
Face - validity	Degree to which the stakeholders believe the measures evaluate an important aspect of performance
Content-validity	Degree to which the indicator measures the domain it represents
Reliability	The extent to which a test is repeatable and yields consistent scores, regardless of hospital or rater
Transparency	Based on agreed definitions clear to all participants, described exhaustively and exclusively
Feasibility	Measurable, not too much extra registration pressure on ICU staff
Dynamic	Improvement of the indicator is possible
Evidence-based	Based on the best available evidence

Furthermore, we list some conditions to which the set of indicators should comply. These are based on our findings regarding the framework of the performance indicator set mentioned above. They also include some conditions that improve the usability of the framework: compactness and future-resistance.

[2] Adapted from van Pullen (2004) and Mainz (2003)

Table 3: Boundary conditions for the individual and the set of indicators

Set of indicators	
Completeness	a) All aspects of ICU performance (figure 9) should be covered
	b) Structure, process and outcome indicators should be incorporated, as described by Donabedian (1982)
	c) Interests of all important stakeholders are covered
Compactness	The set does not contain redundant indicators
Future-resistant	No necessary changes to the set are foreseeable

3.4 Conclusion model selection

In section 2 we have developed a methodology for benchmarking of the ICUs. In this section, we have made a start with designing instruments to use during the phases in which they are needed. For phase 1, the stakeholder analysis, we have described the stakeholder typology model of Mitchell (1997). For step 4, in which we want to assess the system- and control characteristics of the ICUs, we have described the transformation process model that can be used as a basis for the categories in the questionnaire we want to develop. At last, we have developed a framework for performance measurement in phase 6, in which we want to evaluate performance in three domains, using structure, process and outcome variables and represent the needs of the most important stakeholders of the ICU. In the next section, we further define how each phase of the methodology section is designed, using for some phases the models we discussed in this section to construct the instruments.

4 Design of benchmark phases and instruments

We have formulated a benchmarking methodology and have described models needed for the several phases of this methodology, such as a framework for our performance measurement model. In this chapter we describe how we want to walk through the benchmark cycle with the ICU departments, thereby filling in the benchmark-methodology, using for some phases the models described in chapter 3. We refine the benchmark model we develop especially for the use on the participating ICUs. Hereto, we describe per phase the phase objective, the link of the phase with theory described before and the instruments that will be used to walk through the phase with the ICUs. Validity and reliability of the methods used are also discussed.

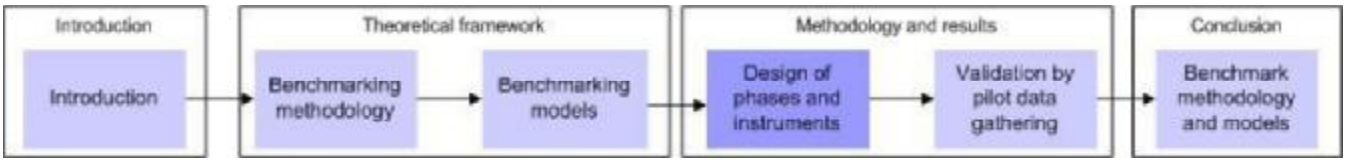

Figure 14: Place of section 4 in the research framework

4.1 Phase 1: choice for comparable partners

In this phase, the participants to the benchmark cycle should be chosen.

4.1.1 Phase objective

The aim of this phase is to compose a benchmark group that will be motivated and able to conduct the first benchmark cycle successfully.

4.1.2 Phase link with theory

There exists a tension in the construction of a benchmark instrument; if we would want to develop an instrument that could also be used among other partners than the now selected hospitals, this could conflict with the wish to make the benchmark instrument especially fit for the participating hospitals. For example, if we wanted to develop an instrument usable for all Dutch hospitals, we could not incorporate performance in the areas of research and education. Of course, benchmarking can be done with an infinite number of partners, but as described in section 2, to make benchmarking successful, it is important the designed instrument does have a good fit with the participants; partners have to be comparable. Since benchmarking in the hospital sector is not used often yet and new to most participants, it is of importance to carefully select and motivate the partners to let their participation be successful. Therefore, we choose to focus our efforts on the participating hospital and let internal validity to the participants outweigh external validity to other hospitals.

In later benchmark cycles, the initiators can choose to participate or not in new benchmark cycles. Partners can participate in the processes they find interesting, and refrain from participation when they do not have resources available or find the subject unattracting. The partners for these cycles should be chosen based on their ability and willingness to learn from each other. As we have stated, in order for the benchmark project to be a success, participants should both be receptive and transparent. Therefore, selecting partners should be based on their experience with the chosen process, the willingness and ability to deliver data to the other participants and the level of resources the partners are prepared to investigate in the benchmark cycle.

4.1.3 Phase methodology

In this paragraph we describe on basis of what criteria the benchmark partners are chosen.

As stated, initiative to benchmark was taken by a university medical center. Teaching hospitals provide on top of common patient care top clinical care and top referent care. Top clinical care involves special medical procedures, and top referent care means the hospital is "the last resort"; patients are not referred further anymore. Examples of top clinical tasks that are performed by some of the teaching hospitals are organ transplantations, complicated hart surgeries and neonatal intensive care. To perform the tasks assigned to teaching hospitals next to the tasks of a common general hospital, the teaching hospitals receive an extra budget of the Ministry of Education, Culture and Science.

Being part of a teaching hospital has implications for the participating intensive cares: since all patients are referred to the ICU by other physicians, the tasks of these referring specialists are reflected in the diagnoses of the patients treated on the ICU, and since teaching hospitals treat the most complicated patients, these also end up on the ICU. For example, since surgeons in the LUMC, Erasmus MC and UMCG perform liver transplants; their ICUs accommodate these patients after the surgical procedure. A previous research to ICUs in the Netherlands revealed big differences in patient characteristics on ICUs between teaching and other hospitals: 62 vs. 20 percent of the patients were ventilated automatically in teaching compared to general hospitals, the average length of stay was more than 2 times as high in teaching hospitals and the mean APACHE II score (an index for severity of disease) was around 10,5 of non-teaching compared to 12 of teaching hospitals (Reis Miranda & Spangenberg, 1992).

To make sure the partners aim to the same goals and to get an idea of what they expect of the project, interviews are held with represents of each hospital. These interviews have, on the one hand, the goal of informing and motivating the participants, and on the other hand serve to get an idea of the conditions under which the hospitals are willing to participate.

4.2 Phase 2: perform a stakeholder analysis

The second phase of our methodology is to get an idea of the different interest groups in the organization. The result of this phase is a list the salient stakeholders and an overview of the dominant stakeholders.

4.2.1 Phase objective

The first aim of this phase is to identify the stakeholders of the organization, whose opinion we want to incorporate in the performance measurement instrument. This is done to assess the salience of the stakeholder to the organization. Second, we want to point to the dominant coalition in the ICUs, to ensure we can involve them in our project so they will support the resulting benchmarking methodology and instruments.

4.2.2 Phase link with theory

We have described in section 3.1 the stakeholder typology model of Mitchell (1997). At first, this theory helps us to distinguish stakeholders and none- stakeholders of the ICU, since stakeholders do have to possess at least one of the attributes of power, legitimacy or urgency. Since we have stated that performing well is based on meeting the demands of key stakeholders, we should assess who these key stakeholders are. Using this typology, we can divide all ICU stakeholders in the nine

categories. The stakeholders who possess at least two out of the three attributes are the most salient stakeholders, whose needs should be incorporated in the performance measurement instrument.

Dominant stakeholders are those whose possess authority, which is a combination of legitimacy and power (Mitchell, 1997). The dominant stakeholders are in the next phases involved in making decisions to ensure they will accept the resulting instrument.

4.2.3 Phase methodology

We first make a list of all stakeholders of the ICU and place them within the stakeholder typology of Mitchell (1997). This list and the stakeholder typology is made and replenished with the help of interviews with a general manager and a quality manager of the ICU.

In addition to Mitchell's stakeholder typology, Bourne et al. (2005) developed a framework to map stakeholder power, proximity (comparable to Mitchell's legitimacy), vested stake and interest in the project (the combination of the latter two comparable to Mitchelll's urgency). We can use this framework to frame the position of the stakeholders to the IC departments.

Hereto, we use an online Delphi stakeholder survey, adapted from a similar survey designed by Postema (2007) to identify and categorize stakeholders based on Bourne's index. The respondents name the five stakeholders they perceive as most important to the ICU and give them a score from 1 to 4 or 5 on each attribute (see appendix 2 for the survey questions). Also, they are asked to describe the interests of these stakeholders in the organization. The survey was distributed among 12 people (4 physicians, 4 nurses, 4 supporting/management staff) in the Erasmus MC. Then, it was evaluated whether the answers to the surveys and the interviews were homogenous or not, to decide whether to disperse more surveys or not.

In addition to the survey, nine interviews are held with a cluster manager and eight IC heads. A full list of all interviews held for the sake of the benchmark project is displayed in appendix 3. They are asked, to mention the five stakeholders they perceive as most important to the ICU as a whole, and their role an interests in the ICU. Since these interviews are held by the same person with the same list of questions, the results of these interviews are not influenced by inter-rater differences.

For each of the stakeholders mentioned as one of the five most important stakeholders by at least one respondent, the score on each attribute is used to find out the place of the stakeholder group within the typology model of Mitchell. In this way, we can identify the most salient stakeholders and the dominant coalition in the organization. We describe their position based on the interviews we conducted and the description of the interests of the stakeholders made by the respondents of the survey.

4.3 Phase 3: choice for a comparable process

After the selection of benchmark partners, the area of the organization that will be benchmarked can be chosen by the dominant coalition of these organizations.

4.3.1 Phase objective

Aim of this phase is to select a (part of a) process that is subjected to evaluation in the following steps, that is important to the dominant coalition in the organization.

4.3.2 Phase link with theory

The choice for a process should be based on the relevance of the area to the organization and should be chosen by the dominant coalition to ensure their support and the relevance to them. Each of the eight participants should be engaged in the choice for a process, and the chosen process should appeal to all participants to ensure motivation of further participation.

4.3.3 Phase methodology

In this paragraph, we describe how the process to be benchmarked should be chosen. It is described how we establish a list of potential processes to benchmark and how a choice for one of these processes is made by the dominant coalition of the ICUs.

4.3.3.1 Making a list of possible processes to benchmark

For assessing which process should be the focus for the first benchmark cycle, the most visible processes on the ICU are listed. These are divided in four areas: processes around stakeholders of the ICU, internal work processes, processes around the organizational resources and financial processes. Interviews are held with representatives of all participating hospitals to rate their preference for processes to benchmark.

4.3.3.2 Phase outline

With the list with processes available, the ICU department heads are asked to rate the relevance of each process to their ICU on a Likert scale from one (not interesting) to five (highly interesting). Also, they are given the opportunity to name processes that were not on the list, but they also found interesting to benchmark. After this assessment, results are provided to the ICU managers in a meeting to make the choice for a focus area. A choice for certain processes can then be made based on the provided score of each project and discussion among the participants concerning their shared interests.

4.4 Phase 4: description and analysis of process and contingency variables

In this paragraph we describe phase 4, in which we analyze process and contingency variables of the ICUs. Hereto, we develop a questionnaire, distinguished in categories based on the theoretical section and filled in with questions based on a description of the ICU we make and several sources on ICU management.

4.4.1 Phase objective

The aim of this phase is to analyze process and contingency variables of the ICUs by means of a to be developed- questionnaire. The result of this phase is a list of these variables per hospital and an overview of the differences and similarities between the ICUs.

4.4.2 Phase link with theory

The value of this phase is twofold: for the process of learning, it serves to get to know each other and stimulate trust, since relatively low-sensitive information is exchanged and partners can show their willingness to cooperate to each other. As stated in the theoretical section, for the benchmarking process, this phase is essential: when in later phases performances measures are gathered, the process- and contingency variable can give us information on how these performances were reached. Therefore, in this phase we should develop an instrument to identify process- and contingency factors. A questionnaire is a good means for this, since in this way information can be gathered in a

structured way with all hospitals answering the same questions. It is important that it has both face-validity (does the questionnaire, according to the participants, measure what we want to measure) and has content-validity: do the questions represent the domain they should represent.

4.4.3 Phase methodology

Since no such questionnaire is available, we need to develop one. We already described on basis of which models we want to assess the process and contingency variable (section 3.2), and make use of these models to develop the questionnaire. In this paragraph, we describe how we distinct categories and fill them in with questions (4.4.3.1). When this is finished, we describe how phase 4 should be conducted with the ICUs, using the developed questionnaire (4.4.3.2).

4.4.3.1 The questionnaire

In this paragraph, we describe how we first make a distinction in categories of the questionnaire, then we fill these categories with questions.

In section 3.2 we mentioned the transformation model as a model fitted as a basis to describe the process and contingency variables. Based on the distinction made in this model, we can divide the questions in four categories: input transforming and transformed resources, processes and outcomes.

We have listed the input transformed resources of ICUs in section 3.2 to be the patients that enter the hospital and the information concerning the health status of those patients. Therefore, we add questions concerning the number and health status of the patients entering the ICUs. The patient stream diagram mentioned in section 3.2 is used to map patient streams to each ICU. The health status of incoming patients is assessed with the APACHE II method, which we mentioned in section 3.3.1 and which is concerned to be one of the most valid and reliable way to measure patient health status (for a discussion on the validity of the APACHE II instrument we refer to .

The input transforming resources of the ICU are the medical and nurse staff of the ICU, the ICU buildings, the technological systems needed to treat the patients and store information of the patients. Also materials needed to treat the patients like medicine make part of these resources. We ask questions concerning the form and quantities of these resources.

These transforming resources are structured in a certain way, differing per ICU, in order to make it possible to conduct the processes on the ICU that deliver value to the patients. To assess how these resources are structured, we make use of the categories described by van Hoorn in the Benchmarking OK project (2006):

- Lay-out: concerning the number of units per bed, the use of open versus close IC boxes, the availability of a pharmacy department on the ICU and so on
- Organizational structure: place of the ICU within the hospital, hierarchy on the ICU etc.
- Functional groups: here the functions of different organizational subunits are specified
- Tasks and responsibilities: lists the tasks and responsibilities of the work force
- Financial: asks to way financial resources are divided on the ICU

To assess the processes in detail would be to detailed, but to get a view of the important processes on each ICU we ask to protocols describing the practices concerning admission and discharge of patients, we ask for a description of the structure of each day and we look to the way the most important daily meeting, the MDO described in the introduction, is conducted.

To assess the output of each ICU, we again use the patient stream diagram to look to the number and destination of leaving patients. There is no valid standardized way available to assess the health status of leaving patients. Only the mortality rate gives us an idea of the effectively of treatment.

We use the questionnaire of Reis Miranda (Reis Miranda, 1991) the NIAZ norms concerning ICU management and organization, the CBO guidelines concerning organization of the ICU (CBO, 2006), the ICU characterization forms used by Hautvast et al. (2001) and the professional ICU audit questionnaire to enrich the questions we developed ourselves. Out of these sources, we filter questions in the above mentioned categories that do give us a clear view on the differences and similarities in organizational set-up between the ICUs.

To improve the validity of the questionnaire, we show and adapt it in interviews with a logistics manager, a quality manager and a care manager. With the questionnaire finished, it was handed out to three physicians of three participating hospitals to assess whether we did not make mistakes in the formulation of medical terms or did forget obvious questions. Their feedback about unclear, redundant or missing questions is used to adapt the questionnaire.

The developed questionnaire is added in appendix 4. Definitions of concepts are, were needed, listed in appendix 5.

4.4.3.2 Using the questionnaire to assess the process and contingency variables

So how should this phase be conducted? The developed questionnaire can be filled in by all the ICUs. For the sake of increasing internal reliability, the questionnaire is first filled in as far as possible by the researchers with the help of provided annual reports, audit reports and NICE reports provided by the ICUs. These data, together with the questions that could not be answered by the researchers, are then handed over to the hospitals to check and be completed. In this way, all hospitals provide the data they have. We make an overview of these data and give insight in remarkable similarities and difference between the ICUs.

4.5 Phase 5: development of performance indicators in conjunction with the stakeholders

In section 3.3, we have established a framework for performance indicators of ICU performance. In this phase, we fill this framework with indicators, based on the opinion of the salient stakeholders identified in phase 1. We let the dominant stakeholders have a last say on the composition of the set.

4.5.1 Phase objective

The phase objective is to develop and choose, together with the stakeholders identified in phase 1, a set of performance indicators. The result of this phase is to have a set of performance indicators that fits the developed framework and complies with the boundary conditions mentioned in paragraph 3.3.

4.5.2 Phase link with theory

This phase serves to offer insight in the performance that is important to the stakeholders and to develop a performance indicator set accordingly. In section 3.3 we have explained why it is important to involve the areas of quality of care, efficiency and quality of work and why they should be measured by means of a set structure, process and outcome indicators.

4.5.3 Phase methodology

To compose the final set of performance indicators, we have to take several steps. There is already framework in which the performance indicators have to be fitted. Now, the first step is to gather potential performance indicators. To find potential performance indicators, two sources are used: literature and representatives of the important stakeholder groups. By listing indicators from peer-reviewed articles, we ensure that we use, were possible, already validated, reliable and accepted indicators for the composition of our set. We can than check if all indicators from literature comply with the boundary conditions we have defined for individual indicators. This ensures us the remaining list contains the indicators we are looking for.

By then assessing the stakeholder interests, we can make a choice out of the potential indicators from literature and add indicators for interests that are not represented in the list of potential indicators from literature. This results in a list of performance indicators, containing indicators already established in literature and representing the interests of the most salient stakeholders.

We then have to check whether the sett complies with the boundary conditions for the set mentioned in section 3.2. This leaves us with a potential performance indicator set. The last step to take is to gain the approval of the dominant coalition of the ICU. Therefore, the department heads are asked to give their opinion about the potential set. Now we have described the outline of the phase, each step is elaborated on.

4.5.3.1 Composition of the list of performance indicators from literature

First, we conduct a literature review to find performance indicators for ICU management. Details of how we perform this literature review can be found in appendix 1. Goal of this review is to collect potential performance indicators in all three areas of performance we have designed, and indicators for all salient stakeholders. We then check whether all indicators found in literature comply with the boundary conditions for the individual indicators we have defined in section 3.2. Information concerning the conditions we have listed can often be found in the articles they stem from. It is expected several indicators will not comply with one or more of the conditions.

4.5.3.2 Identifying the interests of the stakeholders

Second, we list the interests of each stakeholder group by interviewing represents of each group. ICU staff and patient interest are represented thoroughly in literature, so we do not interview them. We speak to a nurse and a nurse unit head to assess the interest of nurses, a division manager to assess the interest of the hospital board, a voluntary ICU host to assess the concerns of patient family members and a surgeon to represent referring specialists. Out of those interest, we distract performance indicators for the salient stakeholder groups.

We ask the following questions:

- What is the nature of your stake in the ICU?
- How do you evaluate whether the ICU does a good job?
- Which aspects of ICU performance are important to you?
- With which indicator we can measure how the ICU performs on this variable?

This leads to an overview of the interests of the different stakeholder groups and a list of indicators per stakeholder group.

4.5.3.3 Establishing a potential set of indicators by combining stakeholder interests with performance indicators found in literature

Now we have a list of potential indicators distracted from literature and an overview we can combine those two to compose a potential set of performance indicators.

Then, with the help of the conditions for the indicator set, we will make a selection out of the remaining list of performance indicators and add indicators deduced from the stakeholder interviews, to compose a set of indicators that also complies with the boundary conditions of the whole indicator set and represent the key stakeholder groups. We fit the indicators from literature that represent stakeholder interest into the framework, making sure we represent all salient stakeholders, have indicators in the three areas and use structure, process and outcome indicators.

4.5.3.4 Choice for the performance indicators by the dominant coalition

Once the final performance indicator set is ready, we propose this set to the ICU management. ICU management can than decide if the set really does represent the interests of the different stakeholders, and if the selected indicators are valid to represent ICU performance. Their feedback is used to improve the indicator set. Also, a discussion concerning the definition of each indicator has to take place; to ensure that the measurement in the next phase is done in an unambiguous way.

4.6 Phase 6: unambiguous and integral measurement

In this phase, the data needed to calculate the scores on the performance indicators are gathered.

4.6.1 Phase objective

The aim of this phase is to measure the scores on the performance indicators on each participating ICU. Result of this phase in an overview of the scores of each ICU on each performance indicator.

4.6.2 Phase link with theory

Measurement of the scores is mainly a result of the phases in front of this phase.

4.6.3 Phase methodology

These data can partly be derived from the data sources that were also used to answer the characteristics questionnaire. To answer some to the quantitative indicators, the hospitals have to perform data queries in their PDMS, personnel or financial systems. An interviewer, asking question in a standardized way, can gather the qualitative questions.

4.7 Last phases of the benchmark cycle

The next phases cannot be executed in the time this research is performed, but have to be executed to fulfill the first benchmark cycle.

4.7.1 Analysis of performance differences

The objective of this phase is to give insight in the assessed performance differences and find best practices to explain for the good performances found. Now the characteristics of each hospital are known and the performance indicators are scored, there should take place an analysis of the scores of each ICU. This analysis should take place on two levels:

1. The scores of each ICU in relation should be related to the scores of the others
2. The scores of each ICU in relation to the characteristics of the respective hospital.

The first point serves to identify over- and underperformers. In the second analysis, characteristics can be related to the level of performance. This makes it possible to identify best practices in the areas of quality of care, quality of work and efficiency.

It is likely analysis of the relation to characteristics and performance will lead to new questions. These can be the basis for a new benchmark cycle.

4.7.2 Developing and implementing of improvement plans by the hospitals

Based on the analysis and the best practices, the ICUs can use the acquired knowledge to develop improvement plans for their own ICU. They can execute these plans to realize improvements in the quality and efficiency they provide. In this phase, it will become clear how much the hospitals have actually learned from each other, and how they are able to translate the results to the own organization.

4.7.3 Evaluation of the benchmark cycle

The last step is the evaluation of the benchmark process. The evaluation should focus on two points

1. The process of benchmarking
2. The content of the benchmark process

To improve the benchmarking methodology, the participants should give feedback about how they experienced the process. They should also consider whether the right instruments were used. Does the performance indicator set represent the right areas of performance of the ICU? It is possible to link the indicators to characteristics, or is this link difficult to establish?

4.8 Conclusion phase and instrument design

In this chapter, we have described how each phase of the benchmark methodology should be conducted. We have developed a methodology per phase and designed the instruments needed to walk through each phase, all adapted to benchmarking on the ICU. We know have everything ready to really start benchmarking on the ICU, and that is exactly what we are going to do in the next chapter.

5 Pilot project: results of the first benchmark cycle

In this chapter, we describe the pilot we have conducted to test whether the methodology we developed and the instruments we designed are valid for use by the participating ICUs. Another aim of the pilot was to gather data for the participating ICUs, to stimulate motivation for participation in the project and trust in each other.

We present the results of each phase, stemming from the methodology described in the last section. Also we evaluate the processes and outcomes of each phase for the purpose of validation of the used methodology and instruments.

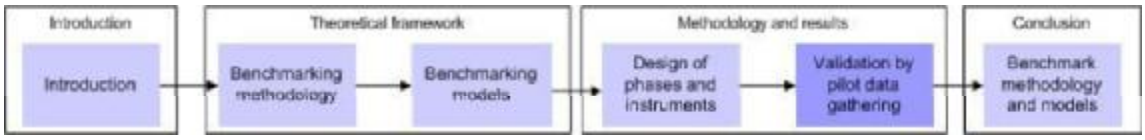

Figure 15: Place of his phase in the research framework

5.1 Phase 1: choice for comparable partners

Here is described who participate in the benchmark project, following the selection process as describe in paragraph 4.1

5.1.1 Phase results

One university medical centre declined participation, the others were interested. One other hospital joined the group: the OLVG, the only hospital in this study not linked to a university, but which is allotted a teaching function and also performs topclinical care. The OLVG participates since it is known to have its ICU well organized and fulfills almost the same task as the university medical centers. University medical centers fulfill three main functions: providing patient care, giving (bio)medical education and generating and spreading knowledge by performing (bio)medical research (Ministerie van VWS, 2006).

The benchmark project is conducted by eight hospitals in the Netherlands:

- The university hospital of Maastricht (azM)
- The Leiden University Medical Center (LUMC)
- The Erasmus Medical Center (Erasmus)
- The University Medical Center of Groningen (UMCG)
- The Sint Radboud university medical center in Nijmegen (Radboud)
- The Onze Lieve Vrouwe Gasthuis in Amsterdam (OLVG)
- The University Medical Center of Utrecht (UMCU)
- The Vrije Universiteit medical center in Amsterdam (VUmc)

For each of the hospitals, the department head or deputy department head takes place in the benchmarking IC group to start up the project. These are all ICU physicians. For some hospitals, also a manager joins the meetings.

5.1.2 Phase evaluation

The selection of partners has gone fine. The selection criteria, being part of a university medical center, ensured that partners were comparable and lead to some trust in each other. All department

head attending the first meeting agreed to participate so this probably was a good method to interst them. It was wise to not ask them to participate in the whole project, since this would have probably lead to more negative answers. However, this leaded to some insecurity and less commitment to the project.

A disadvantage of the choosing comparable benchmark partners, is that it is then less likely to find really different and potential better practices. Incorporating more diverse partners, we would likely have found more diverse practices.

5.2 Phase 2: perform a stakeholder analysis

In this section we present the results of our stakeholder analysis. This helps us to understand who the key stakeholders are. The result of this phase is a list the salient stakeholders and an overview of the dominant stakeholders.

5.2.1 Phase results

In this paragraph we describe the results of the stakeholder identification and positioning, following the methodology described in paragraph 4.3.2.

5.2.1.1 Stakeholder identification

The list of all stakeholders of the ICU as constructed by the researcher with the help of an IC general and quality manger is displayed in a table in appendix 6, showing the stakeholders and their rating on legitimacy, power and urgency.

Nine interviews were held. Six people (50%) responded (2 physicians, 2 nurse heads, 2 supporting/management staff) to the survey. A graphical representation places all stakeholders, mentioned two or more times in the interviews and the surveys, within the ICU, the hospital or the hospital environment (figure 16). Since the same the stakeholder groups were considered important in the interviews and the surveys, no more surveys were dispersed. For each stakeholder group the number of times it is mentioned, in the interviews or in the survey as one of the five most important stakeholders to the ICU, is counted. The number of times each stakeholder was mentioned is displayed in appendix 7. Seven groups are mentioned by at least five respondents (1/3 of the total number of respondents): patients and family of patients, IC nurses, IC physicians, referring physicians, regional hospitals and the hospital board.

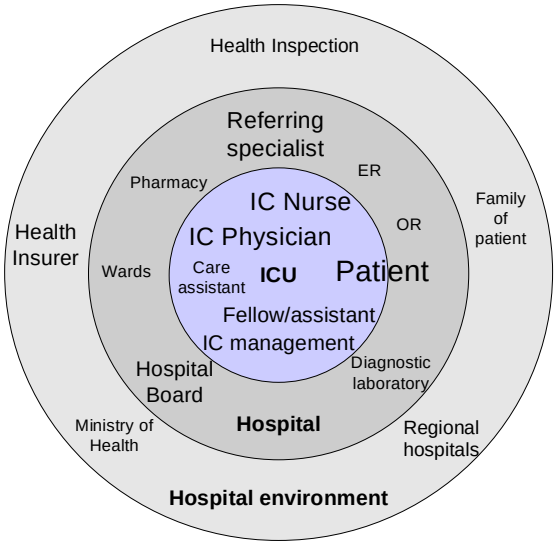

Figure 16: overview of ICU stakeholders

5.2.1.2 Stakeholder positioning

These seven most salient stakeholders are placed in the grid of Mitchell (figure 17) following the methodology described in section 4.2. The position they have is elaborated on below.

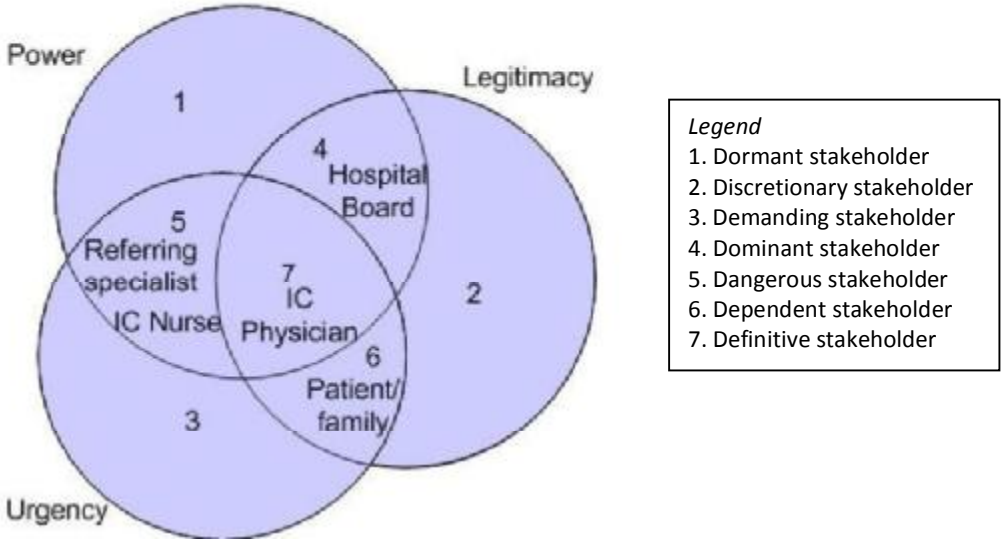

Figure 17: The ICU stakeholders with the highest salience positioned in matrix of Mitchell et al. (1997)

Nurses form the core of the ICU, since they are present around the clock and have most contact with the patients. In the interviews nurses are mentioned most as stakeholder to the ICU. Several studies have established a link between satisfied nurses, satisfied patients, and better quality of care (Hegyvary & Haussman, 1976; Weisman & Nathanson, 1985). Although departments are hierarchically organized dually; with a care and a physician manager on top, the last group traditionally does possess much more power and legitimacy to influence the organization. But this is changing: with the increased specialization possibilities and the expansion of the role of nurses from care to defining the patient's medical status, the negation position of nurses becomes better (Svensson, 1996). Nurses score high on the urgency scale.

ICU staff traditionally has most power in the organization. This is reflected by the survey results, the physicians are placed in the centre of the positioning grid. They also have legitimacy to make decisions and have urgency since they have a professional relation to the ICU. In the university medical centers, they have professional autonomy, but they do have to report to hospital management concerning financial obligations.

Referring specialists like surgeons, internists, neurologists, cardiologists and other specialists refer patients to the ICU. On the ICU primary responsibility for the patient transfers to the intensive care physician. Therefore, legitimacy on the intensive care of the referring specialist is low. However, urgency of the referring specialist is high, since responsibility for the patients is dedicated to him again when the patient leaves the ICU. Power of the specialist is also high, since they possess a lot of knowledge about their patients and they are the "client" of the IC: patients are treated on the ICU after the referring specialist has sent them there. Referring specialists can also be located in regional hospitals.

Patients and the family of patients traditionally do have little power in the hospital. They ofcourse do have urgency, since they need a treatment, and this claim is also legitimate. Although this makeas the position of the patients and their family is that of a dependent stakeholder, there are indications

that the position of patients on the power attribute is changing. As mentioned before, governments are pushing hospitals to publish information concerning the performance of hospitals on several indicators. Also, there is a trend patients and their relatives want to be better informed about the medical condition and demand more information from staff and nurses.

The hospital board operates at a distance from the ICU. According to the survey results and the interviews, the board does not have that much urgency with the ICU. They do have some power: they control the finances of the departments and the ICUs often sign production agreements with the board.

The dominant coalition are those stakeholders having both power and legitimacy (Mitchell, 1997). In this case, the dominant coalition are the ICU physician and the hospital board. It is therefore important to involve those stakeholders in the making of decisions during the process. However, the hospital board operates at a certain distance from the ICU and only want to be involved in the decision whether to participate or not in the project. This leaves the ICU physicians as most important stakeholder to involve in each phase. The ICU physicians are, for each participating ICU, represented by one of the registered IC physicians, mostly the department head. In the following phases, the department heads of the ICUs will therefore be engaged in every important decision made.

5.2.2 Phase evaluation

The stakeholder survey was filled in by only half of the people that were asked to fill it in, which is quite normal for questionnaires. The groups mentioned by the respondents as one of the five most important stakeholder groups were very similar under the respondents, so there seems little doubt that we have identified all important stakeholders. However, scoring the stakeholders on the attributes lead to more controversy sometimes. Power and urgency were relatively easy to assess for each stakeholder group, since the respondents scored all groups in the same way. The respondents were less straight on the legitimacy attribute. In literature, legitimacy is described as the most vague concept and unclarity about the precise meaning of it can have lead to the different opinions of the respondents about the degree to which every stakeholder was legitimate. This implicates that, in this assessment, the nurses were perceived to have little legitimacy by part of the respondents and have a lot of legitimacy by other respondents. The calculated median implicated that by most respondents they were not seen as legitimate, and that they therefore do not form part of the dominant coalition in an organisation. However, the role of nurses in the management team of most organisations implicates that they do have legitimacy and power.

The proportion of the interviewed stakeholders residing in the Erasmus MC was disproportional to the other centres. This was a pity and due to the fact that the stakeholder analysis is conduct very early in the process, right after the choice for partners. This meant for our project that the other ICUs just had confirmed to have some interest in participating when the stakeholder analysis was done. It was therefore difficult to ask them to let their organisation engage in a large survey. It is expected that once the process to benchmark is chosen and the partners know better what is expected of them, performing a thorough stakeholder analysis will be easier. This is an argument to switch phase 2 and 3. However, this would mean we do not know yet who the dominant coalition in the organisation is when a choice for a process is made, and this has disadvantages too.

Concerning this phase, we should therefore keep in mind that the stakeholder typology is dynamic and due to changes. It is a good that the stakeholder analysis is taken up as a phase in the stakeholder typology, this ensures that in every benchmark cycle the right stakeholders are involved in the process.

5.3 Phase 3: choice for a comparable processes

5.3.1 Phase results

The processes have been listed and the ICU department head, representing the dominant coalition of each ICU, have chosen a process to benchmark.

The results of the scoring of processes relevant for benchmarking can be found in appendix 8. Relevant processes were not concentrated in one of the four areas, but were shattered. There were several processes marked as interesting by a large proportion of the participants. Examples are the coordination of patients with the regional hospitals, the management of patient streams by scheduling patients to step-up or step-down facilities and the planning of the work schedules of nurses and physicians. Also, a lot of other processes were mentioned to be relevant too and were added to the list of processes.

Results were presented to the ICU managers in a meeting. They decided not to take one or more processes as the focus of the first benchmark cycle, but to make the integral management of the primary process of the ICU as the subject of the research. This allows the participants to first get to know the other participants before applying a –maybe too narrow- focus. In later cycles of the benchmark project, the sub processes named as relevant can be chosen as a focus to allow for a more thorough look to parts of the ICU operations.

The choice for the transformation process model as a basis for our measurement framework implies a focus on the primary processes of the ICUs. We leave supporting processes out of our scope for now to have a match with our model and to keep our research area manageable. The primary processes exist of all the steps that directly add value to the services the ICU provides. It is important to notice that the primary process on the intensive care does not only exist of the provision of care for the patients in the ICU, but the ICUs also fulfill a research and education tasks. Also, the services ICU members provide do not end at the physical borders of the ICU. Diverse ICU staff members fulfill tasks outside the ICU; like ICU physicians that are consulted by other departments or even other hospitals, or ICU nurses performing visits to wards advising the nurses there concerning a former ICU patient.

5.3.2 Phase evaluation

The decision was made to let the dominant coalition, in this case the department heads, decide on the processes interesting to benchmark. We could also have let represents of all salient stakeholders choose a process. This would have the advantage that all people important to the organization could have a say in the processes that are included in the benchmark. However, it is true that not all stakeholders have even have an idea of all processes, let alone that they know which processes are important to the organization. It is the task of the management of the organization to know this. Therefore, it was wise that this choice was made by the dominant coalition of the ICUs, who also form part of the management.

5.4 Phase 4: description and analysis of process and contingency variables

In section 4.4, we have developed a questionnaire for the ICUs and described how the questionnaire is answered. The results of this phase are the results of that questionnaire.

5.4.1 Phase results

In this paragraph, we report shortly on some of the basic characteristics of each hospital and describe some of the remarkable similarities and differences in organizational set up between the ICUs. The detailed results of the questionnaires and a description of every ICU can be found in appendix 9 and 10.

Input transforming resources

Lay-out. Not all participating ICUs have the same number of beds. Two ICUs have u child unit within their department, and two have medium care beds, without a respiration function. The number of beds per unit differs per ICU (figure 18).

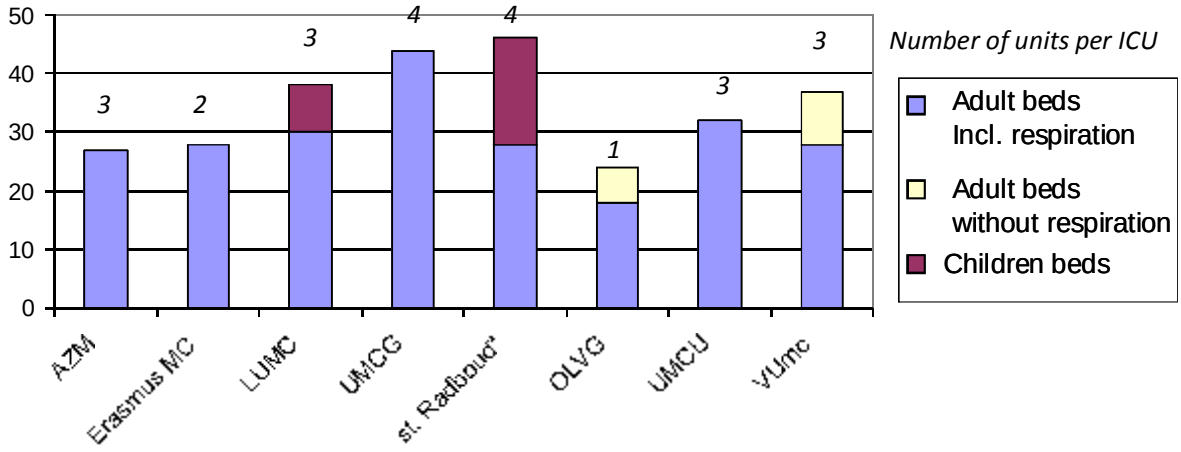

Figure 18: Number of beds and units per ICU

Organizational structure. The ICUs have, from a distance, the same organizational structure. Hierarchically, the physicians fall under a medical coordinator who reports to a department head. The nurses are leaded by a nurse unit head, who report to a care manager. The care manger and the department head make part of the management team of the ICU, of which the department head is the chair. The VUmc, OLVG and UMCU have an organization manager in the management team. In the LUMC and AZM, a surgeon-IC physician forms part of the management team. The degree to which the different units are differentiated differs per ICU. In the UMCG, each unit has its own medical coordinator and nurse head and functions independent of the others. In Leiden, this distinction exists only between the children units and the adult units. In the Erasmus MC, in 2006 the general and thorax ICU were completely splitted. In this research project, only the general ICU of the Erasmus participates. In the other hospitals, the units are more or less integrated. Within each hospital, the ICU department, together with some other departments, forms a division with a division manager, which reports to the hospital board. The St Radboud, the VUmc and the OLVG are less flat and have an extra layer between the division and the hospital board (St Radboud and Vumc) or the unit head and IC management (OLVG).

Functional groups. In each hospital, IC nurses and IC physicians are the largest functional groups. Some ICUs employ care assistants (generally, 1 per unit), to relieve the tasks of the nurses. In some ICUs, some task differentiation is made in the nurse functions: senior nurses have more responsibilities than the junior nurses.
The differences in number of beds are reflected in the number of nurses each ICU employs: also her, the UMCG is the largest (Figure 19).

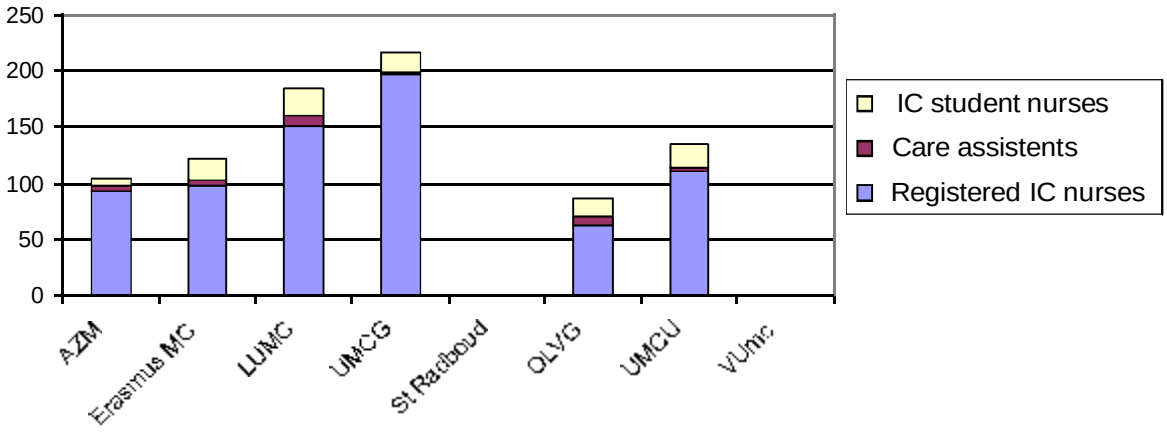

Figure 19: Number of nurses FTE per ICU department

Table 5: Number of nurses FTE per bed per ICU

Nurses per bed	AZM	Erasmus MC	LUMC	UMCG	OLVG	UMCU
Reg. IC nurses per bed	3.5	3.5	5.0	4.5	2.6	3.4
All nurses and assistents per bed	3.8	4.4	5.9	4.9	3.6	4.2

There are, however, differences in the number of nurses per bed (table 5). The LUMC and the UMCG have 5 and 4.5 nurses in duty per bed, the OLVG only 2.6 nurses. This could be due to the lay out and organizational structure: the OLVG has all the beds on one ward and report that this makes the scheduling of personnel flexible, while the nurses of the UMCG can work on one unit only. The OLVG also uses many care assistants compared to the other hospitals. The third reason can be that the OLVG also has medium care beds on the ICU, on which the patients require less care.

When we look to the number of physicians on each ICU, the number of beds is again reflected in the number of registered IC physicians, fellows and physician-assistants are staffed (figure 20). Looking to the ratio of physicians per bed (table 6), we see again that the UMCG has a relatively high number of registered IC physicians. However, they have relatively few fellows per bed. The same counts for the Erasmus MC, who was not granted the qualification to educate physicians fully. The AZM has both many registered IC physicians and fellows, but very few physician-assistants.

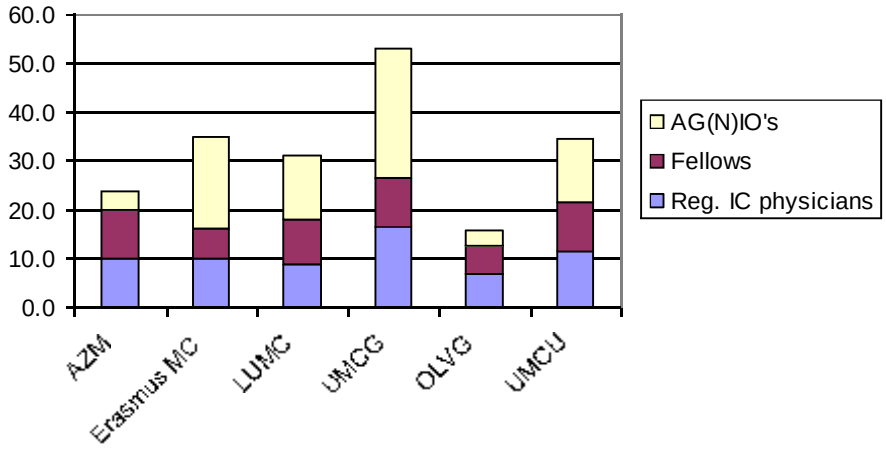

Figure 20: Number of physicians FTEs per ICU

Table 6: Number of physician FTEs per bed per ICU

Physicians per bed	AZM	Erasmus MC	LUMC	UMCG	OLVG	UMCU
Reg. IC physicians per bed	0.37	0.36	0.30	0.38	0.28	0.36
Fellows per bed	0.37	0.21	0.30	0.23	0.25	0.31
AG(N)IO's per bed	0.1	0.7	0.4	0.6	0.1	0.4

Tasks and responsibilities. As stated, the tasks and responsibilities of both physicians and nurses are largely standardized. What does differ, is the number of physicians and nurses each ICU schedules to take care of the patients. Almost all hospitals schedule a certain constant number of personnel for each shift. The OLVG makes use of a system to plan the number of nurses based on the care level needed by the patients. Each patient standard has two care points, depending of the expected level of care the number of points can fluctuate. Per four care points, one nurse is scheduled, independent of the day, evening, or night shift. When we look to the physicians scheduling, we remark several aspects (Table 7). First, the Erasmus MC plans an extra physician in on day shifts. This physician is dedicated to coordinate the admission and discharge to the ICU. Second, it is again clear that the four units in Groningen function independent: they all schedule their own medical staff. Third, at nights there is no registered IC physician in the hospital at night in all ICUs, although they are on duty and can be in the hospital within 20 minutes.

Table 7: Physicians per shift (reg. IC physicians, fellows, AG(N)IOs)

Physicians per shift	Erasmus MC	LUMC	UMCG	OLVG	UMCU	VUmc
Day	5;4;4	3;3;6	4;6;4	2;2;1	4;3;4	4;2;4
Evening	1;1;4	1;1;2	4;1;4	1;1;1	2;1;2	2;2;2
Night	0;1;1;2	0;1;1;2	0;4;1;4	0;1;1;1	0;2;2;1	0;2;2;2

* In the night, we distinguish: IC physician in the hospital, IC physician on duty at home, fellows, AG(N)IOs

Finances. Finance data were difficult to obtain. Only three hospitals gave insight in their budget. Therefore, it was decided by the benchmark group to not share these data until more ICUs gave insight in these data.

Patient streams. The health of patients can be approached with the APACHE II score, a medical indication of the health status measured upon arrival at the ICU. The mean APACHE II score says something about the level of the healthcare that is provided on each ICU (Figure 21).

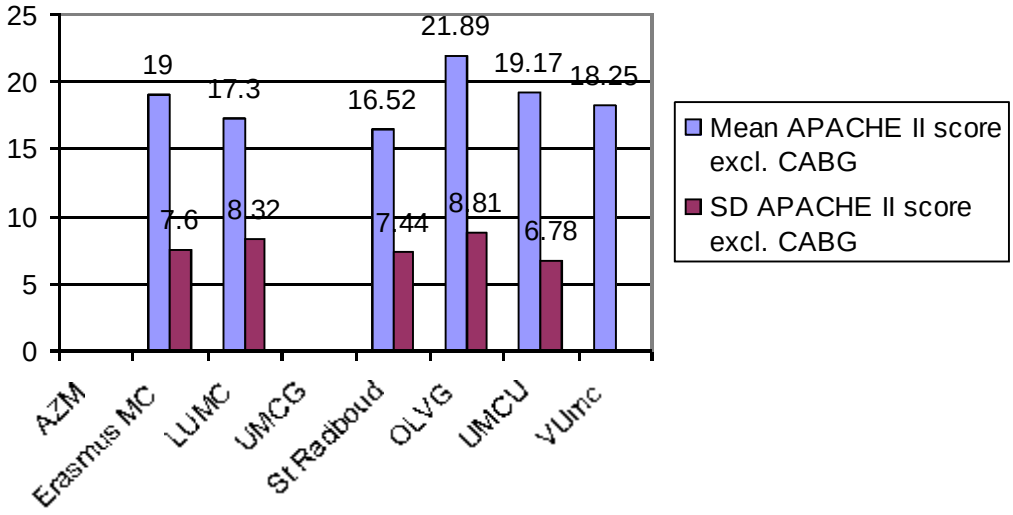

Figure 21: Mean APACHE II score per ICU

According to the MD's in the benchmark group, the APACHE II score do not differ much (they are all in the range between 17 and 22). Data were gathered of the patient streams to and from each ICU. In general, there are no large differences.

Five hospitals were able to give detailed information about the origin of patients (Figure 20). Remarkable is that a large proportion of patient of the LUMC stems from the OK and that a large part of these patients has undergone a planned surgery. This means, the arrival of a relatively high percentage of patients on the LUMC ICU can be planned. The Erasmus MC receives most patients from regional hospitals. Since this generally involves a lot of work, this explains the scheduling of an extra ICU physician during the day for coordinating and receiving patients.

Figure 22: Admissions to the ICU

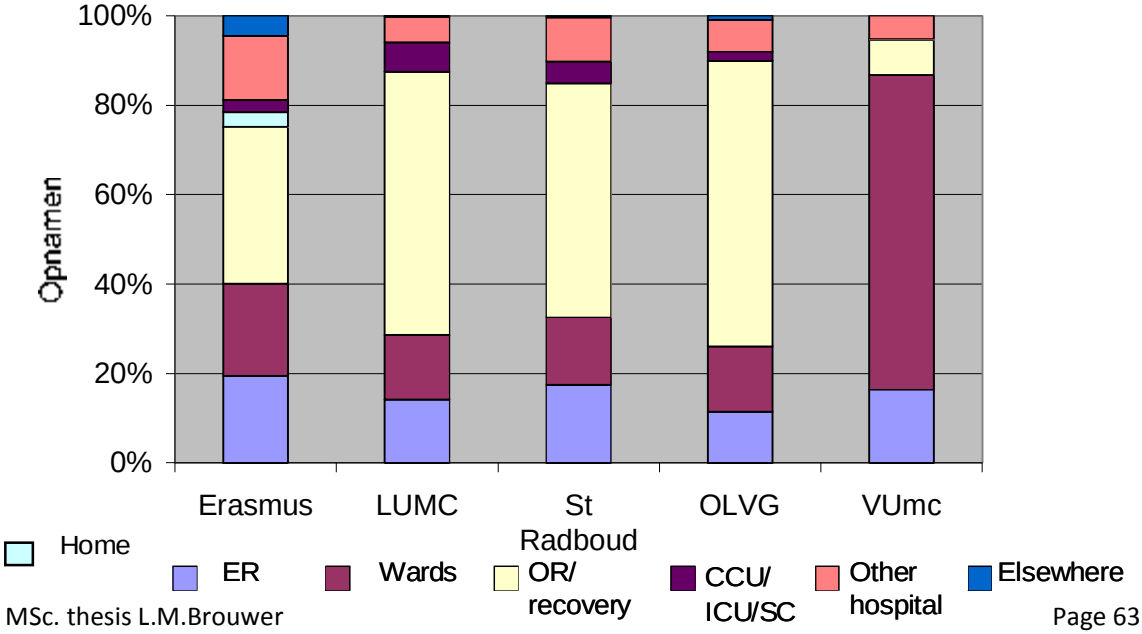

Table 8: percentage of planned patients from the OR

Admissions from the OR	OR (number)	OR (% admissions)	% planned/ elective surgery
Erasmus MC	462	35%	47%
LUMC	960	59%	84%
OLVG	988	52%	82%
St Radboud	813	52%	62%
UMCU	-	-	69%
VUmc	108	8%	-

5.4.2 Phase evaluation

Here we evaluate the gathering of the process and contingency variables by the hospitals

5.4.2.1 Evaluation of the questionnaire

The questions were clear to the hospitals: only two definitions in the input transforming resources section of the questionnaire had to be changed. The section asking to the number of diagnostic requests per patient was deleted, since the hospitals do not keep overviews of the number of laboratory and roentgen requests they make, plus they argued that these data are useless unless a complicated subdivision per patient category is made.

As a basis for the information needed, the reports the NICE foundation publishes each year were used: they have standard definitions and publish reports containing information about each ICU. This increased the reliability of the obtained data. A disadvantage that we cannot avoid is that not all of the participating hospitals participate in the NICE foundation, so for some hospitals we do have incomplete information. It is not possible to avoid inconsistencies in the data gathering when asking for information each ICU has to pull out another information system. However, by checking whether all questions were clear and giving the ICUs the opportunity to report inconsistencies we have tried to make the gathered data as reliable as possible.

5.4.2.2 Evaluation of the process

It took a lot of time to gather the results at all the hospitals. The level to which every hospital was able to answer the questions differed remarkably, and seemed to depend on several factors:

1. In this phase of the project, still only one person per hospital was really involved in the project, the department head. They were asked to distribute the questionnaire to someone else when they were not able to find time themselves, but this was not always possible. If a quality advisor was available for the ICU, this enhanced participation in several steps in the benchmarking project. One hospital did not have a quality advisor available and found it hard to gather all of the requested data.
2. The ability of each hospital to fill in the questionnaire using its own data. This seems to depend on several factors: first is the kind of information system used by the ICU. The OLVG,

for example, has a very sophisticated patient data management system (PDMS) and had no problem at all with the delivery of data, while other hospitals had many problems providing the requested data, according to them partly because data are not inserted in their system by the staff and nurses. Second, participation in the NICE foundation. Since a few years, many Dutch hospitals participate in the structured gathering of data concerning the health and origin of the patients on the ICU. Hospitals participating in this project were already used to the provision of the kind of data we requested, and experienced less difficulties in delivering the requested data. Also the degree to which the different units are organized as one department played a role in the ability of the ICUs to provide the data. In one hospital, the units are still operating as separate organizational entities with a separate staff. Data are not gathered for the whole ICU department but per unit, which brings problems of gathering all data and the comparability of the data from the different units with it. The last factor was the motivation of the department heads. Time is scarce for these busy physicians, but they all did want to check the data themselves.

3. In some hospitals, it was difficult to motivate the department heads and to make clear the advantages of participation in this project, to not let it be "another quality project".
4. Sometimes, other circumstances also played a role. Some questionnaires were difficult to obtain for reasons not related to our project.

5.5 Phase 5: development of performance indicators in conjunction with the stakeholders

Now we have described the stakeholders of the ICU and described each IC department, this section reports on the realization of a list of potential performance indicators, following the outline of this phase as described in paragraph 4.5. In the next paragraph, we report on the results of each phase. In paragraph 5.5.2 we evaluate this phase of the benchmark methodology.

5.5.1 Phase results

First we describe the results of the literature review, to which we can apply the described boundary conditions for the individual indicators to be sure we later make a selection out of valid and reliable indicators. Following, we describe the interviews with different stakeholder groups and list performance indicators per stakeholder group. We then compose a potential list of performance indicators, combining the stakeholder interests with the indicators found in literature. It is checked whether the resulting set also complies with the boundary conditions we have composed for the whole performance indicator set. The set was presented to department heads to enforce the choice for the indicators and the adaptations to the set made stemming from their feedback are described.

5.5.1.1 Composition of the list of potential performance indicators from literature

The literature review delivered us structure, process and outcome indicators that span the areas of quality of care, efficiency and quality of work. Some indicators relate to multiple areas of performance. As stated in section 2: evaluation of ICU performance measurement research, recently the RIVM has performed a study to performance indicators for the intensive care (Vos et al., 2007) This included a systematic literature review, identifying around 60 potential performance indicators. Since this literature review was performed thoroughly and very recent, we found few extra indicators not mentioned in this article.

According to our methodology, we should now reduce this list by applying the boundary conditions for individual indicators to the list. We do this, but choose a different methodology for the quality of care section. As mentioned in section 2, van der Voort (2004) composed a set of quality indicators designed to measure quality of care, based on the RIVM study mentioned above. This set was composed in a very thorough way, validated by Dutch intensive care physicians and is accepted among the professional group. This ensures a valid and accepted set of indicators in the quality of care section and it is better to use the same set of indicators he uses in our performance indicator set in the quality of care section. So where we, in the areas of efficiency and quality of labor, exclude indicators based on the conditions we mentioned, we exclude in the quality of care section only indicators based on the choice of van der Voort. There are some indicators that are excluded by van der Voort since they are not one the most important indicators for quality of care, but can also represent another area of ICU performance.

So, we exclude indicators based on the boundary conditions for individual indicators (table 9)
To the already defined conditions, we add the **O** from **o**mitted by Van der Voort which is used to exclude the indicators in the quality of care section that were identified by the RIVM study but not chosen by van der Voort (2006). The → represents that the indicator was omitted by Van der Voort since it did not represent quality of care, but incorporated by us to represent another area of quality of care in our set. Also we add the **C** to represent that an indicator was more of a **c**haracteristic and is therefore added to the characteristics questionnaire. Indicators that were not excluded are represented with an **I** of **i**ncluded.

Table 9: Boundary conditions for the individual indicators

(Face)-**V**alidity	Degree to which the provider believes the measure evaluate an important aspect of performance
Reliability	The extent to which a test is repeatable and yields consistent scores, regardless of hospital or employee
Transparency	Based on agreed definitions clear to all participants, described exhaustively and exclusively
Feasibility	Measurable, not too much extra registration pressure on ICU staff
Dynamic	Improvement of the indicator is possible
Evidence-based	Based on the best available evidence
Characteristic	
→	omitted by Van der Voort but included in another section
Omitted	by Van der Voort

In table 10, all potential indicators from literature with the reason of exclusion are displayed.

	Quality of care		***Efficiency***		***Quality of work***	
Structure	Daily rounds by an ICU physician[3] Use of sedation policy[4] Physician staffing[2] Nurse patient ratio[2] Mattresses or pressure relieving beds Daily sedation interruption policy Use of case management approach Computerized physician order entry Pharmacist participation during daily rounds Weaning following a protocol Protocol for admission and discharge Infection control participation Quality improvement program Cancelled operating room cases Emergency department bypass hours Rate of unplanned ICU readmission	C O C I O O O O O O C O O O O →	-		Restricting staff working hours to regulation[5] Culture	F F
Process	% patients with a LOS > 7[6] Non-invasive ventilation TISS score by discharge Unplanned extubation Continuous lateral rotational therapy Interclinical transport Red cell concentrate transfusion Nutrition support Glucose regulation Autopsy discussion Open vs closed suction system Daily rounds by an intensivist Number of patients with premature discharge Effective assessment of pain ICU LOS Average days on mechanical ventilation Decubitus incidence Suboptimal management of pain Appropriate use of blood transfusions Prevention of ventilator associated pneumonia Appropriate sedation Appropriate peptic ulcer disease prophylaxis Appropriate deep venous thrombosis prophylaxis	V O O O O O O O O C O C → O I I I O O O O O	Respiration by admission ratio Rate of unplanned re-admissions Number of laboratory researches per patient Number of ECG's per patient Number of lactate researches per patient ER by-pass hours[4] Rate of delayed admissions Rate of delayed discharges[7]	I I F F F F V I	Absence rate Compliance to ventilator bundle[8] Turnover rate Quality of communication among ICU team members	I V I F

[3] Pronovost et al, 1999, JAMA
[4] RIVM systematic literature review (van der Voort et al., 2004)
[5] C. Laine, L. Goldman, J. R. Soukup and J. G. Hayes (1993)
[6] De Mul, 2007
[7] Pronovost et al. (2001)
[8] IHI: ventilator bundle compliance
http://www.ihi.org/IHI/Topics/CriticalCare/IntensiveCare/Measures/VentilatorBundleCompliance.htm

Outcome	Ventilator associated pneumonia	I	Use of expensive antibiotics	V		
	Deep venous thrombosis	O	Utilization rate	I		
	Pulmonary embolism	O	Bed turns[9]	I		
	Decubitus	O				
	Stress ulcer	O				
	Quality of life	O				
	Hospital mortality rate	I				
	ICU mortality rate	I				
	Patient/family satisfaction	→				
	Rate of catheter-related blood stream infections	O				
	Rate of resistant infections	O				

Table 10: Potential indicators from literature and reason of exclusion

The indicators that were not excluded are summarized in table 11:

Table 11: Indicators from literature complying with the boundary conditions we defined

	Quality of care	***Efficiency***	***Quality of work***
Structure	Nurse/ patient ratio		
Process	Length of stay Length of assisted respiration Days of 100% occupation	Delayed discharges Unplanned re-admission Patients on ventilator assistance upon arrival	Absence rate Turnover rate
Outcome	Mortality rate Hospital mortality rate VAPS incidence	Utilization rate Bed turns	

With respect to the set of van der Voort (2006), the indicators in the left column differ in a few aspects of the indicator set proposed:

- We have deleted the availability of a physician in the indicator list, since all participating level 3 ICUs have physicians available on the time. Instead, we have included questions concerning the scheduling of physicians in the characteristics questionnaire, to provide more detail.
- Originally, rate of interclinical transports and unplanned extubation formed part of the indicator set of van der Voort, but after a pilot study these indicators proved to lack face-validity and were hard to define clearly. For this reason, we do not include them.

As can be distracted from the table, three areas of our framework are not covered in literature: outcomes in the quality of work section, structure/quality of work and structure-efficiency. Maybe the stakeholders do mention some interest that fit in these areas.

[9] IHI: Hospital flow diagnostic tool, http://www.ihi.org/IHI/Topics/Flow/PatientFlow/EmergingContent/HospitalFlowDiagnostic.htm

5.5.2 Identifying stakeholders interests

In this paragraph, we describe the interests in the ICU of each of the seven most mentioned stakeholder groups. We name the indicators they perceive as important for measuring ICU performance.

ICU nurses. In an interview with a nurse unit head and a care manager, the main interests of the nurses mentioned where primary quality of the provided care and secondary good working environment. The work environment affects nurse satisfaction and turnover (Lake, 1998; Levek & Jones, 1996). Conditions mentioned in the interview to make a good working environment were a good relationship with physician staff, enough autonomy, the possibility to participate in improvement projects and to follow extra education and a safe work environment. This is in line with literature, in which consistently autonomy, control over the work environment, and a good relationship with physicians are mentioned as factors important to nurses (Grindel et al., 1996; Hoffart & Woods, 1996; Knaus, Draper, Wagner, & Zimmerman, 1986; Zelauskas & Howes, 1992). Indicators for nurse interests were *nurse satisfaction* (measured with asking to the above mentioned conditions)m *absence rate* and *turnover rate*.

Referring physicians. Referring specialists find quality of care, communication towards the referring specialist and the education of physicians on the ICU the most important parts of ICU performance. The first thing they find is important is the *availability of beds* for their patients. A surgeon described quality of care on the ICU in this context as "a strong multidisciplinary treatment". Indicators of good quality of care are, according to him, *the availability and timeliness of several technologies* (like CT scans and hemodialysis machinery) and the *availability of consulting physicians and other specialists* (like a hematologist, nephrologist, urologist, cardiologist, microbiologist, ethicist and pharmacist) to the ICU within a certain time limit. The *use of care protocols*, and especially clear protocols around the transfer and treatment responsibility of patients were also mentioned. *Daily multidisciplinary meetings* are perceived as an important part of the communication between ICU and referring specialist. Other indicators of good communication mentioned are the possibility of *a daily round on the ICU of the intensive care physician and the referring specialist* together, the possibility *to view the status and treatment of their patients* at all times (by means of a shared information system) and the *point in time it becomes clear how many new patients can be admitted to the ICU* that day. The last point is important to the referring specialist because the number of places on the ICU is restrictive for the number of patients that can undergo a risky procedure. Another point important to the referring specialist was the possibility to *educate assistants* on the ICU.

Patients and the family of patients. Patients on the ICU are often sedated or unconscious, and many experience the 'ICU syndrome', characterized by disorientation, confusion and delusions (Hasman, 2006). Stays on the intensive care unit (ICU) are often recalled as distressing, uncomfortable and painful experiences due to stressful aspects like having tubes in one's nose or mouth, being stuck with needles, being in pain, and not being able to sleep (Cochran & Ganong, 1989). Patients emphasized therefore *good pain management*, courtesy, responsiveness and *clear communication* (Hasman, 2006), Jun, Peterson, and Zsidisin, 1998). Since it is often difficult for patients to judge the circumstances of their ICU stay due to their illness, and the ICU period is also a fierce period for relatives of the patient, often the opinion of a family member is taken as a proxy for patients in ICU appraisal. As brought forward by a voluntarily family host of the ICU of the Erasmus medical center, there are some things that are very important to family members. First, clear and full *communication*

of nurses and physicians is important. This is in line with findings in literature (Buchman, Ray, Wax, Cassell, Rich, & Niemczycki, 2003; McKinley et al., 2002). Second, it is important that there *is a place to retreat,* like, for example, a family room. Third, *the availability of host* or someone else who is always available can help to explain what is going on. Fourth, practical measures like the possibility to spend the night in or close to the hospital matters to the family members.

Hospital board. Interests of the hospital board strike the functioning of the ICU department as a whole and focuses mainly on quality of care, a healthy *financial situation* and satisfied employees. They value clarity of the ICU goals each year and the availability of *production agreements*. They do like to have a view on the degree to which the other stakeholders of the ICU are satisfied with the ICU, so they would like to be reported on the *satisfaction level of the stakeholders.* Also, they value the *availability of strategic plans, quality protocols and annual reports*.

Beside the interest gathered a by the interviews, we gathered some indicators that where already used on different intensive care units by the ICU management. The VUmc has composed a set with which they yearly assess performance of their own department. Also the Erasmus MC lists several indicators in their annual plan. Not all of these indicators are suitable for the goal of this project, but some are. The indicators distracted from the stakeholder interviews are summarized here, ordered to structure, process and outcome interests:

Table 12: interests distracted from the stakeholder interviews

Stakeholder	*Indicator*	*Definition of Indicator*
STRUCTURE Hospital board	Stakeholder knowledge	Does the organization once in a few years perform research to the stakeholders of the ICU and their position?
Patients/family of patients	Number of complaints	Measures the number of complaints filed by patients or family of patients
	Availability of complaint processing system	Measures whether complaints are treated and reacted on in the organization
PROCESS ICU staff, nurses, referring specialists	Existence of daily multi-disciplinary meetings	Is a meeting held every day in which all groups are invited?
Hospital Board	Production contract hospital board	Indicates whether production appointments are made with the hospital board
Referring specialists	Production contract referring specialists	Indicates whether production appointments with referring specialists are made
Regional hospitals	Work contract regional hospitals	Indicates whether appointments concerning consultation and coordination of care are made within the region
Patient	Systematic oral and written patient information	Use of a protocol for the provision of information

Patient	Use of sedation policy	Is there a policy and protocol for the assessment of pain and giving sedation on the ICU?
OUTCOME Patient/family	Patient / family of patient satisfaction	Degree to which patients and family of patients are satisfied with the provided care
Staff /nurses	Absence rate	Percentage of staff and nurses absence
Staff /nurses	Personnel satisfaction	Degree to which staff and nurses are satisfied with their work environment
Staff /referring physicians	Scientific contribution	How much research does the ICU produce?
Staff /referring physicians	Education possibilities	Are current y AIO/OIO's in duty?
Staff	Medical education involvement	Does the ICU staff participate in education on all levels of the medical education?

5.5.2.1 Establishing a potential set of indicators by combining stakeholder interests with performance indicators found in literature

Now we have a list of potential performance indicators from literature and those mentioned by the stakeholders, we can combine those two in a potential performance indicator set. In the theoretical section, we have established a list of conditions the set of performance indicators have to comply with (table 3, p. 45). The indicator set has to comply with the criteria of compactness, completeness and future resistance, although the of course exist a tension between the first two conditions.

Another boundary conditions was that all key stakeholder should be represented in the performance indicator set. If we compare table 9 with table 10, as expected, this is not the case. Therefore, we add some indicators we deducted from the stakeholder interviews (paragraph 5.1.3) to the list of indicators from literature, to represent all salient stakeholder groups:

- The interests of patients and their family are represented by the use of a sedation policy and the availability of a patient/ family satisfaction policy
- Staff and nurses interests are incorporated by asking to absence rates, work satisfaction registration and participation in medical education, published articles and acquired funds per year
- Referring physicians find registration of referring specialist satisfaction, point in time bed availability is clear, days of 100% occupation and the availability of production contracts important
- Interest of the hospital board are represented by cost per ICU day, the availability of steering information and a strategy policy and the use of production agreements

In the end, we propose the following performance indicator set (table 10).

Table 13: Proposed performance indicator set

	Quality of care	***Efficiency***	***Quality of work***
Structure	1) Level of ICU 2) Use of sedation policy 3) Nurse/ patient ratio 4) Medication mistakes policy 5) Patient/ family satisfaction policy 6) Quality policy	13) Use of production agreements 14) Availability of steering information 15) Use of strategy policy	23) Registration of satisfaction stakeholders - Staff/nurses - Referring spec. - Regional hosp. - Assistants, nurses students
Process	7) Length of stay 8) Length of assisted respiration 9) Days of 100% occupation	16) Delayed discharges 17) Unplanned re-admission 18) Use of a care weight instrument 19) Patients on ventilator assistance upon arrival 20) Point in time bed availability is clear	24) Absence rate 25) Turnover rate
Outcome	10) Mortality rate 11) Decubitus incidence 12) VAPS incidence	21) Cost per ICU day 22) Occupation rate	25) Acquired funds 27) Published articles 28) Participation in medical education

5.5.2.2 Choice for the performance indicators by the dominant coalition

The proposed performance indicator set was presented to the department heads. They provided feedback concerning the following indicators:

- VAPS (ventilator-associated pneumonias) is very difficult to measure, since the PREZIES norms for VAPS registration are not accepted widely and are difficult to follow. This indicator is removed from the set.
- Number of patients on a ventilator upon arrival (a measure for the number of "wrong bed patients" on the ICU) is not suitable for this project, since all participating ICUs are level three ICUs: it can therefore be assumed, that all patients on these ICU are admitted for a good reason, even if they do not need a ventilator.
- The degree to which the ICUs should calculate in detail the cost per ICU day per patient category is subject to discussion. Decided was to first only calculate cost per patient and per bed. In later benchmark cycles, discussion concerning which cost to include and which categories to choose can be held.
- The definition of beds: should we calculate with "operational beds", that are actually used by patients, or "allocated beds", the number of beds that are present at the units? The difference lies within the strategic choice ICUs make to close some beds and allocate the personnel to the other open beds, but sometimes also on scarcity of personnel. Decided was

to take the number of allocated beds as a basis for calculations since this number is most comparable and budget is allocated based on these numbers.

- The degree to which ICUs have influence on and responsibility for delayed discharges of patients: often this delay is caused by the inability of wards to make place for patients. But, when clear appointments are made with wards, ICUs can have an influence on these delays. This indicator is included in the set.

The potential performance indicator set is thus adapted and the resulting indicator set is therefore composed as follows:

Table 14: definitive performance indicator set

	Quality of care	***Efficiency***	***Quality of work***
Structure	1) Level of ICU 2) Use of sedation policy 3) Nurse/ patient ratio 4) Medication mistakes policy 5) Patient/ family satisfaction policy 6) Quality policy	12) Use of production agreements 13) Availability of steering information 14) Use of strategy policy	21) Registration of satisfaction stakeholders - Staff/nurses - Referring spec. - Regional hosp. - Assistants, nurses students
Process	7) Length of stay 8) Length of assisted respiration 9) Days of 100% occupation	15) Delayed discharges 16) Unplanned re-admission 17) Use of a care weight instrument 18) Point in time bed availability is clear	22) Absence rate 23) Turnover ratio
Outcome	10) Mortality rate 11) Decubitus incidence	19) Cost per ICU day 20) Occupation rate	24) Acquired funds 25) Published articles 26) Participation in medical education

Definitions of the selected performance indicators can be found in appendix 11.

5.5.3 Phase evaluation

In this phase, the in section 3.3 developed framework for measuring performance was filled in with performance indicators in the manner described in section 4.5. This resulted in a set developed with the stakeholders and having the approval of the dominant coalition of the ICU. There are several remarks we can place by this process.

First, it was a pity so less indicators for efficiency could be found in the literature. The indicators we have chosen now are distracted from the interests of the stakeholders and therefore lack the process of validation most of the indicators mentioned in literature have gone through.

Second, we found out that some differences in interests exist within stakeholder groups. Since we use the stakeholder typology model to identify groups, we are treating the whole stakeholder group as homogeneous while there may exist internal differences. For example, it is possible that one of the referring physicians values it to be heavily involved by the decisions made on the ICU, while another

prefers the ICU to handle the patient alone. It is thus possible that although we have tried to incorporate all salient stakeholders in the final set, some individual people feel so not recognize some of their interests in the set. Also, the question who the important stakeholder groups are, was only asked to internal stakeholders, this could have introduced bias in our project. Thus, it may be that in our performance indicator set, the interests of stakeholders of the Erasmus MC are overrepresented, while people in the same stakeholder group but from another hospital value other aspects of ICU performance.

A choice we made regarding to the performance measurement instrument was to include the three separate areas of ICU performance and to represent the most important stakeholder groups. This leaded to broad and complete cover of ICU performance. However, this also meant a not-so-compact performance indicator set of 26 indicators. This seemed a lot for the participating hospitals. However, many of the data needed to measure the indicators is already gathered. Since one of the boundary requirements of the individual indicators was feasibility and all of the included indicators are relatively easy measurable, it is expected the remaining data can be gathered relatively easy. These data will provide a good overview of the performance of each organization.

During the process, we conducted a literature review to find potential performance indicators. There were a lot of indicators of medical performance, but in the areas of efficiency and quality of work indicators were lacking. Especially in the area of efficiency this really was a pity, since it would have lead to better results in our project if unambiguous and accepted ways of measuring financial performance of the ICU would have been available. In the area of quality of work, the absence of indicators made for a hospital environment was not really a problem since indicators uses in other organizations often are also valid for use on the ICU. But also for this area counts that it would be interesting to conduct a research to the specific areas that are important to ICU personnel, that are confronted with an emotional load each day.

Including feasibility as a boundary condition for the performance indicators was a requirement of the hospitals and made it easier to motivate the hospitals to participate in the project. But it does have disadvantages too. In this phase, indicators that were a very good representation of performance, like ventilator-associated pneumonias (VAPS), were excluded because it would be hard to measure them. This is a pity, since it excluded an otherwise valid and important indicator.

5.6 Phase 6: Unambiguous and integral measurement

In this section, we present the scores on the performance indicators that are already gathered. Due to the time span of the project, it was not possible to collect especially the qualitative scores on the indicators. This is also the reason no phase evaluation is added.

5.6.1 Phase results

In the following paragraphs, the results per performance indicator are summarized.

5.6.1.1 Level of the ICU

The level an ICU unit is each year established by the Dutch Health Inspection and is an indication of the level of care that is provided on the ICU units. Level 3 is the highest level of care, indicating a unit is ready to take care for the most endangered patients. The level of the participating ICUs is as follows:

Table 15: Level of each ICU

Level ICU	AZM	Erasmus MC	LUMC	UMCG	St Radboud	OLVG	UMCU	VUmc
Unit 1	3	3	3	3	3	3*	3	3
Unit 2	3	3	3	3	3	-	3	3
Unit 3	3	-	-	3	3	-	3	1
Unit 4	-	-	-	3	-	-	-	-

* 6 of the 24 beds of the OLVG are HC beds and therefore level 1

Since (almost) every participating hospital is a university medical centre, it is logical that most ICUs have reached level 3. The VUmc is the only one that incorporates a medium care departments, and has done so to be able to better regulate patient streams. Patients that do not need respiration anymore can there be transferred to a lower level, and cheaper, department.

5.6.1.2 Nurse/Patient ratio

Nurse/Patient ratio is an indicator for the quality of care provided by each ICU. Indicators often differ during the different shifts, in the night less nurses are available then during the day. The nurse/patient ratio of the participating hospitals is as follows:

Table 16: Nurses per patient per shift

P/N ratio	Erasmus MC	LUMC	UMCG	OLVG	UMCU	VUmc
Day	1:1	1:1	2:1	2:1	1:1	1,5 :1
Evening	1,5:1	1,5:1	3:1	2:1	2:1	1,5:1
Night	2:1	1,5:1	3:1	2:1	2:1	2:1

In most hospitals, most nurses are scheduled on the day shift, somewhat less on the evening shift and less on the night shift (Table 6). The different NP ratio in the OLVG can be related to the scheduling policy of the OLVG described in the characteristics questionnaire.

5.6.1.3 Mean length of stay and mean respiration length

Mean length of stay is perceived as an indicator of quality of care, but is heavily influenced by the condition of the incoming patients. For mean respiration length counts the same, but this indicator is also predictive for the number of avoidable pneumonias on the ICU.

Figure 22: Mean length of stay and mean respiration length

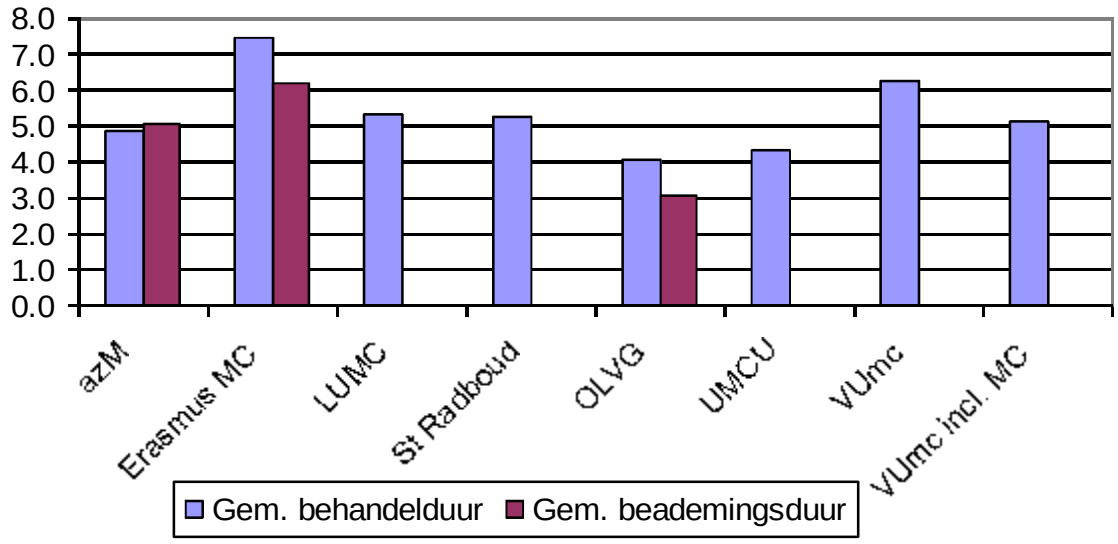

Table 17: Mean LOS and LOR

	AZM	Erasmus MC	LUMC	UMCG	St Radboud	OLVG	UMCU	VUmc
Mean length of stay	4,9	7,5	5,4	4,6	5,3	4,0	4,3	6,3
Mean length of respiration	5,1	6,2	-	-	-	3,1	-	-

As becomes clear from figure 22 and table 17, ICUs which have an MC available (OLVG, UMCU, VUmc) seem to have the shortest total length of stay. The relatively long mean length of stay of the Erasmus can be explained by the fact that not all intensive care units of the hospital participate in the research, which results in an overrepresentation of patients that did not have surgery. This category of patients decreases the mean length of stay.

5.7 Conclusion on the pilot execution of the first benchmark cycle

In this chapter the results of the execution of part of first benchmarking cycle are presented. This pilot serves as a means to validate the developed methodology and motivate the benchmarking partners for participation in benchmarking by providing them results that give them more insight in the functioning of their departments. For each phase, the results of the execution of the phase are described and also we reflect on the way the phase was conducted and on how this could be improved in next benchmark cycles. As can be concluded from the phase evaluations, in general each phase went well and contributed to the ultimate aim of the project; being learning from each other. In the following chapter, discussion and conclusion, we reflect on the contributions and limitations of the research project.

6 Discussion and Conclusion

In this section, we reflect on the performed research and formulate recommendations for the remaining phases of the benchmark trajectory.

Our central problem was how to develop a benchmark methodology and instruments, especially fit for evaluating the intensive care department. This in order to enable the participating IC departments to learn from each other about organizational aspects of their departments:

What should a benchmark instrument look like, to benchmark the performance of the IC departments participating in this research, and how should the ICUs use it?

Answering to this question, a benchmarking methodology was developed consisting of nine steps that facilitate inter-organizational learning in three important areas of ICU performance. The methodology of each phase was described, using for some phases models from literature as a basis for the instruments needed to execute that phase. In order to evaluate the validity of the developed benchmarking methodology and instruments, the first five phases of the benchmark methodology have been executed with the participating ICUs. This leaded first to results of the benchmarking process that already give the hospitals more insight in their organization, and second made evaluation of the methodology and instruments per phase possible.

6.1 Contributions to knowledge of benchmarking

A new aspect of the developed methodology compared to other benchmarking methodologies is that it requires to actively identify and involve the stakeholders of the organization in the benchmark process. The dominant coalition of the organization is involved in the decisions taken in every phase to ensure the acceptance of the results of the project. Other salient stakeholders are consulted to include their interests in the performance measurement set, to ensure the set measures the performance that is actually important to the organization. In this way, different groups in the organizations are involved in the process, which not only has the advantage that the results reflect important aspects of performance and will be accepted by the organization, but also that not only the outcomes, but also the process itself enables learning by the participants.

The developed set of performance indicators has, next to the involvement of the stakeholders, the benefit that is the first set attempting to evaluate both the medical and organizational performance of the ICU. Although it is often argued that these should be combined to get a complete view on ICU performance (Pronovost, 2001, Rotondi, 2006) and to be able to measure whether improvements in one area do not have a disadvantage in another area, there was no such performance measurement set available yet. The set is especially fitted to the Intensive Care departments that do not only take care for patients, but are also involved in research and educational activities. Since the choice was made to fit the set to the participating ICUs by involving the dominant coalition in the decision making process and feasibility was an important boundary condition for inclusion in the set, it is likely that the ICUs will choose to continue to use the set in the future.

Practically, the project lead to the fact that ICU management has, for the first time, participated in structured meetings discussing aspects of their organization. The sharing of this accessible information has made it possible to share, in following phases, more sensitive information concerning performances.

6.2 Discussion and recommendations

In this section some issues concerning benchmarking on the ICU are stipulated, resulting in recommendations for finishing the first benchmark cycle and the continuation of the project afterwards.

6.2.1 Recommendations to successfully finish the first benchmark cycle

To finish the first benchmarking cycle successfully, we make some recommendations for the remaining phases in the benchmarking methodology. As we have described, we have reviewed the degree to which the patients streams the ICUs handle differ. To increase the reliability of the results of the project, the Erasmus MC will have to involve the patients of the thorax IC. These are almost half of the patients the Erasmus ICU handles and have a large influence on some of the performance indicators included in the set. Also, the OLVG should separate the data concerning their Medium Care and the Intensive Care, just like the VUmc does. This will make it possible to compare their results with the other ICUs while both including and excluding the MC beds, which differ in some aspects from the IC beds. The same counts for the ICUs that have beds for children within their ICU facility, the LUMC and St Radboud. Another recommendation for the remaining phases is the involvement of a second project member per hospital, like a unit head or a quality advisor. This will increase the speed of the data gathering and increase the learning effect per hospital, since the participation of extra people per organization will lead to a wider dispersion of the outcomes of the project in each organization.

6.2.2 Discussion on benchmarking vs. innovation

At the start of the project, benchmarking was chosen as a method to learn from each other and find starting points for improvement. This choice was made based on the success of the method on the OK and since benchmarking is an often used method for evaluating performance in all kind of environments. As elaborated on in section 2, benchmarking can be used for the mentioned aim. However, we also listed some considerable limitations of benchmarking. We doubted whether it is even possible to identify, clearly define and transfer a "best practice" from one organisation to the other. Also, we questioned whether copying each other's practices should even be aspired by the hospitals. Maybe other methods are better to reach the ultimate aim of improving the performance in desired areas. Since hospitals do experience competition in the fields of patients and especially employees, they could maybe better think of innovative solutions to problems in areas they regard as strategically important. In this way, they can distinct themselves from the other hospitals and avoid that their best practices are copied by others and "devaluate", since they are not distinctive anymore. Furthermore, innovation has above benchmarking the advantage that the solution is especially fit to the innovating organisation and that the process of innovation contributes to developing core competences more strongly than benchmarking. Of course, innovation also has several disadvantages, like the amount of time and money it can cost and the uncertainty of the validity of the solutions found. Concluding this point, since the intensive care departments are quite young and do not possess a lot of knowledge concerning organizational set-up, benchmarking in this project can be used rather as a means to acquire and combine knowledge in a structured way than to strictly find best practices. As stated by Thompson and Cox (1997), benchmarking can be the basis for innovation rather than as a base for imitation used in this way. We can recommend the intensive care departments to examine the gathered data carefully, then reflect on their own strategic goals and make improvement plans based on their own characteristics and goals.

6.2.3 Recommendations on the processes benchmarked after the first benchmark cycle

In the first benchmarking cycle the choice was made to take the whole intensive care department as our level of analysis. Driven by the question of IC department heads, we have chosen integral performance of the IC department as the level of focus, so our instrument can be specific to and have a good fit with the ICU. In following cycles, two roads can be taken: differentiating to specific processes, or expanding to other parts of the organisation.

Choosing a specific process to benchmark has the advantage that it is possible to study the process in depth in each hospital to make a detailed comparison. It is a logical step after the ICUs have get to know each other in the first benchmarking cycle, and can deliver valuable results to the participants. Already, some processes that are critical to the ICU and are subject of concern on many ICUs are identified, like the role the level III ICUs should take in the regionalization of the IC function and the logistical process of admitting and discharging patients. A (subgroup of) the current participants can choose one of these processes as the subject of another benchmark cycle.

The other road of expanding the level of focus within the organisations can also be promising. As argued by Rotondi (2006), when trying to improve hospital care one should regard the whole care chain, since improvements in one department can be sub-optimal for the whole care-chain the patient goes through. Looking to broader patient care and the strong interdependencies between hospital departments, it would be very wise to extend following projects to other departments. Care can then be optimized with a focus on the patient instead of a department. Benchmarking is then used as a means to point to problems in the care chain that can be missed when the focus is placed at one department. In this way, benchmarking can serve as a means to make problems in the value-delivering process visible, and eventually lead to a change in the current organizational structure, in which there only rests responsibility with departments, not with care chains. Concrete, the departments that would be very appropriate to involve in a next project are anaesthesiology and the group that refers the highest percentage of patients to the ICU, being the surgeons.

6.2.4 Recommendations on the partners with whom to benchmark after the first benchmark cycle

In the evaluation of phase one it was mentioned that choosing very comparable partners leaded to little variation in practices. This was probably wise decision in this phase of the project. But when benchmarking with the selected partners is successful, benchmarking can be expanded to peripheral hospitals or to international partners to broaden the number of learning partners. When, after the first benchmark cycle, part of the ICU processes are benchmarked, it is even possible to extend the view of partners to other industries. For example, if looked to patient safety and identification, logistical companies with expertise in this area can be consulted. In this way, more break-through technologies can be found.

In the introduction, we spoke about the degree to which the results of our research are valuable for other ICUs. We have designed our instrument for eight relatively similar hospitals: all are allotted a teaching function and seven out of eight are a university medical centre. If we would want to extend the benchmark group to other hospitals, it would be important to investigate in what aspects they differ from each other. We would maybe have to include some extra questions in our questionnaire. Nevertheless, The theories concerning learning and benchmarking in a hospital does apply to other hospitals too and the benchmark methodology we use would not have to be adapted. It would be very interesting to extend the benchmark project to hospitals in other countries. As stipulated by Reis

Miranda et al. (Miranda, Rivera-Fernandez, & Nap, 2007), there exist huge variations in the amount of resources used to keep ICUs going. This would make it interesting to expand the benchmark to hospitals in Europe to find out how this variability in resources relates to overall ICU performance.

6.2.5 Discussion on learning

As stated in the theoretical section, it is important to assure transparency, for instance by interesting multiple people of each organization into the project. Due to the preserved attitude of the participants at the start of the project, it took some time to really involve them in the project. It was difficult to let the department heads make available staff, to participate in the benchmarking process. This had consequences for the degree to which it was possible to communicate and get feedback from the ICUs and underlines the importance of, in next phases, involving as soon as possible people stemming from different levels in the organizations.

One of the conditions of enabling learning was having motivated participants. We decided that this implicates that participants should decide after each phase whether they wanted to continue with the process, and this leaded to the department of one of the participants after phase 4. It was a pity the partner left, but avoided that there were partners that were either not transparent (as in the case of the leaving ICU, which did not have the facilities to deliver all needed data) or receptive.

It is the question whether benchmarking is the best way to facilitate inter-organizational learning. As mentioned, learning is often mentioned as one of the possible goals of benchmarking. But benchmarking is not often mentioned as the first way to learn. When we look to the conditions we found for inter-organizational learning, transparent and receptive behaviour, we were able to make links to benchmarking: to enable transparency we provided the questionnaire and the performance measurement set, and for increasing receptivity we stated some conditions for selecting the partners and on the way performance differences should be presented. So, in this way we have succeeded to merge the goal with the method. However, it is the question whether benchmarking is the best way to establish a climate of trust. All participants know that when characteristics and performances are listed so thoroughly, there is a chance this will lead to publication of some results. Although we have made an agreement to prevent this from happening, this threat remains active to some of the participants. This could be one of the causes of the experienced difficulty in gaining all data. Therefore, it learning really is the goal of such a project, it should be evaluated it there are no other means than benchmarking to reach this goal.

6.3 Conclusion

The gain of the partners in this project was that they got more insight in their own performance by giving insight to the other participants. We believe to have laid a strong basis for learning in the next phases. It is our hope, in the remainder of this project the scores on the performance indicators and the solutions the ICUs have developed to deliver a high quality of care, come to the light and form the basis for thorough discussions. In this way the partners will get a better view on the performance of their ICU in relation to the others and they will be able to make assumptions on which practices lead to which performances. This will enable them to improve the quality of care they provide daily to the patients that rely on their efforts every day.

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Appendix 1: Literature review ICU performance measurement

To write section 3, a literature review was conducted in the Web of Science Cochrane database and Scirus (the last including Sciencedirect and PubMed). In this appendix the method of finding literature is described.

The goals of the literature search were

1) to identify organizational factors associated with high ICU performance
2) to get an overview of the attempts to and results of ICU performance measurement

Method

Databases used were Medline via PubMed and Web of Science. The following key words, identified with the help of the MeSH database, were used for the search. Rows were combined with AND, columns with OR. Articles with the key words in their titles were selected.

Search object	Topic	Outcome
ICU	Management	Performance
Intensive Care	Organization	Appraisal
Critical Care	Structure	Utilization
		Outcome
		Efficiency
		Indicator

(ICU or (intensive care) or (critical care)) (management or organization* or structure) (performance or appraisal or utilization or outcome or efficiency or indicator)

Inclusion criteria: Since a review article (Berenholtz et al, 2001) till 2002 was available, the articles had to stem from 2002 till 2007 to avoid dated information and because the article of . The articles had to published in a peer-reviewed journal. Articles in English, Dutch, German and French were included. The design of the study had to be observational, experimental trial or review. Another criterion was the population of the study: adult critically ill patients.

Exclusion criteria: Articles mainly handling certain patient groups on the ICU were not selected, since integral management is our research objective. Articles concerning children or neonatal ICU's were excluded since they fall outside the scope of the project. Furthermore, articles popping out the search machines were deselected based on the researchers experience.

After finding qualitative good articles, their reference lists were looked at to identify more good articles. The main articles found are summarized in section 3 to describe the history of ICU appraisal. The indicators found are summarized in the results section.

Results With the help of Web of Science, a "title only" search delivered 31 results. Six of them were perceived useful. A second search using Web of Science with the same key words and limits, but with key words in title, keywords or abstract delivered 1.983 outcomes. This search was refined with categories: articles in the categories CRITICAL CARE MEDICINE, OPERATIONS RESEARCH & MANAGEMENT SCIENCE, ENGINEERING, INDUSTRIAL, BUSINESS and ENGINEERING, MULTIDISCIPLINARY were selected. This resulted in 27 articles useful for our study objectives.

Appendix 2: Stakeholder ICU survey

Stakeholder IC survey

Met deze vragen willen we er achter komen wie de belangrijkste belanghebbenden van de IC zijn. Dit is noodzakelijk om deze belanghebbenden bij het onderzoek te kunnen betrekken. Op deze manier kunnen we er achter komen wat voor hen de belangrijkste indicatoren voor kwaliteit van bedrijfsvoering op de IC zijn, zodat de resultaten van het benchmarking IC onderzoek voor alle belanghebbenden relevant zijn.

A - Inleiding

Twee korte vragen ter inleiding.

*** 1: Wat beschrijft uw functie het beste?**

Selecteer alle toepasselijke antwoorden

- ☐ Arts
- ☐ Verpleegkundige
- ☐ Management/Leidinggevende

Andere: _____

*** 2: In welk ziekenhuis werkt u?**

Schrijf uw antwoord hier

_____

B - Benoemen Stakeholders

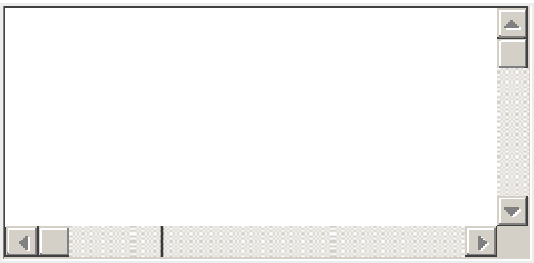
In dit onderdeel zal door middel van vijf vragen uw mening gevraagd worden over de belangrijkste stakeholders, ofterwijl belanghebbenden, van de intensive care, en hun karakteristieken. Met stakeholders worden bedoeld: personen of groepen binnen of buiten de organisatiegrenzen, die eigendom, rechten of interesses hebben of claimen te hebben in een organisatie en haar activiteiten. Voorbeelden zijn; patienten, de snijdende specialismen, andere afdelingen in het ziekenhuis etc.

*** 1: Welke vijf stakeholders ziet u als zeer belangrijk in relatie tot de activiteiten van uw intensive care? Geef deze geprioriteerd weer, met de belangrijkste boven.**

Help: LET OP! Stakeholders zijn over het algemeen GEEN naamspecifieke organen, tenzij dit specifieke

Schrijf uw antwoord hier

orgaan echt wordt bedoeld; voorbeeld; niet Chirurg Mr. X, maar bv. Radiologen, Ziekenhuis management, etc.).



2.: Stakeholders kunnen op basis van vier dimensies worden gescoord. U wordt gevraagd dit voor de belangrijkste 5 te doen. De eerste dimensie is macht. Hoe kan de stakeholder's mogelijkheid om de werkzaamheden op de IC te beïnvloeden of te veranderen worden gedefinieerd?

Kies het toepasselijk antwoord voor elke optie

	Laag machtsniveau	Informele macht om verandering te veroorzaken	Wat capaciteit om formeel verandering op te leggen	Hoog machtsniveau: grote capaciteit om formeel verandering op te leggen
Stakeholder 1	☐	☐	☐	☐
Stakeholder 2	☐	☐	☐	☐
Stakeholder 3	☐	☐	☐	☐
Stakeholder 4	☐	☐	☐	☐
Stakeholder 5	☐	☐	☐	☐

3.: De tweede factor is afstand. Hoe kan de afstand van de stakeholder worden tot de IC gedefinieerd, in termen van hoe nauw de stakeholder is geassocieerd met de IC?

Kies het toepasselijk antwoord voor elke optie

	Ver verwijderd (geen directe betrokkenheid)	Verwijderd v/d IC maar regelmatig contact met of input voor het proces	Werkt regelmatig met de IC samen (snijdende specialismen bv.)	Werkt regelmatig op de IC (IC verpleegkundige bv.)
Stakeholder 1	☐	☐	☐	☐
Stakeholder 2	☐	☐	☐	☐
Stakeholder 3	☐	☐	☐	☐
Stakeholder 4	☐	☐	☐	☐
Stakeholder 5	☐	☐	☐	☐

4.: De derde factor is belang. Hoeveel heeft de stakeholder te winnen of verliezen, gebaseerd op de uitkomsten van het proces op de IC (dit kan financieel, emotioneel, reputatie, etc. zijn)? Het belang van de stakeholder bij het proces op de IC is:

Kies het toepasselijk antwoord voor elke optie

	Erg laag	Laag (bv. indirect belang)	Gemiddeld (wat direct belang)	Hoog (ziet uitkomsten als belangrijk voordeel)	Erg hoog (heeft grote persoonlijke belangen)
Stakeholder 1	☐	☐	☐	☐	☐
Stakeholder 2	☐	☐	☐	☐	☐
Stakeholder 3	☐	☐	☐	☐	☐
Stakeholder 4	☐	☐	☐	☐	☐
Stakeholder 5	☐	☐	☐	☐	☐

5.: Hoeveel belang hecht de stakeholder aan het proces op de IC, dit wil zeggen: hoe waarschijnlijk het is dat de stakeholder actie onderneemt om een gewenst resultaat te behalen?

Kies het toepasselijk antwoord voor elke optie

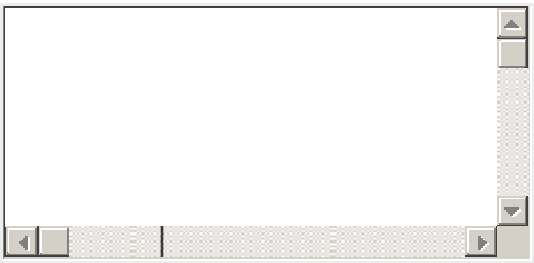
	Het belang het proces op de IC is erg laag, zal niet gauw het het proces op de IC beinvloeden	Het belang van het proces op de IC is laag; kan het het proces op de IC potentieel beinvloeden	Het belang van het proces op de IC is gemiddeld; kan stappen ondernemen om het het proces op de IC t	Het belang van het proces op de IC is hoog;kan significante stappen nemen om proces te beinvloeden	Het belang van het proces op de IC is erg hoog; zal alles proberen om het proces te beinvloeden
Stakeholder 1	☐	☐	☐	☐	☐
Stakeholder 2	☐	☐	☐	☐	☐
Stakeholder 3	☐	☐	☐	☐	☐
Stakeholder 4	☐	☐	☐	☐	☐
Stakeholder 5	☐	☐	☐	☐	☐

6.: Tot zover de scoring op de dimensies van de stakeholder. De volgende vraag gaat verder in op de belangen van de 5 belangrijkste stakeholders. Wat zijn de belangrijkste belangen bij het proces op de IC van de vijf stakeholders die u hierboven heeft benoemd, volgens uw ervaringen op de IC? Geef bij de belangen aan voor welke stakeholder deze gelden.

Schrijf uw antwoord hier

7: Nu de laatste vraag: zijn er in de loop van deze vragenlijst nog andere stakeholders bij u opgekomen die volgens u ook een groot belang bij het proces op de IC hebben?

Schrijf uw antwoord hier



Bedankt voor uw deelname aan deze enquête.

Appendix 3: Interview and meeting list

Name	Hospital	Function	Subject
Prof. Dr. Jan Bakker	Erasmus MC	Department head ICU	Aims of project, requirements, stakeholders, ICU in general, indicators, characteristics
Drs. Naomi Nathan	Erasmus MC	Cluster manager	Stakeholders, subjects of benchmarking, ICU Erasmus MC
Dr. Tulleken, dr. Zijlstra	UMCG	(deputy) medical unit heads ICU	Aims of project, requirements, stakeholders, ICU UMCG, characteristics
Dr. Schneider	UMCU	Medical manager	Aims of project, requirements, stakeholders, ICU UMCU, indicators, characteristics
Dr. Bert Harinck	LUMC	Deputy department head ICU	Aims of project, requirements, stakeholders, ICU LUMC
Mevr. A. Vuyk	LUMC	ICU manager	Characteristics LUMC
Prof. Dr. Hans van der Hoeven	St. Radboud	Deputy ICU department head,	Aims of project, requirements, stakeholders, ICU OLVG, indicators, characteristics
Drs. Edith Gommers	OLVG	ICU manager	Organizational aspects of the ICU, stakeholders, ICU OLVG
Prof. Dr. Girbes	VUmc	Cluster head VUmc	Organizational aspects of the ICU, stakeholders, ICU Vumc, indicators
Drs. Marleen de Mul	iBMG	Researcher	How to compose an indicator list
Dr. Ben van der Hoven	Erasmus MC	ICU physician	Quality of NICE data
Monique Westerlaken	Erasmus MC	Care manager	Indicators, interests nurses
Luc Knap	Erasmus MC	Quality advisor	Characteristics questionnaire, indicator list, interests nurses
Francine Ijpelaar	Erasmus MC	Financial advisor	Characteristics questionnaire

Erik Zwarter	Erasmus MC	Logistics manager	Characteristics questionnaire
Wilbert Borst	Erasmus MC	Unit manager ICU	Nurses, patient interests, characteristics ICU Erasmus MC
Jan Gorter (?)	Erasmus MC	Host ICU	Interests family of patients
Dr. Casper van Eijck	Erasmus MC	Surgeon	Interests referring physicians in ICU

Table A1: Interviews benchmarking IC

Date, Place	**Subject**	**Participants**
15-9-2007, Maastricht	Information + kick-off benchmarking IC	Prof. dr, Bakker (Erasmus MC), dr. van der Spoel (OLVG), dr. Tulleken, dr. Zijlstra (UMCG), prof. dr, Zwaveling, prof. dr. Zandstra, dr. Harinck (LUMC), prof. dr. van der Hoeven, prof. dr. Girbes
21-12-2007, Utrecht	Progress of the project, discussion characteristics, presentation proposed indicator set	Prof. dr, Bakker (Erasmus MC), dr. van der Spoel (OLVG), dr. Tulleken, dr. Zijlstra (UMCG), prof. dr. Kesecioglu, dr. Schneider (UMCU) dr. Strack (VUmc), prof. ir. Krabbendam, Leonoor Brouwer (Universiteit Twente), ir. Arjan van Hoorn (Benchmarking OK, vz)
15-02-2007, Ede	Presentation characteristics, discussion indicators	Prof. dr, Bakker (Erasmus MC), dr. van der Spoel (OLVG), prof. dr. Kesecioglu , dr. Schneider (UMCU), dr. Strack (VUmc), prof. ir. Krabbendam, Leonoor Brouwer (Universiteit Twente), ir. Arjan van Hoorn (Benchmarking OK, vz)

Table A2 Meetings with the benchmark group

Appendix 4: Characteristics questionnaire Intensive Care Units

Instructies: in de linker kolom staan de vragen. Deze zijn voor zover mogelijk ingevuld met behulp van geleverde gegevens. Wilt u deze controleren? Wilt u verder de nog niet ingevulde vragen beantwoorden? Deze zijn geel gemaakt. De begrippen in groene vakken zijn verduidelijkt in bijgevoegde definitielijst.

Input - transforming resources
Niveau IC
Bij visitatie bevestigd?
Lay-out en capaciteit IC
Unit 1 - naam
specialisme
operationele bedden
bedden beademd
bed bezetting
Unit 2 - naam
specialisme
operationele bedden
bedden beademd
bed bezetting
Unit 3 - naam
specialisme
operationele bedden
bedden beademd
bed bezetting
Unit 4 - naam
specialisme
operationele bedden
bedden beademd
bed bezetting
Maximale capaciteit IC bedden binnen uw organisatie
Totaal aantal hemofiltratie-apparaten
Totaal aantal isolatie-bedden (incl sluis en overdruk)
Hoe veel minuten lopen is het tussen de twee verst van elkaar verwijderde IC units?
Valt er een MC onder uw IC organisatie? Zo ja, vul de volgende drie vragen in:
Naam MC
operationele bedden
bedden beademd
Is er een 24-uurs PACU met beademingsmogelijkheden in uw ziekenhuis? Zo ja, vul volgende drie vragen in:
operationele bedden
valt PACU onder uw IC organisatie?
Bent u vanaf januari 2008 een MICU- coordinatiecentrum?
Hoort er een aparte IC voor kinderen bij uw IC organisatie? Zo ja, vul volgende twee vragen in:
Kinder IC - naam
operationele bedden
Bevat uw ziekenhuis een centrum voor thuisbeademing?
Valt deze onder uw IC organisatie?
Totaal aantal bedden in uw ziekenhuis
Welke medium, high en intensive cares zijn er nog meer in uw ziekenhuis, maar maken geen deel uit van uw organisatie?

Technologie
Diagnostische apparatuur aanwezig op de units zelf?
Skills lab aanwezig voor gebruik door IC?

Financieel
IC budget 2006
Deelposten exploitatie 2006 (gerealiseerd)
- Personeel
- Materieel
- PDMS beheer
- Diagnostiek
- Onderzoek 1e geldstroom
- Onderwijs

Overhead (olvg)
apotheek (olvg)
Totaal IC gerealiseerd 2006

Organisatie algemeen
Jaartal laatste grote reorganisatie IC (doel reorganisatie)

Input - transformed resources - patienten karakteristieken

Algemeen
Totaal aantal opnamen in 2006 - eigen systeem
Totaal aantal opnamen in 2006 - NICE
Totaal aantal behandeldagen
Totaal aantal unieke patienten opgenomen in 2006

Beademingsduur
Aantal beademde patienten totaal
Aantal beademingsdagen totaal
Aantal heropnames binnen dezelfde ziekenhuisopname

Ernst ziekte opgenomen patienten
Gemiddelde APACHE II score 2006
Standaarddeviatie APACHE II score
Patientenaantal waarop APACHE II score gebaseerd is

Opnametype
Aantal medische opnamen
Aantal spoed en urgente chirurgie opnamen
Aantal geplande en electieve chirurgie opnamen
Aantal opnamen waarbij patient was overleden voor de IC-opname
Aantal opnamen met onbekende achtergrond
Totaal

Aantal opnamen per specialisme
Inwendige geneeskunde
Cardiologie
et.
Totaal

Aantal opnamen naar herkomst
Spoedeisende hulp dit zkh
Spoedeisende hulp ander zkh
etc.
Totaal

Structuur kenmerken
Management
Aantal management lagen tussen IC verpleegkundige - RvB
Kunt u deze lagen benoemen?
Heeft u een organogram van de IC-organisatie en de plaats van de IC in het ziekenhuis? Zo ja, wilt u deze bijvoegen als deze nog niet in de aangeleverde verslagen staat?
Aansturing
De intensivist(en) zijn formeel hoofdbehandelaar van alle IC patienten De intensivist(en) zijn in de praktijk hoofdbehandelaar van alle IC patienten
Formatie (optellen alle units die onder uw IC organisatie vallen)
Rouleren de artsen tussen alle units?
Rouleren de verpleegkundigen tussen alle units?
Minimale bezetting
Minimale bezetting overdag: intensivisten; fellows; arts-assistenten
Minimale bezetting 's avonds: intensivisten; fellows; arts-assistenten
Minimale bezetting 's nachts: intensivisten (beschikbaar), intensivisten (bereikbaar); fellows; arts-assistenten
Minimale patient/verpleegkundige ratio overdag Minimale patient/verpleegkundige ratio 's avonds Minimale patient/verpleegkundige ratio 's nachts
Normale bezetting
Normale bezetting overdag: intensivisten; fellows; arts-assistenten Normale bezetting 's avonds: intensivisten; fellows; arts-assistenten
Normale bezetting 's nachts: intensivisten (beschikbaar), intensivisten (bereikbaar); fellows; arts-assistenten
Normale patient/verpleegkundige ratio overdag Normale patient/verpleegkundige ratio 's avonds Normale patient/verpleegkundige ratio 's nachts
Overlegorganen Management
Naam Functies vertegenwoordigd Frequentie
Naam Functies vertegenwoordigd Frequentie
Coordinatie van zorg
Vindt er dagelijks een MDO plaats? Zijn verwijzende specialisten hierbij aanwezig? Zijn verpleegkundigen hierbij aanwezig? Welke andere functies zijn hierbij aanwezig?
Vinden er dagelijks nog andere overleggen met verwijzende artsen plaats? Met wie?
Hoe vaak wordt er visite gelopen per dag door de IC artsen? Zijn verwijzende specialisten hierbij aanwezig? Zijn verpleegkundigen hierbij aanwezig?
Beschikt u over een verpleegkundig outreachteam voor afdelingen in het ziekenhuis?
Beschikt u over een poli nazorg of een consulting nurse?
Is er een gebruikersoverleg? Zo ja, hoe vaak per jaar vindt dit plaats? Zo ja, welke specialismen zijn hierbij aanwezig?
Maakt een een productie/prestatieafspraak met de RvB? Wat wordt hier in vastgelegd?
Kwaliteit
Gebruikt U een set prestatie-indicatoren voor intern gebruik?
Welke prestatieindicatoren gebruikt u?
Registreert u complicaties?
Vinden er complicatie en necrologie besprekingen plaats?
Wordt er een IC jaarverslag gemaakt?
Heeft u een jaarverslag van NICE ontvangen?
Werkt u met een opname- en ontslagprotocollen?

Formatie en bezetting personeel 2006

Aantal FTE per functie gemiddeld over 2006

Functie
Medische staf
Afdelingshoofd #FTE
Geregistreerd intensivist #FTE
Fellow (incl. aandachtsgebieders) #FTE
AGIO's #FTE
AGNIO's #FTE
Totaal artsen
Verpleegkundige staf
Regieverpleegkundige #FTE in dienst van de IC (aan bed)
Senior geregistreerd IC-verpleegkundige #FTE (aan bed)
Geregistreerd IC-verpleegkundige #FTE (aan bed)
Leerling IC-verpleegkundige #FTE
Zorg/afdelings assistent #FTE
Overige #FTE
Totaal verplegend + verzorgend
Totaal geregistreerde verpleegkundigen
Wetenschappelijke staf (buiten bovenstaande medische staf)
Research verpleegkundige #FTE
Wetenschappelijk onderzoeker #FTE
Anders: Functie + #FTE
Totaal wetenschappelijk personeel
Management, administratie en ander personneel in dienst IC
Verpleegkundig unithoofd/zorgmanager/sectiehoofd #FTE
Verpleegkundigen (niet aan bed) #FTE
Teamleider #FTE
Secretaresse/officemanager #FTE
Ethicus #FTE
Adviseur kwaliteit #FTE
Apothekersassistenten # FTE
Anders: Functie
#FTE
Anders: Functie
#FTE
Anders: Functie
#FTE
Totaal ondersteunend personneel

Appendix 5: Definitions characteristics list ICU

No	Kenmerk – Naam	Omschrijving
3	Bedbezetting	Totaal aantal behandeldagen 2006 / (aantal bedden * 365)
4	Maximale capaciteit bedden	Het totaal aantal bedden dat op de unit aanwezig is, dus operationele bedden en bedden die niet gebruikt wordt wegens bijv. gebrek aan verpleegkundigen
17	Bezetting/formatie	Bezetting is het werkelijke gemiddeld aantal werknemers per functie in 2006, de formatie is het aantal plekken dat officieel vastgesteld is voor 2006 per functie
19	IC Budget 2006 (*1000)	Totaal budget voor uw IC organisatie zoals vastgesteld voor 2006
	Deelposten exploitatie 2006	Vul alleen de gerealiseerde deelposten in die u zelf ook gebruikt of voeg deze toe
20	Jaartal laatste grote reorganisatie IC (doel reorganisatie)	Vul hier het jaartal in dat de laatste grote reorganisatie op uw IC plaats vond, en tussen haakjes de aard van deze reorganisatie
23	Opnametype	Indicatie van type opname:
30	Bezetting 's nachts: intensivisten (beschikbaar), intensivisten (bereikbaar); fellows; arts-assistenten	Beschikbaar: in huis, bereikbaar: thuis maar binnen 20 minuten aanwezig
		"Medisch" (geen chirurgie in de week voor IC-opname); "Spoed chirurgie" (onmiddellijke chirurgie waar resuscitatie, stabilisatie en fysiologische optimalisatie simultaan met de chirurgische ingreep plaatsvindt); "Urgente chirurgie" (chirurgie zo snel mogelijk na resuscitatie, stabilisatie en fysiologische optimalisatie); "Geplande chirurgie" (vroege chirurgie gepland binnen 24 uur na OK-indicatie); "Electieve chirurgie" (chirurgie op een tijdstip dat zowel patiënt als chirurg schikt); "Overleden voor ICU opname" (overleden voor ICU opname, bv opname voor orgaan donatie).
	Personeelsbezetting	het aantal FTE dat werkelijk in dienst is
	Formatie	personeelsbezetting plus vacatures

Appendix 6: ICU stakeholders list

Stakeholder position in Mitchells' stakeholder grid, scored by the researcher, and validated in two interviews with an ICU care manager and a care researcher.

Stakeholder Group	Urgency	Legitimacy	Power
Patients	+	+	0
Family of patients	+	-	0
Physicians (Staff)	+	+	+
Fellows, assistants	+	+	-
Nurses	+	+	+
Care assistants	+	0	-
IC management	+	+	+
Hospital management	-	+	+
Regional partners	0	-	-
Referring Physicians	+	0	+
Supporting services	-	+	-
Teaching institutions	0	-	-
Faculty	-	+	-
Medical research firms	-	0	-
GHOR	-	0	-
Patient associations	0	-	-
MICU	-	+	-
Centre for home respiration	-	+	-
Health insurer	-	+	-
CBO	0	-	-
NIAZ	0	-	0
Hospital pharmacy	-	+	-
Health Inspection	-	+	+
NVIC	0	-	-
NVIVC	0	-	-

Appendix 7: stakeholders most mentioned

Number of times each stakeholder group was mentioned as one of the five most important stakeholder groups, in six surveys and nine interviews.

# genoemd	Stakeholder groepen	Belang stakeholders
10	Verpleegkundigen	Kwaliteit van zorg, professionele expertise, werkklimaat en inkomen, opleiding
10	Verwijzende specialisten	Opnamecapaciteit en kwaliteit, door kunnen sturen van patiënten, klinische zorg van hun patiënt.Dit reflecteert ook op hun prestatie, mogelijkheid academische taken te kunnen uitvoeren
9	Patiënten	Kwaliteit van zorg, bejegening
7	Artsen	Kwaliteit van zorg, professionele expertise, onderzoek, research academische werkomgeving top referente zorg, medisch productie uitstraling
6	Familie van patiënten	Kwaliteit, bejegening
5	Ziekenhuismanagement / RvB	Kwaliteit IC zorg, efficiëntie/kostenbeheersing, binden en boeien medewerkers, belangen om het UMC goed te laten functioneren als topklinisch centrum, voldoen aan landelijke richtlijnen, patiëntenzorg, imago, organisatie van zorg voor alle patiënten,doorstroom, voorkomen van wachtlijsten bij grote ingrepen, die IC nodig hebben
5	Specialismen/IC andere ziekenhuizen	Capaciteit, bereikbaarheid
2	Arts-assistenten	Zorg voor patiënten, verkrijgen van opleiding.
2	Ondersteunende specialismen	Ondersteuning van de IC als academische taak
2	Verpleegafdelingen	Ondersteuning van de doorstroming op de IC, tegelijk belang van mogelijkheid tot opname op de IC (koehandel)
2	IGZ	Kwaliteit van zorg
1	NVIC / NVIVV	Uniformiteit, positie IC binnen de zorg profileren
1	Opleidingsinstituten	Opleidingsplaatsen
1	Centrum voor thuisbeademing	Faciliteiten van de IC
1	VWS	Bewaakt uitgaven BNP en kwaliteit van zorg

Appendix 8: Processes interesting as part process for benchmarking

Inventarisatie processen IC geschikt voor benchmarken

= totale interesse >= 5

= kan optreden als kennisdonor

Nog te combineren in +/- vijf deelvoorstellen / onderzoeksontwerpen

Score: 0 (niet interessant voor benchmarking); 0,5; 1 (zeer interessant voor benchmarking)

De onderwerpen die genoemd zijn in gesprekken zijn, logischerwijs, niet door alle ander IC's beoordeeld

	AZM	Erasmus	LUMC	UMCG	Radboud	OLVG	UMCU	VUMC	Totaal
Patiënten en andere belanghebbenden									
Hoe kan je patienten betrekken om de zorg patientgerichter te organiseren (en hoe meet je patienttevredenheid)	1	0	1	0	1	0.5	0	0,5	4
Hoe geven we vorm aan de relatie met gebruikers van de IC? Verstandhouding, planning ed	0,5	1	0,5	1	1	0	0,5	1	5,5
Hoe is de IC betrokken in de OK planning?	0,5	1	0	1	1	0	0	1	4,5
Hoe is de afstemming tussen SEH en IC geregeld? Welke patiënten komen wanneer naar de IC?	0	0.5	0	0	1	0	0	1	2.5
Interne werkprocessen									
Wie heeft formele verantwoordelijkheid voor de patiënten? Hoe is dit in de overdracht met de OK, SEH en verpleegafdelingen geregeld?	0	1	0,5	0	0	0	0	0	1,5

Hoe zorgen we dat alleen de patienten die op de IC horen er liggen? Opname en ontslag criteria ed.	0	1	0	0	0,5	0	0	1	2,5
Is het gebruik van step-up/step-down faciliteiten zoals een MC aan te raden?	0	1	0,5	1	0	1	1	1	5,5
Maken we gebruik van een zorgzwaarte meting en gebruiken we deze ook?	1	1	1	0	0	1	0	0,5	4,5
Hoe stemmen we de zorg tussen specialist en intensivist af? Is hier een protocol voor?		1	0	0	0	0	0	1	2
Hoe stemmen we de zorg tussen intensivist en verpleegkundige af?	0,5	1	0,5	0	1	0	0.5	1	4,5
Hoe kan er vorm worden gegeven aan in CBO norm vastgelegde regiofunctie?	1	1	1	1	1	1	1	1	8
Gebruiken we een elektronisch dossier en zo ja, wat zijn de ervaringen hier mee? Hoe kunnen we beter gebruik maken van de beschikbare technieken?	0,5	0		1	1	0.5	0	1	4
Werknemers en organisatie capaciteit									0
Hoe hoog is ons ziekteverzuim?	1	1	0,5	0	1		0	1	4,5
Hoe is de medewerkertevredenheid ? Hoe meet en beinvloed je dit?	0	1	0	0	1	1	0	1	4
Waarop baseren we de personeelsplanning (artsen)? Wat zijn de minimumeisen, hoe gaan we om met bezetting 's nachts en overdag, bereikbaarheidsdiensten en in hoeverre (willen en kunnen) we voldoen aan de CBO normen?	1	1	1	1	1	1	1	1	8
Waarop baseren we de personeelsplanning (verpleegkundigen)?	1	1	1	0	1	0	0	0	4
Hoe kunnen we omgaan met het (stijgende) gebrek aan verpleegkundigen?	0	1	0,5	1	0	0	0		2.5
Wat is de beste layout voor een IC unit?	1		0	1	1	0	0,5		3,5
Financieel:									0
Wat is de bezettingsgraad van de bedden op de IC?		1	0,5	0	0	0	0.5	1	3
Hoe zorgen we dat ons budget niet wordt overschreden?	0		0,5	0	1	0	0		1.5

Berekenen we de koster per bed en per diagnose, en zo ja hoe?	0	1	1	1	1	1	0.5	1	6,5
Hoe onderhandelen we met verzekeraars? Hoe zit het met DBC's?	0	1	1	0	1	1	0,5	0,5	5
Genoemd in gesprekken									0
Hoe wordt invulling gegeven aan poli nazorg/ outreachteams, ervaringen ermee?	1	1						1	3
Wat is precies het werkveld van de IC (omvat grenzen SEH, OK, outreach, etc)	1								1
Hoe vorm te geven aan de complicatieregistratie? Wat vastleggen?	1	1				1			3
Kunnen we zorgpaden inrichten voor de grootste patientengroepen?		1	0,5						1.5
Hoe geven we vorm aan het onderwijs aan fellows?	1	0	1	1					3
Hoe stimuleren we de staff om wetenschappelijk onderzoek te doen?		1		1					2
Hoe kunnen we een skills lab inrichten en gebruiken?		1	1						2
Hoe organiseren we onze units zo dat ze een geheel vormen?/ wat is de org vorm		1		1	1				3
		1			1				2
		0.5	0	1	1	1			3,5
	1	0							1

Appendix 9: Results of the questionnaire

kenmerken IC's 2006	AZM	EMC	LUMC	UMCG	St Radboud	OLVG	UMCU	VUmc
Instructies: in de linker kolom staan de vragen. Deze zijn voor zover mogelijk ingevuld met behulp van geleverde gegevens. Wilt u deze controleren? Wilt u verder de nog niet ingevulde vragen beantwoorden? Deze zijn geel gemaakt. De begrippen in groene vakken zijn verduidelijkt in bijgevoegde definitielijst.								
Gegevens beschikbaar gesteld per ziekenhuis	Interview Jaarverslag IC	Interview Toegang medewerkers	Interview NICE 2006	Interview Visitatierapport 2006	Interview NICE 2006	Interview Jaarverslag IC NICE 2006	Interview Jaarverslag IC NICE report	Interview Jaarverslag IC prestatie-indicatoren IC
Gegevens gecontroleerd?	Nee	ja	nee		nee			ja
Input - transforming resources								
Niveau IC	III	III	III	III	III	III	III	III, III, I
Bij visitatie bevestigd?	Ja	ja	ja	Ja	ja	ja	ja	ja
Lay-out en capaciteit IC								
Unit 1 - naam	D3	3 zuid		ICB	AOV	ICU	1	7D
specialisme	gemengd/langdurig	gemengd	Heelkunde	Interne/gemengd	Thorax	gemengd	gemengd	gemengd
# operationele bedden	9	14	9	12	12	24	13	14
# bedden beademd	9	14	9	12	12	18	13	14
bed bezetting	91%	84%		≥ 85 %		94%	87%	92%
Unit 2 - naam	E3	10 zuid	ICNI	NCIC	N12		2	6D
specialisme	gemengd/langdurig	gemengd	neurologie	Neuro	Neuro		gemengd	gemengd

# operationele bedden	9	14	11	6	6		8	14
# bedden beademd	9	14	11	6	6		8	14
bed bezetting	91%	84%					87%	92%
Unit 3 - naam	F3 Postoperatief/planbaar	IC Thorax		THIC	H20 interne/heelkunde		3	
specialisme		Thorax	Thorax	Thorax			gemengd	
# operationele bedden	9		10	14	7		11	
# bedden beademd	9		10	14	7		11	
bed bezetting	79%						87%	
Unit 4 - naam				CHIC	H35			
specialisme				Chirurgie alg.	Interne/heelkunde. met isolatie			
# operationele bedden				12	8			
# bedden beademd				12	8			
bed bezetting								
Max male capaciteit IC bedden binnen uw organisatie			29	44	46	26	32	28
Totaal aantal hemofiltratie-apparaten						4		5
Totaa aantal isolatie-bedden (incl sluis en overdruk)						2	5	3
Hoe veel minuten loper is het tussen de twee verst van elkaar verwijderde IC units?		10 min		3		nvt	5	2
Valt er een MC onder uw IC organisatie? Zo ja, vul de volgende drie vragen in:	Nee	nee	nee	nee	nee	nee	ja	ja
Naam MC								2D MC
# operationele bedden								9
# bedden beademd								0

Is er een 24-uurs PACU met beademingsmogelijkheden in uw ziekenhuis? Zo ja, vul volgende drie vragen in: # operationele bedden valt PACU onder uw IC organisatie?	ja (recovery) Nee	ja (6 zuid) ook beademing? 5 nee	nee 5 nee			nee	nee	nee
Bent u vanaf januari 2008 een MICU-coordinatiecentrum?	Ja	ja	nee	Ja	ja	nee	ja	nee. aanvraag loopt
Hoort er een aparte IC voor kinderen bij uw IC organisatie? Zo ja, vul volgende twee vragen in: Kinder IC - naam # operationele bedden	Nee	nee (Sophia)	ja KIC 8	nee (Beatrix)	ja QC3 13	nee	nee (Wilhelmina)	nee
Bevat uw ziekenhuis een centrum voor thuisbeademing? Valt deze onder uw IC organisatie?	Ja	ja ja	nee	Ja nee	nee	nee	ja	nee
Totaal aantal bedden in uw ziekenhuis	715	831	882	1339	953	550	1042	733
Welke medium, high en intensive cares zijn er nog meer in uw ziekenhuis, maar maken geen deel uit van uw organisatie?		IC, HC, MC thorax	MC neurochirurgie (5, 6 beder)	MC neurochirurgie			MC neurochirurgie, MC cardiochirurgie, MC heelkunde	
Aantal bedden totaal binnen IC organisatie	**27**	**28**	**38**	**44**	**46**	**24**	**32**	**37**
Aantal bedden totaal	27	28	38	44	46	24	32	37

binnen IC organisatie								
Aantal beademde bedden voor volwassenen	**27**	**28**	**30**	**44**	**28**	**18**	**32**	**28**
Ziekenhuisbedden per IC bed	26	30	23	30	21	23	33	20
Ziekenhuisbedden per beademd IC bed	26	30	29	30	34	31	33	26
Technologie								
Diagnostische apparatuur aanwezig op de units zelf?		ja (bloedgas)				ja		ja
Skills lab aanwezig voor gebruik door IC?	nee?	nee	ja	Ja			nee	ja
Financieel								
IC budget 2006		14342.7				12285	15.250	
Deelposten exploitatie 2006 (gerealiseerd)								
Personeel		11067.9				6576.4	11.172	
Materieel		3110,6				785	3.624	
PDMS beheer						70	396	
Diagnostiek		385,8				1587	-	
Onderzoek 1e geldstroom		517				0		
Onderwijs						90		
Overhead (olvg)						1557	-	
apotheek (olvg)						1618	-	
Totaa IC gerealiseerd 2006	**0**	**15081,3**	**0**	**0**	**0**	**12283,4**	**15.192**	**0**
		538,6	**0,0**	**0,0**	**0,0**	**511,8**	**474,8**	**0,0**
Organisatie algemeen								

Jaartal laatste grote reorganisatie IC (doel reorganisatie)	2005 (IC aparte afdeling)	2006 (herorganiseren units)		2007 (samenvoegen units)		2006/2007 (samenvoegen HC en IC / aansturing verpleegkundigen)	2005 (ontstaan IC-centrum), 2007 (herorganiseren werkorganisatie)	2001 (oprichting van de afdeling)
Input - transformed resources - patienten karakteristieken								
Algemeen								
Totaal aantal opnamen in 2008 - eigen systeem	1688	1319	1630	2879	1552	1529	2018	1501
Totaal aantal opnamen in 2008 - NICE	-	-	1630		1552	1529	1972	-
Totaal aantal behandeldagen	8216	9838	8728	13214	8199	6187	8563	9438
Totaal aantal unieke patienten opgenomen in 2006		1215	1469		1396	1375	1819	
Gem behandelduur (unieke patiënten)	#DEEL/0!	8,1	5,9		5,9	4.5	4.7	
Gem. behandelduur (opnames)	4,9	7,5	5,4		5,3	4.0	4.3	6,3
Gemiddelde behandelduur (dagen)		8,1	5,4		5,3	4.0	4.3	5,3
Beademingsduur								
Aantal beademde patienten totaal	1420	944	1294		1133	1415		1358
Aantal beademingsdagen totaal	7286	5812				4357		
Gemiddelde beademingsduur (dagen)								
Aantal heropnames binnen		104	116		120	123	126	223

dezelfde ziekenhuisopname								
Ernst ziekte opgenomen patienten								
Gemiddelde APACHE II score 2006 excl. CABG		19	17,3		16.52	21.89	19,17	18.25
Standaarddeviatie APACHE II score excl. CABG		7,6	8,32		7,44	8,81	6.78	
Patientenaantal waarop APACHE II score gebaseerc is		1319	534	0	1157	591	1038	1269
Opnametype								
Aantal medische opnamen		856	523		647	470	543	
Aantal spoed en urgente chirurgie opnamen		222	180		337	186	435	
Aantal geplande en electieve chirurgie opnamen		194	925		561	873	967	
Aantal opnamen waarbij patient was overleden voor de IC-opname		0	0		2	0	0	
Aantal opnamen met onbekende achtergrond		47	2		5	0	27	
Totaal	1688	1319	**1630**		1552	1547	1972	
Percentage planbaar&electief	0%	47%	84%	#DEEL/0!	62%	82%	69%	#DEEL/0!
Aantal opnamen per specialisme								
Inwendige geneeskunde		128	251		97	122	70	52
Cardiologie		12	37		88	144	87	69
Longziekten		48	37		60	68	31	18
Reumatologie			2		4	-	3	2
Gastro-enterologie		38	21		15	20	5	4

Anestesiologie		6	3		17	-	3	1
Heelkunde		371	306		267	223	301	
Urologie		12	23		54	16	17	16
Orthopedie		11	12		41	20	16	22
Neurochirurgie		244	165		262	-	199	96
Plastische chirurgie		16	-		9	1	2	1
Gynaecologie en verloskunde		24	19		32	14	19	12
Kindergeneeskunde			2		6	3	-	
Neurologie (aantekening klinische neurofysiologie)		175	43		82	37	159	26
Dermatologie			-		2	-	-	
Keel-, neus-, oorheelkunde		32	19		36	4	41	22
Revalidatie		2	-		3	-	2	
Cardio-pulmonale chirurgie		4	-		293	863	626	
Klinische geriatrie			-		2	-	1	
Mondziekten en kaakchirurgie		2	1		28	1	26	1
Vaatchirurgie		41	-		75	-	42	103
Hematologie		23	18		36	1	12	19
Kinderchirurgie					2	-	-	
Nefrologie		14	14		23	10	11	12
Oncologie		3	2		9	-	4	
Thorax chirurgie		16	655		-		245	609
Ander specialisme:		60					9	222
Specialisme onbekend		37			5	-	41	44
Totaal	**0**	**1319**	**1630**	**#DEEL/0!**	**1548**	**1547**	**1972**	**1351**
Aantal opnamen naar herkomst								
Spoedeisende hulp dit zkh		256	231		270	177	-	226
Spoedeisende hulp ander zkh		53	0		42	32	-	
Verpleegafdeling dit zkh		273	235		235	226	-	969
Verpleegafdeling ander zkh		41	19		15	10	-	

Huis		44	0		0	0	-	4
CCU/ICU dit zkh		34	3		18	32	-	
CCU/ICU ander zkh		70	71		67	61	-	
Special care dit zkh		2	104		57	0	-	
Special care ander zkh		11	0		4	0	-	
OK dit zkh		451	960		780	986	-	
OK ander zkh		8	4		18	5	-	
Recovery dit zkh		11	0		33	2	-	108
Recovery ander zkh		0	0		0	1	-	
Elders ander zkh		6	0		8	0	-	71
Andere lokatie dit zkh		16	0		0	15 cathkamer van SEH OLVG of ander ZH	-	
toelichting andere locatie		arr bulance						
Onbekend		43	3		5	0	1972	
Totaal	**0**	**1319**	**1630**	**0**	**1552**	**1547**	**1972**	**1378**
Aantal herkomst ander ziekenhuis		189	94	0	154	109		71
percentage herkomst ander ziekenhuis		14%	6%		10%	7%		5%
Aantal herkomst OK dit ziekenhuis		462	960		813	986		108
percentage OK dit ziekenhuis		35%	59%		52%	64%		8%
Aantal verpleegafdelingen/ CCU/specialcare		309	342		310	258		969
percentage verpleegafdelingen dit ziekenhuis		23,43%	20,98%		19,97%	16,68%		70,32%
Aantal opnamen naar ontslagbestemming								
Verpleegafdeling dit ziekenhuis		750	1237		757	648	613	
CCU dit zkh		17	2		72	54	60	
Recovery / MC dit zkh		0	93		397	603	1025	

Ander ziekenhuis - verpleegafdeling		119	46		33	37	29	
Ander ziekenhuis - IC/CCU		11	20		28	25		
Ander ziekenhuis - recovery/MC		1	0		19	0		
Huis		46	20		21	6	19	
Anders		18	1		7	0	29	
Totaal	**0**	**962**	**1419**	**0**	**1334**	**1373**	**1775**	**0**
Proces								
Management								
Aantal management lagen tussen IC verpleegkundige - RvB		2	2	4		3	2	4
Benoeming functies lagen:		unithoofd - zorgmanager (clusterbestuur)	teamleider - verpleegkundig hoofd-	teamleider. afdelingshoofd. sectorvph		afdelingsleider - bedrijfsleider - unitvoorzitter	teamleider of unithoofd-management IC	teamleider - verpleegkundig hoofd - afdelingshoofd - divisievoorzitter - RvB
Heeft u een organogram van de IC-organisatie en de plaats van de IC in het ziekenhuis?		ja				ja		ja
Zo ja, wilt u deze bijvoegen als deze nog niet in de aangeleverde verslagen staat?		ja	-			in jaarverslag		in jaarverslag
Aansturing								
De intensivist(en) zijn formeel hoofdbehandelaar van alle IC patienten	Ja	ja	ja	Ja	ja	ja	ja	ja
De intensivist(en) zijn in de praktijk hoofdbehandelaar van alle IC patienten	Ja	ja	ja	Ja	ja	ja	ja	ja

Formatie (optellen alle units die onder uw IC organisatie vallen)								
Rouleren de artsen tussen alle units? Rouleren de verpleegkundigen tussen alle units?	Ja ja ??	ja nee	ja nee?	nee nee	ja	nvt nvt	ja nee, soms	ja deels. in principe niet rouleren
Minimale bezetting								
Minimale bezetting overdag: intensivisten: fellows; arts-assistenten		5;4:4		4,4,4		2:1;1	4;1;4	4:2;3
Minimale bezetting 's avonds intensivisten; fellows; arts-assistenten		1:1;4		4,1,4		1:1;1	2;1:2	2;2;2
Minimale bezetting 's nachts: ntensivisten (beschikbaar), intensivisten (bereikbaar); fellows; arts-assistenten		0;1 1;4		0,4 1.4		0;1;1	0;2:1;1	0;1;2;2
Minimale patient/verpleegkundige ratio overdag				2:1		2:1	1:1	1.5 : 1
Minimale patient/verpleegkundige ratio 's avonds				3:1		2:1	2:1	1.5 : 1
Minimale patient/verpleegkundige ratio 's nachts				3:1		2:1	2:1	2:1
Normale bezetting								
Normale bezetting overdag: intensivisten; fellows; arts-assistenten		5;4:4	3;3:6	4,6,4		2:2;1	4;3;4	4:2;4
Normale bezetting 's avonds intensivisten:		1:1;4	1;1:2	4,1,4		1:1;1	2;1:2	2;2;2

fel ows; arts-assistenten Normale bezetting 's nachts: ntensivisten (beschikbaar), intensivisten (bereikbaar); fel ows; arts-assistenten		0;1;1;2	1;1:2	4,1,4		0;1;1	0;2:2;1	0;2;2;2
Normale patient/verpleegkundige rat o overdag		bijna 1 vp op 1 p	bijna 1 vp op 1 p	2:01		2:1	1:1	1.5 :1
Normale patient/verpleegkundige ratio 's avonds			1 vp op 1,5 p	2:01		2:1	2:1	1.5:1
Normale patient/verpleegkundige ratio 's nachts			bijna 1 vp op 2 p	3:01		2:1	2:1	2:1
Overlegorganen Management								
Naam	Managementtea m	Managementtea m	Managementteam			Medisch verpleegkundi g overleg	Management team Medisch manager-vz, manager O&O-	Managementt eam
Functies vertegenwoordigd	Afdelingshoofd. plv. afd. hoofd, chirurg-IC arts. 2 hoofdverpleegku ndigen	Zorgmanager, Afdelingshoofd	Afdelingshoofd, plv. afd. hoofd, chirurg-IC arts. 2 hoofdverpleegkundi gen			med. Staf, afdelingsleider s, bedri fsleider, biotechnicus	afd.hoofd, manager zorg, manager bedrijfsvoerin g	Hoofd IC, verpleegkundi g hoofd, manager zorg en manager bedrijfsvoerin g
Frequentie	Wekelijks		Wekelijks			maandelijks	wekelijks	maandelijks
Naam	Stafvergadering		Stafvergadering			stafvergaderin g	stafbvergade romg	stafvergaderin g
Functies vertegenwoordigd	Medisch specialisten IC + 2		Intensivisten			intensiv sten	intensivisten	medische staf

	hoofdverpleegkundigen							
Frequertie	Maandelijks		wekelijks			maandelijks	2-wekelijks	maandelijks
Naam	zie jaarverslag					overleg bedrijfsleiders - afdelingsleiders	unitoverleg unithoofden, medisch aanspreekpunten,	staf-staf
Functies vertegenwoordigd						bedrijfsleiders, afdelingsleiders	medisch afdelingshoofd	verpleegkundige leiding en medische staf
Frequertie						2-wekelijks	2-wekelijks	maandelijks
Coordinatie van zorg								
Vindt er dagelijks een MDO plaats?	Ja	ja	ja	Ja	ja	ja neen, thoraxchirurgen aparte bespreking dgl, overigen individueel, deze komen verder in de ochtend langs	ja	ja
Zijn verwijzende specialisten hierbij aanwezig?	ja op uitnodiging	ja op uitnodiging	ja	?	gedeeltelijk		ja	deels
Zijn verpleegkundigen hierbij aanwezig?	nee, muv van die van 1 patient die uitvoerig besproken wordt	nee, muv van die van 1 patient die uitvoerig besproken wordt	nee, alleen bij besproken patiënt	Ja	?	ja	ja	ja

Welke andere functies zijn hierbij aanwezig?		ethicus, microbioloog,	microbioloog, apotheker		hematoloog. microbioloog	apotheker 1x/wk. microbioloog 3/wk	microbioloog/ infectioloog. chirurg en op uitnodiging andere specialismen	microbioloog, apotheker,
Vinden er dagelijks nog andere overleggen met verwijzende artsen p aats? Met wie?	ja, met cardiochirurgen	nee		Ja dagelijks MDO met verwijzers	ja:neuro, rontgen,	nee		ochtenrapport met chirurger: ochtendrapport met internisten, ochtendrapport met cardiochiriurgen
Hoe vaak wordt er visite gelopen per dag door de IC artsen?		2: ochtend, avond		2: ochtend avond		3: ochtend. middag, avond	3; ochtend. middag, avond	2; ochtend avond aparte ronde met verwijzende specia isten
Zijn verwijzende specialister hierbj aanwezig?		nee		nee		ja ('s ochtends informeel)	wisselend	
Zijn verpleegkundigen hierbij aanwezig?		nee		Ja		ja	ja	ja
Besch kt u over een verpleegkundig outreachteam voor afdelingen in het ziekenhuis?				nee		nee, is medisch van aard	consultfunctie	ja
Beschikt u over een po i nazorg of een consulting nurse?				nee		Er is een taakgroep die zich richt op nazorg	nee	nee
Is er een gebruikersoverleg?				ja		nee	ja	wij noemen dat verwijzersconferentie

Zo ja. hoe vaak per jaar vindt dit plaats? Zo ja. welke specialismen zijn hierbij aanwezig?				1 idem			2 x per jaar overge patientendivisies	eenmaal per jaar alle verwijzers
Maakt een een productie/prestatieafspraak met de RvB? Wat wordt hier in vastgelegd?		Aantal beademingsdagen. bezettingsgraad. aantal mensen in opleiding, deelname aan zorgpaden, aantal weigeringen		nee		ja, opnames / behandeldagen	ja, aantal opnames, bedbezetting. weigeringen, ziekteverzuim. publicaties. onderwijs	ja. Beademingsdagen
Kwaliteit								
Gebruikt U een set prestatie-indicatoren voor intern gebruik? Welke prestatieindicatoren gebruikt u? Registreert u complicaties? Vinden er complicatie en necrologie besprekingen plaats? Wordt er een IC jaarverslag gemaakt? Heeft u over 2006 een jaarverslag van NICE ontvangen? Werkt u met een opname- en ontslagprotocollen?	ja mee bezig Ja Nee	ja nee ja ja nee ja	ja nee ja	nee ja ja, meestal per moederspecialisme, en gecompliceerde casus op vrijdagochtend nee nee niet op alle afdelingen		ja in het PDMS ja, 5 a 6 maal per jaar ja ja	ja, NICE, NVIC (vd Voort) en inspectie - nog niet ja ja ja -	ja ja ja ja staat in verslagen nvt ja

Appendix 10: Summarizing description of participating ICU's based on characteristics questionnaire

In this appendix, a short summary of the characteristics of each ICU is given.

1.1.1 Intensive Care of the University Medical Centre of Maastricht

The level of the intensive care of the azM is level 3. The intensive care has, in total 26 beds, spread over 3 units:

- D3 and E3 (both 9 beds, utilization 91%), both general and long-stay intensive care units
- F3 (8 beds, utilization 79%), on which elective patients are accommodated

The recovery unit of the azM also has beds with respiration possibilities.

In 2005, the intensive care received the status of an independent department within the hospital with an own management. This management team exists of the department and deputy department head, the surgeon-IC physician and the two nurse unit heads. Other organizational committees are the staff meeting, the education, care, quality, research and planning committees. From 2007 on, the different staff units are organized as one department staff. Staff of the IC department consists of around 20 fte of IC physicians. Next to that, there are 4 physician-assistants in education.

Two nurse unit heads mange the nurses. Around 94 FTE of registered IC nurses work for the ICU of the azM. With 5 nurse pupils and 5 care assistants, the total number working near the patients becomes 104 FTE.

Daily multidisciplinary meetings take place. Besides the physicians, the nurse who is responsible for the patient whose case is spoken of that meeting is present. A separate daily meeting is scheduled with the cardio surgeons. A special referring physicians committee exists, whom meet twice a year to discuss topics related to the coordination of the care they provide with the ICU.

In a collaboration with the VieCuri hospital in Venlo, four times a year a meeting for all regional hospitals is organized. On this meeting, it is tried to make appointments concerning consultation and coordination in the region. However, these meetings have not yet leaded to a division of tasks or tangible results. The establishment of the MICU (mobile ICU) should accelerate the development of the functioning of the region as one big ICU department, in concordance with the CBO guidelines.

In 2006, the ICU of the AZM has organized a "benchmark" it selves. Two staff members paid a two day visit to several other university medical center ICUs to learn whether they could bring some knowledge back home.

In 2006, 1688 patients were treated on in total 8216 treatment days on the ICU of the azM. (mean LOS: 4,87 days, splitted in 2,45 days on F3 and 8,92 on D3 and E3). Of those patients, 84% received artificial respiration. In 2006, 179 reanimations were conducted in the hospital.

1.1.2 Intensive Care of the Erasmus Medical Centre (H-buidling)

As stated, in this project only the general ICU of the Erasmus is assessed, the thorax and oncology ICU's do not participate. The level of the general intensive care of the Erasmus MC is level 3. De

intensive care has, in total, 28 beds, and in case of need, 4 more beds can be used as medium care bed. These beds are dispersed as follows:

- H 10 zuid: General intensive care (16 beds)
- H 3 zuid: General intensive care (16 beds)

In the first part of 2006 the PACU also was part of this ICU organization, later it became a separate unit. In 2007, the thorax intensive care became part of the ICU department. In the Erasmus hospital, a thorax high and medium care and an intensive and medium coronary care unit exist next to the intensive care department, for those categories of patients needing a higher level of care than the wards provide.

In 2006, 1215 patients were treated on the ICU in, in total, 9838 treatment days (mean LOS: 7,5 days). Many different specialists refer patients tot the ICU, most from general surgery (28% of all patients on the ICU), followed by neurosurgery (18%).

Staff of the IC department consists of around 16 FTE of ICU physicians. Next to that, there are around 19 FTE physician-assistants in education (internist, surgeon or anesthesiologist). An ICU team is responsible for 8 beds. Such a team consists, in the day shift, of 16 nurses and 1 ICU physician in education. One ICU physician, that is scheduled on top of the physicians covering the units, does the coordination of new admissions on all units. In the evening, night and weekend there is one ICU physician in education available and one ICU physician at home, but within the hospital in 20 minutes for the care of the patients on the ICU. Nurses work for either unit 10 or unit 3.

Daily multidisciplinary meetings take place, in which besides the ICU physicians also interested referring physicians, an ethic and a microbiologist take part. Also, the nurse who is responsible for the patient whose case is spoken of that meeting is present. A separate daily meeting is scheduled with the surgeons, who make a round alongside the patients each morning with the department head. A special referring physicians committee exists, whom meet twice a year to discuss topics related to the coordination of the care they provide with the ICU.

The management team of the ICU exists of the department head/professor, the care manager, the medical coordinators and the two nurse unit heads. The ICU of the Erasmus hospital did not participate in the NICE foundation in 2006, but does so in 2007.

1.1.3 Intensive Care LUMC

The IC department of the LUMC consists of four separate ICUs, of which one for children:

- The surgical unit of 9 beds
- The ICNI of 11 beds for neurology patients
- The thorax unit of 10 beds
- The KIC, an 8-bed unit for children

Also, a child intensive care unit with 8 beds is placed within the IC department. The IC department is managed by one department head, but the staff for the child intensive care operate separately from the other staff. Most patients come from thorax surgery (40%), followed by general surgery (19%).

The medical staff exists of 9 registered IC physicians. Nine fellows are educated on the ICU. Around 150 FTE of nurses are in service on the ICU of the LUMC, of which a part are child IC nurses. A large reorganization in the work structure has taken place in 2006 and a new ICU department is build in 2007.

The LUMC participates in the NICE foundation and therefore delivered a NICE report. No annual report is made.

In 2006, 1469 patients were treated on in total 8728 treatment days on the ICU of the LUMC (mean LOS: 5,4 days). The APACHE II score of the patients of whom this score could be calculated was 17,3 (SD: 8,3).

1.1.4 Intensive Care St Radboud

The intensive care of the st. Radboud university medical centre is of level 3. De intensive care has, in total, 46 beds, of which 18 reserved for children. These beds are dispersed as follows:

- H20: General intensive care (7 beds)
- H35: General intensive care with the possibility of isolation (8-10 beds)
- N12: Neuro-surgical intensive care (6 beds)
- AOV: Thoraxsurgery (12 beds, of which 5 for children and 7 for adults, this ranging can be changed)
- Q3C: Children intensive care, 13 beds in the Q-building

Although in 2006 from April on, cardio surgery was forbidden in the st Radboud by the inspection of health care, patients were in 2006 referred to the ICU mainly by cardio-pulmonal surgeons (19% of all ICU patients on the ICU), neurosurgery and general surgery (both 17%).

The intensive care units are not all close to each other: from one unit, it is a 20-minute walk to another. Staff consists of around 20 fte of physicians. Of those, 11 are ICU physicians (2 are part-time surgeons, 2 part-time anesthesiologists) and 8-10 are ICU physicians in education. Next to that there are around 20 fte physician-assistants in education (internist, surgeon or anesthesiologist). In the evening, night and weekend there are one or two physicians in education and an ICU physician available for the care of the (maximum of 30) adult patients on the ICU. The ICU for children has its own staffing scheme. Nurses work for a specific unit. The management team of the ICU exists of the department head/professor and the nurse unit heads. A medical coordinator and a nurse head manage each unit. The ICU of the St. Radboud participates in NICE and produces an annual report. By day, coordination of new admissions on all units is done by one of the experienced ICU physicians ("oudste van dienst"). Daily multidisciplinary meetings take place, in which besides the ICU physicians also invited referring physicians, a hematologist and a microbiologist take part. Separate daily meetings are scheduled with the neurologists and radiology physicians of the st. Radboud.

Not all units are located near each other, one is located on a 20-minute walk. This has consequence for staff and nurse scheduling. Daily admission coordination is regulated by so called "oudsten van dienst".

1.1.5 Intensive care OLVG

The level of the intensive care is of level 3. De intensive care has, in total, 24 beds, of which 18 with a respiration function. These beds are located in the same area and form one unit, of which the utilization is 94%, which is quite high. Next to these IC beds, there is a coronary care unit in the OLVG.

12 physicians form the staff of the intensive care department of the OLVG, of which 6 are still in education. 63 fte of nurses are in service at the OLVG, of which 3 are unit heads and around 15 are senior nurses. A special system is used to schedule nurses: to each patient, points are given, based on the care level the patient is expected to need. Points are summarized and nurses are scheduled based on these score.

In 2006, 1396 patients were treated on in total 8199 treatment days on the ICU of the OLVG (mean LOS: 5,3 days). The mean APACHE II score of the patients of whom this score could be calculated was 21,9 (SD: 8,8). 56% of all patients on the ICU of the OLVG came there after cardio pulmonal surgery. 14% of the patients were referred to the ICU after general surgery. Thorax surgeons visit the ICU each day together to meet with the intensive care physicians to discuss the patients. Other referring physicians visit the ICU separately during the morning, so during the noon meeting only IC physicians meet (with sometimes the pharmacist and microbiologist present).

The OLVG is known concerning their outstanding PDMS system. They write an annual report and participate in the NICE foundation.

1.1.6 Intensive Care UMCG

The intensive care is of level 3. De intensive care has, in total, 44 beds, all with a respiration function. The IC department consists of four separate functional ICUs:

- ICB (12 beds), internal intensive care
- NCIC (6 beds), neurology intensive care
- THIC (14 beds), thorax intensive care
- CHIC (12 beds), general surgery intensive care

There are three department heads. Besides these department heads, 16 registered IC physicians are in duty, educating 10 fellows and 27 ANIOs. Almost 180 FTE of nurses care for the patients.

The UMCG makes use of a skills lab, in which physicians and nurses are trained to work in teams in several patient situations.

In 2005, 2880 patients were treated on in total 13214 treatment days on the ICU of the UMCG (mean LOS: 4,6 days). The APACHE II score of the patients is not known. The UMCG is the largest transplantation centre in The Netherlands, so a lot of the patients on the ICU have undergone a transplantation surgery. Once a year, a meeting with all referring physicians takes place. No production contract is signed with the hospital board.

1.1.7 Intensive Care UMCU

The level of the intensive care of the UMCU is of level 3. The intensive care has, in total 26 beds, spread over 3 units:

- D3 and E3 (both 9 beds, utilization 91%), both general and long-stay intensive care units
- F3 (8 beds, utilization 79%), on which elective patients are accommodated

The ICU department of the UMCU is in development. In 2006, the four specialized ICU's were remodeled in three units. Staff and nurses received extra training, protocols were harmonized and

materials were evaluated with the aim that every patient could be treated on every bed. Steps were taken to organize care in care chains. Also, in the following year a completely new ICU centre will be build on the roof of the OR department.

Staff of the IC department consists of around 20 fte of IC physicians. Next to that, there are 4 physician-assistants in education.

Two nurse unit heads mange the nurses. Around 115 FTE of registered IC nurses work for the ICU of the UMCU. With 16 nurse pupil places and 3 care assistants, the total number working near the patients becomes 134 FTE.

In 2006, 2018 patients were treated on in total 8944 treatment days on the ICU of the UMCU. (mean LOS: 4,43 days). Of those patients, 88% needed invasive ventilation of on average 5 days during their stay. The APACHE II score of the patients of whom this score could be calculated was 19,2 (SD: 6,8). Patients are referred to the ICU by many different physicians: 31% has undergone cardio-pulmonal surgery, 15% general surgery and 12% thorax surgery.

The UMCU has introduced an active quality policy. They actively monitor the number of complications and uses these to improve their organization.

1.1.8 Intensive Care VUmc

The intensive care department of the VUmc consists of two intensive care units and a medium care unit:

- 6D and 7D, both of 13-14 beds wit a utilization percentage of 92%, level 3
- 2D, the medium care unit, with 9 beds, level 1

10,8 registered physicians took care of the patients on the IC and MC units, together with 160 FTE IC nurses. Physicians work on all units, nurses mostly for one unit.

In 2006, 2513 admissions were registered, of which 1500 on the two intensive care units. Patients were treated on in total 12912 treatment days (of which 9438 on the ICU). The mean LOS was 6.1 days for the ICU and 5,1 days for the whole department including the MCU. Median admission length was 26 hours, meaning that half of the patients left the ICU within 26 hours, which brings a high workload due to the large number of mutations. The APACHE II score of the patients of whom this score could be calculated was 18,25 on the ICU. Patients have, for the most part, undergone cardio-pulmonal surgery (45%), vascular surgery (8%) and neurosurgery (7%).

The VUmc actively monitor its "customers". Patients "satisfaction" is measured, just as VAPS and survival rates. Opinions of family of patients, referring physicians, physician-assistants are all monitored, published internally and used for improvement of the ICU department. Every day, at 7.15 o'clock the medical coordinator knows how many places the ICU will have that day for surgery patients. The utilization level is very high, 92 to 99% in 2006, which forced the ICU to carefully select patients for admission. Each specialism was allocated a certain number of beds for their patients.

The VUmc publishes an extensive annual report elaborating on the developments, policies, performance indicators, publications, patient numbers and other facets of the IC department.

Appendix 11: Definitions of indicators in proposed indicator set

In this appendix, definitions of the performance indicators in our set are given.

1.1.9 Definities: Kwaliteit van zorg

Indicator		Definitie	Specificatie
1	Level IC	Level zoals gedefinieerd door CBO	Level zoals gedefinieerd door CBO
2	Pijnbestrijding	Aanwezigheid van een evidence-based pijnmeting protocol	Protocol pijn beschikbaar ja/nee
3	Verpleegkundige / patiënt ratio	Aantal gediplomeerde IC verpleegkundigen ten opzichte van het aantal operationele bedden	Teller: aantal fte gediplomeerde IC verpleegkundigen aanwezig op de intensive care Noemer: aantal operationele IC bedden
4	Beleid ter voorkoming van medicatiefouten	Preventie van medicatiefouten kan op verschillende, elkaar aanvullende manieren. Van 10 uit de literatuur geëxtraheerde items wordt bepaald of deze uitgevoerd worden[1]	Teller: aantal items dat met ja beantwoord wordt.
5	Beleid t.o.v. patiënt- en familie tevredenheid	De aanwezigheid van faciliteiten en metingen van de patiënt- en familietevredenheid van patiënten of familie daarvan die op de IC afdeling opgenomen zijn	Patiënt tevredenheidsmeting ja/nee Familie tevredenheidsmeting ja/nee Familie kamer per unit ja/nee Case management ja/nee Standaard bezoek van tevoren ja/nee Aanwezigheid IC-gastheer/vrouw ja/nee
6	Kwaliteitsbeleid	Aanwezigheid kwaliteitsbeleid: er is een kwaliteitsbeleid, uitgewerkt in doelstellingen, actieprogramma's en middelen en past in het kader van het beleid en de randvoorwaarden van de organisatie.	Er zijn afspraken over de wijze waarop het kwaliteitsbeleid tot stand komt, bijgesteld en vastgesteld wordt ja/nee
7	Ic-verblijfsduur	Het a) gemiddeld en b) mediaan aantal dagen dat patiënten behandeld zijn op de IC en/of HC	a) Teller : Het totaal aantal verblijfsdagen op de IC in een bepaalde periode Noemer: Het totaal aantal op de IC ontslagen patiënten in dezelfde periode b) Mediane ligduur

Indicator		Definitie	Specificatie
8	Beademingsduur	Het gemiddeld aantal beademingsdagen, dat is een kalenderdag waarop op enig moment sprake is van invasieve of non-invasieve mechanische beademing van een patiënt binnen een IC of HC afdeling, of indien de beademingszorg elders is gerealiseerd minimaal onder medische eindverantwoordelijkheid van een intensivist is uitgevoerd.	Teller: totaal aantal beademingsdagen Noemer: totaal aantal beademde patiënten
9	Dagen 100% bezetting	Het percentage dagen dat alle IC en HC bedden op enig moment bezet waren en er a) geen enkele patiënt met spoed kan worden opgenomen. b) geen patiënten uit andere ziekenhuizen kan worden opgenomen	Teller: aantal dagen gesloten per jaar *100% Noemer: 365
10	Mortaliteit	a) Het gecorrigeerde percentage patiënten dat op de IC overlijdt b) Het gecorrigeerde percentage IC patiënten dat in het ziekenhuis overlijdt (standardized mortality ratio, SMR	Teller: a)Totaal aantal op de IC overleden patiënten b) Totaal aantal in het ziekenhuis overleden IC patiënten Noemer: Verwachte aantal overleden patiënten op grond van gemiddelde voorspelde mortaliteit gecorrigeerd voor ernst-van-ziektescore.
11	Decubitus	Iedere vorm van weefselversterf, veroorzaakt door de inwerking op het lichaam van druk-, schuif- en wrijfkrachten, of een combinatie daarvan"	Teller: het aantal patiënten met nieuw opgetreden decubitus graad 3 op een bepaald tijdstip of in een bepaalde periode op de IC, of het aantal patiënten wat tijdens de opname een verergering in gradering (tot graad 3 of 4) doormaakt. Noemer: het totaal aantal patiënten dat opgenomen is op de IC, op hetzelfde tijdstip of in dezelfde periode.

[1]Tabel beleid medicatiefouten (van der Voort, 2004)

Is er een centrale registratie van medicatiegebruik op patiënt niveau?
Is er een handboek/protocollen beschikbaar voor de toediening van alle parenteralia?
Is er een handboek/protocollen beschikbaar voor de toediening van alle enteralia?
Is er een apotheker aanwezig bij de dagelijkse patiëntenbespreking op de intensive care?
Is er over het laatste jaar inzicht in het aantal medicatiefouten met dodelijke afloop?
Is er over het laatste jaar inzicht in het aantal medicatiefouten waarvoor medisch handelen noodzakelijk was?
Is er over het laatste jaar inzicht in de medicatiefouten dat niet gevolgd hoefde te worden door medisch handelen?
Worden de perfusorspuiten centraal (bv. door de apotheek) bereid?
Is er een feedback over interacties betreffende voorgeschreven combinaties van medicatie?
Is er een systeem van barcodering ter preventie van medicatiefouten?

1.1.10 Definities: Doelmatigheid

Indicator		Definitie	Specificatie
12	Sluiten van productiecontracten	Er wordt jaarlijks een productieafspraak gemaakt met de RvB, verwijzend specialisten en ziekenhuizen in de regio waarin minimaal aantal behandeldagen (RvB, verwijzers) of afspraken rondom coördinatie en consultatie (verwijzers, regioziekenhuizen is opgenomen	Contract RvB ja/nee Contract verwijzend specialisten ja/nee Contract regioziekenhuizen ja/nee
13	Beschikbaarheid stuurinfo	- informatie over productie is beschikbaar - deze wordt bv. maandelijks besproken	Beschikbaarheid informatie ja/nee Cyclische evaluatie ja/nee
14	Bepalen en borging strategie	Mate waarin een strategie geformuleerd en verwerkt in beleid wordt	Wordt er een jaarplan gemaakt ja/nee Wordt hierin een visie/missie vermeld ja/nee Worden prestatie-indicatoren benoemd ja/nee
15	Uitgesteld ontslag	Percentage patiënten dat meer dan 4 uur vertraging ondervindt na ontslag door een intensivist	Teller: Aantal ontslagen patiënten dat langer dan 4 uur na ontslag door een intensivist van de IC af gingen (exl. 0verplaatsingen naar ander ziekenhuis) Noemer: totaal aantal IC opnamen
16	Ongeplande heropnames	Percentage ongeplande heropnames binnen 48 uur na IC ontslag	Teller: aantal patiënten dat na een IC opname binnen 48 uur opnieuw opgenomen wordt Noemer: totaal aantal ontslagen patiënten
17	Zorgzwaarte registratie	Wordt zorgzwaarte elke dag per bepaald en geregistreerd en wordt dit gebruikt in planningen	Wordt zorgzwaarte geregistreerd ja/nee Wordt deze gebruikt in het maken van personeelsplanningen ja/nee
18	Tijdstip duidelijkheid IC bed	Tijdstip waarop dagelijks 's ochtends duidelijk is of operaties door kunnen gaan of niet	Tijdstip
19	Kosten per IC dag	Kosten per bed per IC behandeldag	Teller: totale kosten van de IC Noemer: aantal behandeldagen
20	Bezettingsgraad	Bezettingsgraad operationele IC bedden	Teller: aantal behandeldagen (patiënt langer dan 4 uur op IC) Noemer: aantal operationele bedden *365

Definities: kwaliteit van arbeid

	Indicator	Definitie	Specificatie
21	Registratie van tevredenheid stakeholders	Geeft aan of er door de IC clientonderzoeken en enquêtes worden gehouden om tevredenheid van de stakeholders te meten	Staf/verpleegk. Ja/nee Patienten en famillie: Ja/Nee Verwijzers ja/nee
22	Ziekteverzuim	a) kortdurend verzuim staf en verpleegkundigen b) langdurig verzuim staf en verpleegkundigen	Teller: a) aantal uren verzuim < 1 jaar excl. zwangerschap en langdurig verzuim b) totaal aantal uren verzuim excl. zwangerschap Noemer: totaal aantal plekken * aantal werkdagen * aantal werkuren
23	Verloop personeel	Het percentage functies waarin per jaar een nieuwe medewerker terecht komt	Aantal personeelswijzigingen/ aantal functies
24	Verworven fondsen per jaar	Aantal onderzoeksprojecten en gemiddeld bedrag per project dat door stafleden binnengehaald wordt	- Aantal projecten - Gemiddeld bedrag per project
25	Gepubliceerde artikelen	Aantal in peer-reviewed journals verschenen artikelen per IC staflid	Teller: aantal artikelen Noemer: aantal FTE stafleden
26	Participatie aan studenten onderwijs	Geeft aan of de IC participeert in alle onderwijs lagen van medisch onderwijs	- wordt er college gegeven? - Worden er ANIO's, AGIO's en fellows opgeleid? - Heeft de IC opleidingsbevoegdheid?