

# Evaluating a model for unit-based cost allocation at hospitals

*A case-study of the neonatal clinic at Karolinska University Hospital*

## Abstract

As healthcare costs increase, so does the need for accurate cost allocation systems. This thesis evaluates how current employee incentive structures would be affected by a move from clinic-based to unit-based cost allocation. Knowledge about current systems and incentive structures at the hospital, and opinions of the unit-based cost allocation system, was gathered by interviewing employees at the neonatal clinic at Karolinska University Hospital. The results from the interviews and an independent analysis concluded that healthcare professionals, without relation to budgetary work, are largely indifferent to costs and the financial systems of the clinic in general. All interviewees agreed that unit-based costing would better reflect the resource usage per patient. Implementing a unit-based cost allocation system at Karolinska University Hospital, using the nurses' schedule as a starting point, could be a simple and effective way to more accurately distribute costs per patient without adding additional administration or costs for the hospital or its employees.

Keywords: Cost allocation, Healthcare, Karolinska University Hospital, Incentives, Unit-based

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# Introduction

Healthcare organisations are complex, involve many actors, have sizable budgets and require models to be managed and understood. A common financial model used by healthcare organisations combines a patient grouping system to distribute reimbursements with a costing system to allocate indirect costs.

One emerging idea is to integrate the data registered by healthcare professionals as part of their day-to-day work into the financial model. One such data point, which unit the patient is located in, could be used to allocate costs more accurately but is not utilized today. Using the location of a patient by unit to better portray resource usage could be a simple and effective way to improve the costing system by making it more accurate without encumbering healthcare professionals with additional administrative work.

## Project background

The initial project design was to evaluate the cost-savings associated with an intervention to reduce infections at the neonatal clinic, using the current costing system in place at the hospital. Upon closer examination, it was clear that the main cost-driver for these patients was not their prolonged length-of-stay, but rather that they spent more time in the more resource-intensive unit relative to comparable non-infected patients at the clinic. As the current costing system does not take the units' different resource intensiveness into account, the cost-savings associated with the intervention were undervalued. The experience highlighted how easily projects that improve quality of care and reduces resource usage could be misrepresented by an inaccurate cost allocation system. This insight prompted a re-examination of the current costing system and led us to the final project design.

## Identified gap in current research

Cost allocation systems with varying degrees of precision have been used in the healthcare sector for decades. A fundamental concept of cost allocation is that it should be done as close to the activity as possible, yet in practice organisations often allocate based upon traditional organisational hierarchies instead of the best available information (Horngren et al., 2012). We have in our research found an absence of articles discussing the use of unit-costing and its effect on incentive structures. This thesis attempts to remedy this by providing insight into the practical effects and implications on current incentive structures a move from clinic-based to unit-based cost allocation could have.

## Research question

The purpose of this thesis is to examine the impact a move from clinic-based cost allocation to a revised model using unit-based cost allocation could have on the incentive structure at Karolinska University Hospital's (KS) neonatal clinic. This was done by interviewing employees at the Huddinge neonatal department and the KS neonatal clinic managers. Their knowledge and opinion of the current

reimbursement and costing system as well as of the revised model was gathered and analysed in addition to an inductive analysis using our theoretical framework.

The questions at hand:

*Would a change from clinic-based to unit-based cost allocation system give a better representation of the resource usage per patient? How does the current cost allocation system affect the incentives at the clinic? What impact would the revised model have on the incentive structures at the clinic?*

## **Delimitations**

This thesis is delimited to the effects of moving from clinic-based to unit-based cost allocation for personnel costs only. As personnel costs constitutes the majority of the treatment costs for neonatal patients, any change in cost allocation will end up having a large impact on the calculated cost per patient (John et al., 1983). Adjusting other indirect costs would necessitate the identification and use of additional keys, which would complicate the model without adding an increase in accuracy.

Furthermore, this thesis is delimited to exploring the effects of the revised model for the neonatal clinic at KS. Interviews were performed with healthcare professionals and the manager at the Huddinge department as well as with managers at the clinic level. The neonatal clinic was chosen for the study as almost all its indirect costs are kept within the same budgetary unit and the majority of cases are exclusively treated as inpatients, often staying within the same department during their course of treatment. The neonatal clinic is, also unlike other clinics, responsible for their patients from admittance to discharge in the vast majority of cases. The clinic studied is therefore not representative for the average clinic at KS, but it functions as a model for the hospital at large. The effects studied will therefore be more applicable to a hospital-wide implementation than other clinics. This makes the study more relevant to decision-makers, as a potential implementation would most likely be done across all clinics simultaneously. That the neonatal clinic is in the majority of cases responsible for the entirety of the clinical pathway for their patient makes the study even more relevant to hospitals oriented around clinical pathways.

## **Expected contribution to research**

We hope to contribute to the area of management accounting by examining what potential impact moving to a unit-based cost allocation system could have on the incentive structures at a clinic. By highlighting the incentives that cost allocation systems create at hospitals, further understanding of their impact on healthcare professionals could be gained. This would also be of value when examining or implementing other cost allocation systems than the one discussed in this thesis.

# **Theoretical framework**

## **Motivation theory**

Extrinsic motivation and intrinsic motivation are terms often used when discussing the motivation of individuals. Extrinsic motivation is when someone is motivated to perform a task in order to earn a reward or avoid punishment. Intrinsic motivation is motivation without an external reward or punishment, and can be described as being driven by an interest or enjoyment in the task itself, e.g. because of ethical reasons, religious reasons or a wish for self-fulfilment (Ryan et al., 1988).

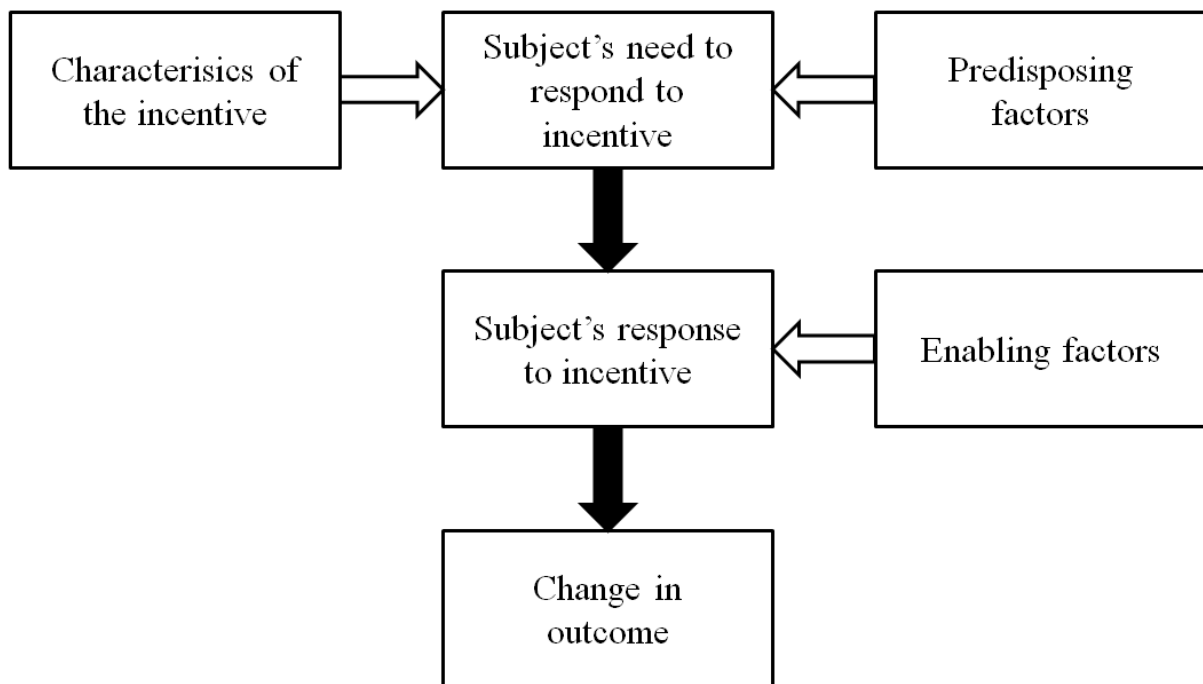
## **Agency theory**

When discussing the issue of incentive structures, the agency theory as described by Michael C Jensen et al. (1976) provides a useful framework. The theory suggests that actors, defined as someone acting on behalf of or affecting someone else, is motivated to act in their own best interest and not necessarily in accordance with the interests for whom they are acting, the principal. The core of the problem is information asymmetry, as the principal cannot monitor the actions of the agent at all times but is still affected by the actor's actions. This can create a conflict of interest, especially if the actor's actions are hard to measure or observe directly. To resolve this imbalance and avoid potential pitfalls, incentives are used to align the agent's goals with those of the principal.

## **Factors affecting the efficiency of incentives in healthcare**

Dudley et al. (2004) provides a framework for predicting the impact of a new incentive on healthcare professionals. Dudley's model is an adapted version of Andersen's Behavioural Model of Health Services Use, a model originally meant to be applied on patient behaviour when seeking healthcare (Andersen, 1995). Dudley adjusts the model to evaluate the impact a primarily financial incentive has on a healthcare organisation.

The Dudley model is divided into three components, the characteristics of the incentive, predisposing factors and enabling factors. All components will have to be considered in relation to any change in the cost allocation system as they may end up changing the dynamic at the clinic.



*A condensed version of the Dudley model*

### **Characteristics of the incentive**

The characteristics of the incentive are crucial to determine how it impacts the intended subject. Dudley divides the characteristics into the financial aspects of the intervention and the non-financial aspects of the intervention. The financial characteristics of the incentive are related to revenue potential - how large of a difference does the incentive make to the recipient? The costs associated with completing the incentive goals are also important. There are several non-financial characteristics, for example - how realistic is the set performance goals? What is the domain of performance measured, i.e. is it the degree of implementation, the implemented processes, or the patient outcomes that is evaluated? Acceptability of the incentive or performance goal is also important.

### **Predisposing factors**

The predisposing factors for the incentive are divided into three factors, the general financial characteristics of the environment in which the subject operates, the provider characteristics and the market characteristics.

### **Enabling factors**

There are a number of factors that might enable the providers to respond more strongly to an offered incentive, as a group called enabling factors. Dudley lists these as organisational characteristics, patient characteristics and other factors. Organizational characteristics that could impact the magnitude

of the incentive include among other things leadership, size, number of patients, organizational culture and the proportion of providers in the organisation that the incentive is relevant for.

## **Earlier applicable research**

The relative weight of financial motivation versus other types of motivation is discussed by Lambrou et al. (2010). Using a survey of 286 healthcare professionals, they explored healthcare workers' relative motivations. Most respondents valued the achievements (defined as job meaningfulness, earned respect and interpersonal relationships) of the health care profession the highest, with remuneration (salary, environment, retirement/pension and absenteeism) at second place. Other factors explored were job attributes and co-workers. The relative importance of different types of motivation for healthcare professionals is relevant, because of a need to assess the magnitude of effect a certain type of incentive would have.

Bjorvatn (2012) examines the impact of moving budgetary power and authority over performance decisions to the department level from higher levels within the hierarchy. She concludes that departments with more autonomy and self-governance saw an increase in productivity compared to departments with less autonomy. This is an encouraging reason to move cost allocation from clinic-based to unit-based. There is an important difference between the transitions studied by Bjornvatn and the revised model, as the revised model would not bring more autonomy or decision-making power to the department, limiting the article's applicability to our study. The article suggests that there are efficiency gains in moving budgets closer to healthcare professionals.

The conflicting duties of doctors are discussed by Ellis et al. (1986). They suggest that maximal societal benefit only occur when the doctor acts as a perfect agent between the patient and the hospital, valuing patient and hospital benefit equally. The authors write that a doctor cannot possibly act as perfect agent with respect to both the economic and clinical aspects of the job and has to pick a side. How doctors manage to balance the patient's best interest with the hospital's best interest is key to understanding how such systems affect the physician, making the discussion in the article relevant to our study.

Several studies suggest that healthcare professionals are affected by financial incentives and change their medical decisions in response to changes in incentive structures. Mendiratta et al (2009) show that financial incentives made doctors discharge to nursing homes instead of to the patient's home. Ho et al. (2013) show that when doctors were given part of the cost-savings, they sent their patients to cheaper hospitals further away than when they were not incentivised to do so. It is important to note that the authors found no evidence of diminished quality of care or health outcome from the more incentivised doctors, suggesting that it was more a question of convenience rather than quality. Lester et al. (2010) show that when an incentive to increase quality was removed, the quality of care was

reduced below the level before implementation of the incentive. It is relevant to our study that incentives or changes in incentives can affect medical decisions as there is a possibility that the revised model affects the current incentive structure.

Petersen et al. (2013) show differences in an incentive's effectiveness between individual and practice-level by comparing clinics using either method. While individual incentives led to better outcomes, practice-level incentives did not. This indicates that whether the recipient of an incentive is a group of providers or an individual matters when discussing the incentive structures at the clinic.

Ryan et al. (1988), John et al. (1983) and Rogowski (1999) all provide an overview of the costs broken up by unit at neonatal care clinics. These articles give a hint on how the costs are distributed at a neonatal clinic. All suggest that personnel constitute the majority of costs and that there are differences in personnel usage between the units. However, the articles describe each unit's part in the total cost of the clinic, not the unit's part in the cost of the patient. This is a crucial distinction as the revised model aims to give greater accuracy to the cost of individual patients. Another caveat with the studies is that they are over 15 years old and have a lighter case-mix than a clinic would have today, especially one at a university hospital such as KS.

## **Summarizing earlier research**

To summarize, earlier research indicates that healthcare professionals value the meaningfulness of their profession the most but still respond to financial incentives, to which degree depends on the strength of the incentive. Aligning healthcare professional's interests with the hospital's, either through closer budgeting or through incentive structures, appears to be beneficial. Neonatal clinics are costly and there are considerable differences between its units concerning personnel resources used.



# Methodology

To answer our research questions, a qualitative, case-study approach was chosen, as described by Bryman & Bell (2011). Since it was predicted that the revised model would have an impact on the processes at the department, a qualitative approach was deemed suitable. Such an approach also allows for evaluation of outcomes on an individual level to a higher degree than a quantitative approach, which was predicted to vary between as well as within professional groups. Furthermore, it enables a more individualised approach to each interviewee, where the interviewer can adapt the presentation of information as needed. This was important as the knowledge of economic concepts varied greatly between interviewees, often to the extent that some questions became unanswerable without explanations from the interviewer (Patton, 1990).

The use of a qualitative approach allows for slight modifications of the project intent during the course of the project, which given the thesis's background was deemed important (Bryman & Bell, 2011). In addition, it allows for a formative evaluation by being open for feedback, which is important as the model has yet to be implemented (Patton, 1987). As qualitative research is more personal in nature and sensitive issues such as medical ethics or patient safety in relation to costs are therefore less likely to be rejected or side-stepped by interviewees, issues that are important to our research question (Patton, 1987).

## Research methodology

Considering the extensiveness of research available within management accounting, delimitations were needed to find relevant research. We limited our search to articles and books concerning healthcare, as the healthcare professional-patient relationship is so unique and defining that any relevant research had to take it into consideration. The online databases available from the Stockholm School of Economics and the Karolinska Institute library were used in the initial stages of the research. It became apparent that the Karolinska library had more articles relevant to our research question and was therefore used more in the later stages of the research process.

Our first round of research, which focused on management accounting and incentives in general concerning healthcare, was performed using the keywords "Healthcare", "Management Accounting", "Incentives". Realising that "Management Accounting" did not add any hits to our search, it was removed. Relevancy was given to articles that were extensively linked by other articles or had titles or abstracts that were especially relevant to our research questions. Common causes for exclusion were: used charges or bills to calculate cost, were only implemented to illustrate the issue, focused exclusively on pay-for-performance incentives with direct remuneration to healthcare professionals, or published before 1980.

The second round of research focused on articles which specifically mentioned separate hierarchical levels using the keywords “Healthcare”, “Incentives”, “Unit”, “Department”, “Clinic”. The last round of research focused on articles dividing up neonatal costs by unit, using the keywords “Cost” and “Neonatal”, articles were then read to see if their cost-breakdowns were performed at the unit-level.

In addition to searching the online databases, a management researcher with healthcare expertise was consulted. The articles suggested gave an introduction to the theoretical incentives caused by different reimbursement systems.

## **Evaluating a hypothetical model**

Analysing the potential impact of a hypothetical model presented certain challenges. The main challenge was ensuring all the interviewees understood the revised model correctly. During the interviews, a concerted effort was made to describe the model in as uniform a way as possible in order to avoid a variance in the interviewees’ understanding of the revised model to create artificial differences in opinion (Bryman & Bell, 2011). In the instances where it was obvious from their answers that there had been a misunderstanding when explaining the model or economic concepts, clarifications were given by the interviewer after the interviewee were done answering the questions. After the clarifications, the relevant questions were asked again and notes were made of differences between the first and the second round of answers.

Another inherent problem with evaluating the effects of a hypothetical model is that even if the interviewee understands the question, his or her ability to accurately predict what impact it will have once implemented will depend on how well the interviewee understands the current systems. To account for this, we also asked questions to ascertain the extent of the interviewee’s knowledge of the systems. Their knowledge was then taken into account in the analysis, giving more weight to interviewees with knowledge of the systems, as their predictions are more likely to be accurate.

The questions also made an independent inductive analysis on the revised model’s impact in relation to these structures and the employee’s knowledge possible. By asking how much incentives affected them today, we could analyse the potential impact of new incentives using our theoretical framework.

We used methodological triangulation, combining the interviewees’ opinions and knowledge of the current systems together with our own, independent, analysis of the current structures and how those would be affected by the revised model (Bryman & Bell, 2011). By using multiple methods in our analysis, the challenges pertaining to evaluating a hypothetical model was mitigated.

## **Interview methodology**

### **Interview strategy**

We decided to use a semi-structured interview strategy for our interviews. The interviews began with open questions and then progressively more specific questions were asked. For clarity and structure, the interview was divided into two thematic sections, the first concerning the current systems and second concerning the revised model.

The semi-structured interview schedule enabled comparisons between multiple professional groups while still enabling individual interviewees to frame the interview based on their personal experiences. It also allowed us to triangulate the revised model's impact on the department as a whole and the open-ended questions allowed us to take into consideration the interviewees own thoughts and concerns into the empirical results to a wider extent than a more rigid approach.

Open-ended questions provide a framework in which people can respond in a way that accurately and thoroughly represents their point of view on a subject. It is also beneficial when discussing sensitive topics such as how costs and reimbursements affect medical decisions (Patton 1990). Both of these reasons were important to our research question and were the main reasons for using a semi-structured interview strategy. In addition, we also used vignettes to approach these sensitive issues; presenting hypothetical scenarios to the interviewee who were then asked how that would affect his/her decision (Wilson & White, 1998) (Barter & Renold, 2000). In order to depersonalise the more sensitive topics, we asked them not only to talk about how it would affect them, but also other people at the clinic, giving them room to project their concerns onto a group of unnamed individuals rather than themselves (Brennen, 2012).

The discussion of sensitive issues introduces the possibility of harm to interviewees when presenting the results publicly, which raises an ethical issue. Special attention was placed on anonymising the source to the widest extent possible. In the instances where the answer was directly attributable to a person, the interviewee was contacted for their approval.

A closed question was used for the resource-intensiveness question as it was important that all answers were comparable between each other and that all interviewees had interpreted the question the same way. The interviewees were asked to reply with a multiplier, e.g. one unit being twice as resource intensive as the other. In the instances when the interviewee replied in another format, such as percentages, the answer was converted to a multiplier by the authors after the interview.

An interview schedule, together with a list of the positions of the interviewees, can be found in the appendix.

## **Procedure**

All interviews were primarily conducted by M. Balsvik who, as a medical student as well as a business student, were more proficient with the terminology used among healthcare professionals. This allowed J. Carlsson to focus on taking notes during the interviews. Eleven interviews were conducted by both authors. Two interviews were conducted by M. Balsvik alone, but the audio recordings of those interviews were listened to by J. Carlsson.

To reduce the risk of unintended selectivity in note-taking, audio recordings were done at all interviews. The notes were then complemented by transcribing the recording. When transcribing, only information that was relevant for the research question was entered into the final interview notes as recommended by Flick (2009). The summary of each interview was then discussed to ensure that both authors had understood the interviewee the same. When translating from Swedish to English, the message was prioritised over a direct translation. Original quotes in Swedish can be found in the appendix.

Each interview lasted between 45-70 minutes and was done in the spring of 2015. All interviewees were interviewed separately except for the two clinic-level managers who were interviewed together due to time constraints. After each interview, a discussion was held between the authors on how the information gathered during the interview could be used in later interviews and in the thesis. After the first round of interviews, it became apparent that additional questions concerning how the incentive structures applied upon the clinic from KS and how it affected the healthcare professionals at the department were needed. One doctor and one manager was therefore interviewed again as the first round of interviews indicated they were particularly knowledgeable on these two subjects.

In the analysis, the researchers own impressions of the interviewees was part of the data collected as suggested by Flick (2009), especially when discussing the interviewees general attitude towards the cost of healthcare and their knowledge of the current systems.

## **Interviewees**

The Huddinge department was deemed by the clinic management as the most representative of the clinic at large and therefore interviews were done with healthcare professionals at that department only. We chose to purposively select our sample, sampling more experienced interviewees at the department as they would probably be able to predict the models impact better than more junior employees. We asked the clinic director to suggest candidates who matched our criteria.

In total, eleven employees at the clinic were interviewed, eight working at the Huddinge department and three working at the clinic-office in Solna. After all interviews were completed, one employee asked to be removed from the study and was subsequently removed. Our final sample included three

managers, one controller, two doctors and four nurses, two of which sometimes functioned as coordinators at the department. A controller working at the neonatal clinic provided us with information about the DRG system and the costing system.

## **Reliability and validity**

Reliability and validity, two important topics when assessing research quality, can both be further divided into internal and external components. There are significant differences in how these should be applied to qualitative research. We have chosen to discuss these issues according to the definitions set by LeCompte & Goetz (1982) as described by Bryman & Bell (2011).

Validity presumes reliability. The criteria for external reliability, the degree that the results of the study is reproducible, are difficult to meet in qualitative research but the description of our methodology provides a guide for anyone attempting to replicate our findings. The internal reliability of our study, i.e. to what degree the authors have understood the interviewee the same way, is high as we conducted the majority of interviews together and discussed the final summary of each interview together, with support from the audio recording, to ensure that both authors understood the interviewee the same way.

The internal validity of our study, whether the results from the interviews describe reality, is high when it comes to implications from the revised model but the purposive sampling and the choice of only interviewing at the Huddinge department merits an in depth discussion. The final interview sample included nurses who were more likely to work in the more resource-intensive unit than the other nurses at the department. This means that the study's internal validity concerning nurses' knowledge of current systems, their relation to current incentive structures and their opinion of the revised model is lower than for the other professional groups. The relevance this has to the research question is limited as the purpose was not to evaluate the nurses but to investigate the revised model's impact on employee decisions and for that purpose the sampling was adequate. The same arguments can be made for the choice of only interviewing healthcare professionals at the Huddinge department. However, the first interviewees at the department concurred with the clinic management that the differences between the departments are limited. The focus on one department lent itself to more in-depth interviews with multiple staff members across the professional groups, conveying a more complete view of the department as a whole instead of an overview of all departments at the clinics, increasing the internal validity of the thesis.

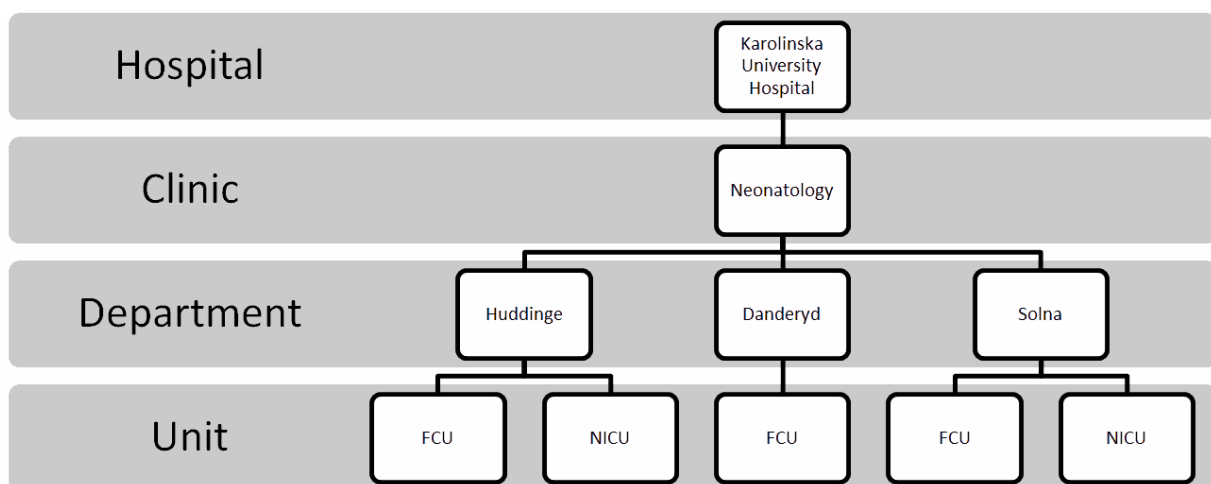
The external validity, to which degree the findings can be generalized, depends on what setting it is applied to. Choosing the neonatology clinic means that our findings are not as applicable to other clinics at the hospital as they rarely have the entire clinical pathway for a patient group within the clinic. The main advantage in choosing the neonatal clinic is that the results are far more applicable

than other clinics when discussing an implementation onto the organisation at large, as patients are often kept within the same organisation, analogous to the neonatal clinic.

# Empirical Background and Results

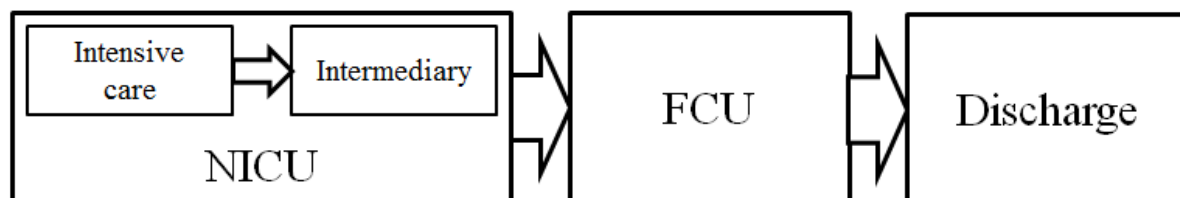
## The neonatology clinic

Neonatology is a sub-specialization within paediatrics concerned with newborn infants (U.S. National Library of Medicine, 2015). The neonatology clinic studied is part of Karolinska University Hospital and operates three different neonatal departments located in Danderyd, Huddinge and Solna. Each department has units that specialise in different levels of care. Solna and Huddinge both have neonatal intensive care units (NICUs) for patients in need of intensive care. All departments have one family care unit (FCU) for patients needing neonatal care but not intensive care.



*Organisational structure of the neonatal clinic*

The patients in the NICU do not require a uniform level of care; they have varying demands depending on their medical condition. Patients who require equipment or expertise only available at the NICU but at the same time do not require the same amount of attention as typical NICU patients are termed intermediary patients. Intermediary patients cannot be moved to the FCU, setting them apart from “backlog patients”, patients who stay in the NICU because there are no available FCU beds but who could be moved to the FCU.



*Schematic overview of patient flow through the neonatal clinic*

To help find available NICU and FCU beds, the clinic has nurses that work as coordinators. Their main responsibility is coordinating patient transfers and finding open beds for patients. It is difficult to

find open beds to move patients to and coordinators can sometimes spend an entire day finding one, searching first within the clinic, then within the county and as a last resort in surrounding counties.

## **Reimbursement systems in healthcare**

### **Overview**

There are two types of reimbursements within healthcare, retrospective and prospective reimbursement. Retrospective reimbursement systems reimburse based on the cost of treatment incurred for each patient. Prospective reimbursement instead tries to predict the cost of treatment for each patient, most commonly by using the diagnoses given during the course of treatment.

A reimbursement system can also be characterized by its approach to volume, e.g. whether its remuneration is fixed or variable. A fixed system reimburses independent of the volume produced, as opposed to a variable system that reimburses based upon the volume produced.

### **Diagnosis-related groups**

Diagnosis-related group (DRG) is a way of classifying hospital cases with similar characteristics into groups. The purpose is to have reimbursements vary by the severity of the condition treated so organisations with more complicated patients are compensated fairly. Each DRG is given a number, DRG point, by the average cost of treating a patient within the group, using costs from the previous year. The amount of DRG points a clinic treats also function as a production indicator, where more points indicate a higher production. The reimbursement per DRG point is negotiated between counties and healthcare organisations, such as KS. Reimbursements are then linked to the number of points a healthcare organisation has acquired, calculated by the sum of DRG points multiplied by the reimbursement per DRG point. As DRG points are calculated based on the average cost for the same DRG from the previous year, changes in the cost allocation system affect the reimbursement system indirectly.

### **Reimbursement system used by the neonatology clinic**

As the majority of patients at the neonatology clinic live in Stockholm, most reimbursements come through the Stockholm County Council (SLL). SLL uses a prospective variable reimbursement system, built upon a DRG system provided by Socialstyrelsen, a government agency under the Ministry of Health and Social Affairs.

Costs taken by patients treated at the clinic but who live outside the Stockholm County are reimbursed by the patient's home county retrospectively per day treated. The patients from other counties are typically patients so complicated that they can only be treated at KS. The clinic used to charge other



counties using the KS costing system, but abandoned the practice when they realised they were not sufficiently compensated for the actual costs.

## **Costing systems in healthcare**

### **Overview**

Hospitals use costing systems to estimate the cost of individual patients. To distribute indirect costs between patients, cost allocation systems are used. A common type of cost allocation system employed in healthcare today is the Normal Costing System (NCS).

In NCS, indirect costs are accounted for by taking the budgeted indirect costs for the upcoming year and dividing those with the budgeted annual quantity of the cost-allocation base, which in healthcare often is patient hours, creating a cost-per-patient hour. The sum is then used to calculate the cost of personnel for individual patients by multiplying it with time spent at the specified economic unit. The system requires little information to work and the calculations are easy to perform (Horngren et al., 2012).

### **Costing at KS**

The current costing system at KS uses NCS for distributing indirect costs using patient hours and cost-per-patient-hour for each cost category. KS makes the system prospective by using the costs from the preceding year to estimate cost per patient, instead of using the budgeted costs like a traditional NCS. Each clinic does its own calculations and has its own cost-per-patient hour numbers.

### **Clinic goals and targets**

The clinic is not managed or evaluated according to their income but by production as measured by DRG points and by keeping within the set budget. This means that on the clinic level, the reimbursement is not variable but instead fixed by the budget. There are measurements for comparing clinics on cost efficiency using cost per DRG point but in reality they are not used. Theoretically, a fixed reimbursement system incentivises low output, as each additional unit of production adds cost but provides no additional income. To prevent this, fixed systems can have a minimum production target to ensure that production is kept at an acceptable level, such as at KS (Jacobsson, 2007). KS have lately reported negative financial results, which has led to extensive cost-saving programs being implemented across the hospital to balance the budget (Karolinska University Hospital, 2014).

## **Interviewee answers**

### **Current reimbursement and costing system**

#### ***Knowledge of the systems***

The managers were able to give detailed and specific information about the reimbursement system. Managers could give a rough overview of the cost allocation system and understood the link between the reimbursement system and the costing system.

The doctors provided a detailed explanation of the reimbursement system. One doctor could give a detailed summary of the costing system whereas the other was unable to give more than an overview on how the system attempts to divide costs per patient. This difference was also reflected in their knowledge of the connection to the costing system.

The nurses were able to explain the reimbursement systems in general terms. The nurses were aware of the existence of a cost allocation system but the majority could not name the defining features. Some nurses were aware of the costs for some specific, extraordinary, activities such as the daily cost for a patient with an NO-inhaler, but lacked a wider understanding of the costs associated with the daily operations of the department. The nurses' limited knowledge of the costing system meant that they were unaware of its connection to the reimbursement system.

#### ***Opinion and impact of the systems***

Despite the belief that the current cost allocation system evens itself out, all managers offered critique of the costing system due to its poor connection to reality.

*"I find the [cost allocation] system very rough and lacking of nuance." - Manager*

### **Attitudes towards the cost of healthcare**

The general consensus was that financial incentives play little to no role in the interviewees' daily work. They considered the medical reasons far more important than any financial motivations and acting otherwise would, in their opinion, be unethical. At the same time, managers felt they had an obligation to ensure that the clinic was cost-efficient. Doctors and nurses were concerned about the increasing healthcare costs and the shared responsibility that healthcare providers have in reducing costs but conceded that, at the department, not a lot of thought was given to the issue.

*"The managers and directors want us to be influenced by [the cost-saving program] and to think about cost-efficiency. I think that many of us are pushing back somewhat against that mind-set because it is irrelevant when compared to the medical aspects" - Doctor*

Several interviewees emphasized that the neonatal clinic is different from other clinics at KS, being largely unaffected by KS' recently enacted cost-saving program. Some interviewees felt that neonatal care is inherently "allowed" to be expensive.

*"Neonatal intensive care is a bit different, all in and no limits." – Nurse*

Interviewees often noted when talking about costs and cost-cutting at the clinic that they were mindful not to waste medical material when treating patients. The only effect felt from the enacted savings program was the increased focus from the central procurements office at KS on getting cheaper products, which according to some had led the department to procure certain products independently due to quality problems.

When asked whether the staff would change their behaviour if it was made transparent that the NICU was considerably more expensive than the FCU, one doctor said:

*"More expensive for whom? For us, for the county, or for the taxpayers? It's so vague [who pays for the costs today] that it is hard for me to imagine it would override my medical decisions." - Doctor*

When the quoted doctor was asked if the costs had no value, the doctor reformulated the opinion, stressing that the staff was not spending for spending's sake but rather saw costs as unimportant relative to medical considerations.

Another doctor suggested that everyone at the clinic is constantly thinking about being efficient with the open beds available, but not everyone is thinking about being cost-efficient. One doctor estimated that two thirds of the doctors at the clinic were at least somewhat mindful of costs, with the rest being in the early stages of their medical career and had not yet started to think of, in his words, the bigger picture.

### **Shortage of open beds**

All interviewees mentioned that the clinic routinely has to decline patients due to a lack of open patient beds. One doctor estimated that in an average week, the department declines 2-3 patients due to lack of open NICU beds. There is constant pressure to accept patients to the clinic, especially to the NICUs but also to the FCUs.

Some beds at the clinic are non-serviced, closed, as the clinic lacks personnel to open them. This is due to the national shortage of nurses and, according managers, not the result of an underfunded personnel budget. The clinic prefers to hire specialised neonatal nurses, but often have to make due with non-specialised nurses who are then educated in neonatal nursing as part of their day-to-day work.

*“Our limiting factor today, the reason why we haven’t got enough open patient beds, is the shortage of nurses.” - Manager*

### ***Consequences from shortage of open beds***

According to nurses and doctors, the shortage of open patient beds puts high pressure to move or discharge patients as soon as possible to free up beds. Sometimes this leads to patients being moved or discharged before the staff felt completely comfortable doing so. One doctor estimated that this happens once every five days on average. All healthcare professionals at the clinic suggested that the system is unfavourable, but considered the alternative unacceptable, that an incoming patient in need of NICU care does not get it in time.

*“Sometimes we have to discharge children too early, which can be an uncomfortable feeling.” - Nurse*

### **Transferring patients between units and hospitals**

#### ***Decision-making and logistics***

Doctors and coordinators are in charge of moving patients to appropriate units, transferring patients or discharging them when needed. In theory, doctors decide who to move and the coordinators manage logistics but in practice, these responsibilities are shared. One doctor felt that the task of searching and coordinating patient beds diverts a considerable amount of time to administration instead of patient care, and described it as *“not being part of my calling as a doctor”*.

#### ***Backlog of patients***

Sometimes, patients are not moved from the NICU even if they are healthy enough for the FCU. These patients, who are ready to be moved to the FCU but remain at the NICU, become backlog patients and are given the same treatment that they would get at the FCU.

The interviewees all considered the cause of the backlog an outflow problem from the FCU. Sometimes patients stay in the NICU for days until a suitable FCU bed is found. When asking interviewees about the extent of the issue, the answers varied greatly, ranging between 8-30 patient days per month.

*“Because we are always constrained by the backlog in the system, patients aren’t always treated where they should.” - Manager*

#### ***The accordion system***

To counteract the backlog, a system to move staff from the NICU to the FCU, internally called the “accordion system”, is sometimes used when there are many intermediary patients in the NICU. It makes it possible to increase the amount of patients receiving care in the FCU temporarily. One nurse

felt that the accordion system maximised the available resources and was beneficial for both patients and personnel. Some interviewees noted that the system leads to tension and irritation between employees, especially from senior and specialised personnel, who were forced to work in the FCU to facilitate the system.

*“[About the accordion system]...it does not always become the best allocation of staff, not the right competencies in the right place” - Nurse*

### ***Cost of movement***

Several interviewees talked about the downsides of moving patients. Interhospital moves, unlike intrahospital moves, carry significant risk for the patient and consume more resources than intrahospital moves. One doctor estimated that the clinic sends a patient to another hospital once every five days due to the shortage of beds, of which approximately a third was sent from the department's NICU to another hospital's NICU. There was a definite preference towards sending healthier patients between hospitals, keeping high risk patients within the hospital.

### **Unit resource usage differences**

This part of the interviews was performed at the end of the first section and formed the basis for the discussion of the revised model. The answers from each interview is presented in the table below, describing how much more resource-intensive the NICU is relative to the FCU according to the interviewees.

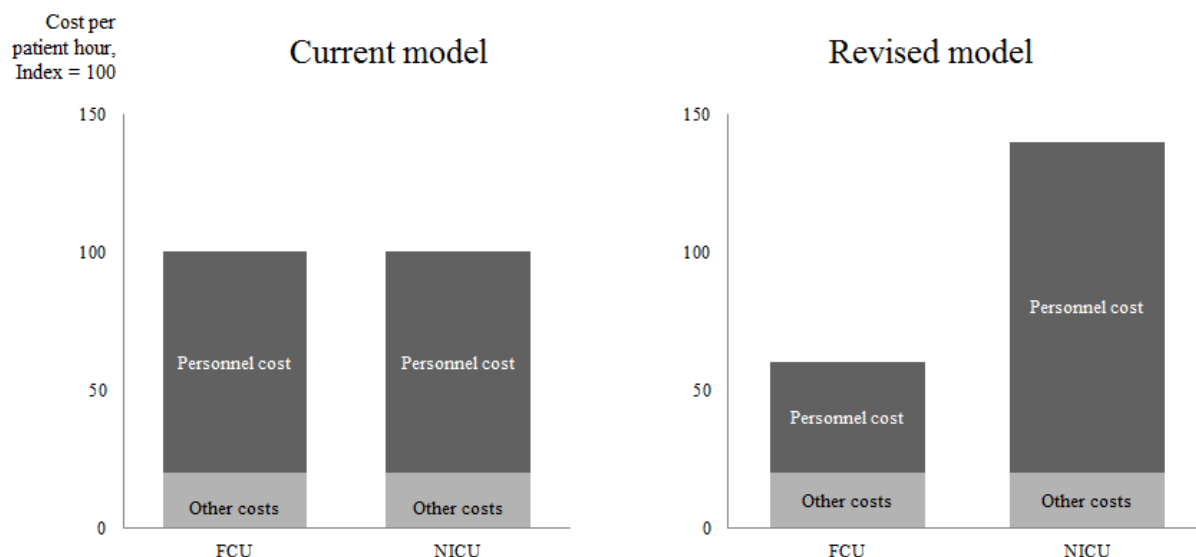
<b>Personnel group</b>	<b>Average</b>	<b>Individual answers</b>
Managers	3:1	3, 3, 3
Doctors	3.25:1	2.5, 4
Nurses	3.875:1	1.5, 3, 3, 8

The frequency three in the answers can be explained by the principles used when scheduling nurses' between the units, which when calculated per patient gives an intensiveness ratio 3:1.

With the median of the sample being 3:1 as well as being the most common answer from the interviews, we are confident that the distribution key 3:1 is an accurate representation of the relative resource intensiveness between the FCU and the NICU. This echoes previous research by Ryan et al. (1988), John et al. (1983) and Rogowski (1999).

### **The revised model**

The revised model would give each unit its own cost-per-patient hour by using a resource intensiveness key to redistribute the current clinic-based cost-per-patient hour. Given the answers during the interviews, the resource intensiveness key for the neonatal clinic's units would be 3:1 instead of the current system which implies 1:1.



*Comparing cost per patient using current model and revised model, index from current model*

### **Rationale for a new model**

The current cost allocation system suggests that the personnel resource spent per patient hour is the same in all departments and units. This is in stark contrast with reality, where NICU patients are more personnel resource-intensive per hour than FCU patients.

The current system misrepresents the true cost of care when cost estimates are done by unit, DRG or by patient. Patients spending more than 50% of their stay at the clinic in the NICU use more resources than the current system reflects. The opposite is also true; patients that spend less than 50% of their stay in the NICU are considered more resource-intensive than they actually are. This is crucial when evaluating interventions or when calculating the cost of individual patient groups. Furthermore, the current system limits the ability to make strategic decisions at the clinic, as the costs per patient do not reflect the actual resources spent. This means that a tool, which managers could use to better understand the clinic's resource usage, is currently inaccurate.

### **The interviewees' answers regarding the revised model**

The second part of the interview focused on the interviewees opinions on how the revised model would affect the clinic's operations.

## **The transfer of patients**

### ***Increased pressure***

Because of the already high pressure from the open bed shortage, many interviewees felt that the effect of applying more pressure by differentiating the costs between the two units would have no practical impact. They felt that they already were doing everything they could to get patients through the treatment as fast as possible, and that adding more pressure would not matter.

### ***New argument***

Both the doctors and nurses believed that the new cost allocation system would create a new argument for doctors and coordinators when discussing the movement of patients out of the NICU to the FCU or to another hospital. However, no one could see the argument having anything more than a minor practical impact.

## **Impact on cost efficiency thinking**

Some interviewees thought that the change might incentivise the earlier movement of patients. One nurse thought that if it was stated clearly that NICU cost more, it would incentivise personnel to ensure that patients are not spending unnecessary time in the NICU.

*“It would have an impact; if it costs more in the NICU we would be keener on transferring them [patients ready to move to the FCU] faster.” - Nurse*

One doctor thought that if it was possible to differentiate between the two units from a cost perspective and make it transparent and publicly known at the clinic, then it would make personnel at the department more mindful of the resource intensiveness of the NICU. This sentiment, that the system would make staff members more aware of the costs at the clinic, was echoed by some of the nurses.

*“It might make staff more aware of the economic side, which is relatively important but that we do not really think about on a daily basis...” - Nurse*

Several interviewees suggested that the proposed change could encourage interventions aimed at reducing treatment time at both units, either through minimising unnecessary complications prolonging hospital stay or by educating more parents in taking care of their child at home with assistance from the hospital. This method is already in use because of the shortage of beds and the revised model would add to that incentive.

## **Impact for managers**

One manager thought the change might impact the departments by showing that some departments are more expensive than others, and thus hopefully induce a redistribution of resources. However, the

manager conceded that every department manager would argue for their own department's need for resources.

One manager noted that an implementation of a unit-based costing system would make performance evaluations and comparisons between the departments and their units more accurate than those done today.

Another manager suggested that the system, if implemented, could potentially enable out of county patients to be billed using the current costing system.

### **Relationship between the NICU and the FCU**

One nurse thought that the proposed change would make the NICU more like the adult ICU, where the care is not considered part of the workflow in the same manner. It would put more emphasis on the limited resource that NICU beds are, which the interviewee felt was lost somewhat in the current system which sometimes uses the NICU as an FCU. Another nurse extended the argument and suggested that the units should be more separated organisationally as it would clarify the responsibilities and the positions within the personnel group.

*"[The revised model] would show that some activities are more important than others.... That it is more important with NICU care than FCU care." - Nurse*

However, the managers emphasized the importance of everyone at the clinic sharing responsibility for the entire clinical pathway of their patients. One manager also noted that they had tried separating the NICU and the FCU before at other departments, but stopped when it proved detrimental to the work environment. There was already a degree of classism to the different units, which was worsened by the separation of the units.

### **Alternative ways to determine resource allocation**

The possible use of personnel schedules for determining resource usage was discussed with managers as a way of obtaining the differences in resource usage between units, represented as a key, in a more cost-efficient manner. The doctors' schedule was, according to the managers, a bad choice due to how the doctors moved between units. However, using the nurses' schedule would, in the managers' opinion, be the most cost-efficient method to determine unit intensiveness, saying that the doctor's time spent correlated with the nurse's schedule.

### **Opinion of the revised model**

Both managers thought differentiating personnel costs might provide incentives to move patients in order to be cost-efficient, but also acknowledged that the clinic organisation and management might be more interested in costs than the personnel.



*“The employees aren't interested in being informed about different costs, the doctors might be a little interested, but on an organisational level it is highly interesting to be able to make the connection between results and costs” - Manager*

One doctor needed more information about the system in practice before making a judgement. Another doctor said it was a better way to allocate costs but was indifferent to its implementation, considering it an affair for managers rather than doctors. Most nurses were positive of the revised model, citing the better connection between costs and resources as an improvement over the current model. However, no one could see it having any real impact at the department.

### **Suggestions to improve the revised model**

The current costing system does not yet register patients by bed, but one manager suggested that the model would become even more accurate if it was room-based instead of unit-based. As the intermediary patients are always kept in specific rooms in the NICU, room-based cost allocation would give a more accurate depiction than the revised model, which does not distinguish between intermediary patient and NICU patients.

# Analysis and discussion

## Agency theory applied to the financial relationships at the neonatal clinic

The purpose of incentive structures is the same in healthcare as in other industries, namely to ensure that the agent works in the principal's best interest. The interviews highlighted several agent-principal relationships with relevance to the neonatal clinic, summarized in the table below.

Principal	Agent	Description
General public	SLL	Elected to represent interests
SLL	KS	Reimbursed for providing healthcare to constituents
KS	Neonatal Clinic	Given budget for providing specific types of care
Neonatal Clinic	Healthcare professionals	Spend the clinic's budget to treat patients
Healthcare professionals	Patients	Provide healthcare

We have chosen to not go into detail in the first and the fifth relationships, despite their importance for the incentive structures, because they were not discussed as part of our interviews. How the two have influenced the other relationships is however discussed below.

### SLL-KS relationship

SLL tasks KS with providing healthcare to its constituents and uses a variable reimbursement system based upon DRGs to incentivise production. In theory, this would cause KS to produce as long as the marginal cost is below the marginal gain from said production. This is however not the case, as KS imposes set budgets and production targets to their clinics, effectively limiting production. This is incongruent with the incentives provided by the reimbursement system.

To explain this, one has to consider SLL's obligation towards their constituents, to spend the tax money collected as efficiently as possible. It is probable that the county directs the organisations they own, like KS, to focus less on maximizing their reimbursements and more on providing cost-effective care. This would explain the incentive structures used internally at KS.

### KS-Clinic relationship

In the current goal and target structures at KS, the clinic's focus is on meeting their production target and keeping within their budget. There is no reward from doing so, only the absence of critique from upper management. There are management tools to measure cost efficiency between clinics but they

are currently not used when assessing the clinic. This supports the hypothesis that KS is directed to focus more on budget balancing than cost efficiency.

The production target and budget gives some degree of cost efficiency as it sets an average cost per DRG point that the clinic has to reach. The impact this has on the clinic depends on the budget. According to the interviewees, the neonatal clinic is allowed to be expensive, more so than the average clinic. Some speculated this is because of the nature of the patients treated. Simply put, it is difficult for decision-makers to propose a lowered budget for a clinic treating vulnerable newborns. The current budgetary condition means that the incentive structure at KS creates little incentive to rein in on costs at the clinic today.

### **Clinic-Healthcare professionals relationship**

Incentives placed upon the clinic are meant to be applied to the healthcare professionals by the clinic management, as the professionals are responsible for the cost-driving activity; the treatment of patients. This means that the pressure put on the healthcare professionals to be cost-efficient correlates with the pressure to be cost-efficient put on the clinic.

The clinic gives their employees a salary, which is dependent on the employee's expertise. The salary has no variable component and employees are not measured by production or cost efficiency individually. The clinic management uses directives and recommendation to encourage employees to act in accordance with the clinic's best interest, which could carry negative consequences if not followed. The chance of any negative consequences occurring is presumably low, unless the employee show public disregard for the directive, as the outcome of these directives are never measured on an individual basis and rarely even on the department level.

### **Summarising the agent-principal relationships**

The three agent-principal relationships and the incentive structures discussed above suggest that there are no incentives for the neonatal clinic or its employees to be cost-efficient or mindful of costs. Unless faced with a significantly reduced budget, which is unlikely given the special nature of the clinic, there is no pressure on the clinic or the healthcare professionals at the clinic to be cost-efficient.

However, it became apparent during our interviews that there was an interest in reducing costs and being cost-efficient, especially among the managers. Hence, alternative incentives beyond the financial ones applied above must be explored. These could be taken into account within the principal-agent framework, but to avoid repetition they are explored through the Dudley model as it relates more to the revised model's impact on the department, which is the focus of this thesis.

## **The Dudley model applied**

### **Overview**

As stated in the end of the financial principal-agent analysis, the revised model is unlikely to have any direct financial impact on healthcare professionals at the clinic. As the Dudley model is centred on financial remuneration, some elements of the model would become inapplicable unless a substitution for it could be found. We substituted the non-financial gains from being cost-efficient for the financial gain discussed by Dudley. This substitution means that the model can be applied to the neonatal clinic in its entirety. In order to evaluate the revised model's impact, we must look at the cost-efficiency incentives in place at the clinic and how they relate to the revised model.

### **Characteristics of the incentive**

We identified two non-financial incentives, societal responsibility and reputation. The social responsibility of healthcare professionals to be cost-efficient was mentioned by all interviewees, that they should strive to keep the care they provide as cost-efficient as possible in their role as agents for the clinic. This internal motivation seemed, especially for the healthcare professionals at the department level, weak during the interviews, and it is doubtful that it would impact their decisions. This incentive appeared stronger for managers, who emphasised their part in lowering costs and being cost-efficient considerably more than their colleagues.

No one interviewed wanted to be considered wasteful by colleagues, giving everyone the motivation to at least appear cost-conscious. Appearing cost-conscious is, given the current incentive structure, more important for managers than healthcare professionals. Having a reputation for cost-efficiency as a manager is an advantage when it comes to career advancement and could be a strong motivator for being cost-efficient and promoting cost-efficiency. This makes it an external motivation with elements of internal motivation due to the aspect of self-betterment in career advancement. Additionally, being known for meeting the set budget has become increasingly important at the hospital and having a reputation for going over the budget can reflect poorly on the manager.

A factor that could limit the impact of the revised model would be the perceived attainability of the incentive. Several of the interviewees, including managers, already considered the clinic stretched to the limit in regards to reducing the time spent at the NICU because of the shortage of open beds. Because the personnel at the clinic are invested in reducing time spent, not lowering costs, time-consuming interventions that lowers costs but does not lower time spent at the NICU will be harder to implement at the clinic.

## **Predisposing factors**

Dudley suggests that in a controlled budget environment, an activity that adds workload to a professional, without a sufficient increase in reward for said individual, decreases the chance of the incentive having an impact. The revised model could lead to more effort being put into reducing the amount of backlog patients, which could lead to resistance if employees felt that it did not improve quality for patients as well. There were conflicting views on the value of optimal patient placement, but generally there was a strong aversion for moving patients, especially between hospitals, for the sake of cost efficiency.

There were negligible differences between doctors and nurses concerning cost efficiency thinking. Everyone considered their main responsibility to be providing high-quality care, not cost-efficient care. Furthermore, one interviewee saw it as healthcare professionals' duty to "protect" patients from cost-efficiency programs. The dislike among the healthcare professionals to using cost efficiency as a goal in itself would lower the impact of an incentive for cost efficiency caused by the revised model.

If the internal structure of the clinics at KS is described as a market, then there are currently no rewards for clinics that are cost-efficient. If that were to become the case in the future, efficiency gains at other clinics could pressure other clinics to increase cost efficiency.

Another predisposing factor could be whether the healthcare professionals have faith in that the revised model's cost distribution reflects reality. This was also implicitly suggested during the interviews, where the need for transparency when implementing the revised model was pressed. Everyone interviewed thought that the revised model would be a more accurate representation of the resource usage at the clinic than the current system, which could motivate them to be more cost-efficient.

## **Enabling factors**

We found no notable enabling factors when interviewing, instead finding limiting factors. Several interviewees noted the special nature of neonatal care and that it was "allowed" to cost a lot of money within the organisation. Many also considered thinking about cost-efficiency when treating ill newborns to be cold-hearted, emphasising the patient group when making the statement. Both factors would limit the impact from incentive for cost efficiency caused by the revised model.

## **Conclusions from the Dudley model**

When taking all these factors into account, it can be concluded that the revised model would have limited impact on the incentive structure at the clinic. Breaking up the impact into professional groups, specifically between managers and healthcare professionals, differences emerge. The motivation from social responsibility and the reputational gain for being cost-efficient is stronger for managers. This

means that cost-efficiency motivates managers more, and that a change in the cost allocating due to our revised model could change the actions of managers, and possibly the healthcare professionals through them.

## **Inductive analysis**

### **Impact on healthcare professionals**

There was a strong correlation between seniority and the understanding of the different financial systems used at the clinic. This is unsurprising as the more senior personnel were more involved in the department's budget. That our sample was skewed toward more senior personnel proved helpful as the accuracy to predict the impact of the model correlates with the knowledge of said systems. The nurses' predictions of the effects of the revised model varied more than those of the managers' and doctors', probably because of some nurses' limited knowledge of the relevant systems. They were also more hesitant in their predictions and several of them wondered if they could pass the question because they felt that they were almost guessing.

As noted in the empirical section, out of county patients used to be charged using the cost allocation system but stopped once they realised that they were not reimbursed for their costs. This is probably because the patients sent to KS from other counties need a relatively higher amount of NICU care than the average patient. The revised model would compensate for this and make the cost allocation system viable for billing out of county patients once more.

The implementation of the revised model would also make comparisons in cost-efficiency between units at different departments possible. This is difficult to do in the current system due to the fact that an inefficient unit might be compensated by an efficient unit in the same department.

As one of the nurses noted, the revised model might lead managers and staff to feel that the NICU is a more important part of the operation than the FCU. This could have negative ramifications in that schisms might be created between the units if more focus is put on the NICU relative the FCU. The managers, as noted before, are however focused on preventing this from happening and it is thus unlikely that the revised model would significantly alter the current dynamic between the units.

The nurses of the department were mainly focused on the healthcare materials when asked about cost-cutting, exemplifying the low-quality products from KS' central procurements and prioritising material cost-mindedness. However, material costs are small compared to personnel costs, something that was not mentioned by the nurses, highlighting the shortcomings of the current cost-savings program. Wrongly founded cost attentiveness not only lowers quality of care but can also end up more costly for the clinic.

In summary, the healthcare professionals' limited knowledge of the current systems indicates that they are not particularly interested in them. Trying to lower costs by asking personnel to be more mindful with material usage can end up more costly in the long run. Their current lack of insight in financial systems is most likely the result of the systems not affecting them in their day-to-day decision-making, which is in line with previous conclusions.

### **Impact on movement of patients**

According to our previous analysis, the revised model is unlikely to directly affect patients. Indirectly, through upper management or managers, the revised model could put pressure on healthcare professionals to move patients out of the NICU quickly. More time could be spent finding FCU beds, diverting attention away from patients. The current shortage of beds already exert immense pressure on employees to move patients, to the extent that they feel they are already doing everything they can and would not be affected by the revised model.

In a scenario where there is no shortage of open FCU beds, there could be pressure to move patients that would not be moved today because of the current cost allocation system. Within the department this would not be an issue but an increase in interhospital transfers would add risk to patients. Moving patients to make room for more needing patients is done today and is an inherent part of the workflow at the clinic. The guidelines outlining which patients to move are important today and their importance must be stressed, were the revised model to be implemented.

In the empirical results, there is conclusive evidence for saying that the healthcare professionals at the clinic consider patient needs far more important when making decisions than costs. The signs of defiance the interviewees show towards the current, albeit weak, incentive structures promoting cost-efficiency is also a representation of the struggle described by Ellis et al. where doctors have to choose between what is best for the patient and what is best for the hospital or the hospital's principal.

The solution seems to be to promote projects that reduce costs by increasing the quality of care for patients, like reducing infections. Such measures have far more support among the healthcare professionals and will therefore be more likely to succeed. With that in mind, the practical impact of the revised model will most likely be in the form of promoting interventions with support from healthcare professionals, rather than added pressure on healthcare professionals to move patients in response to the new cost allocation system.

### **Evaluating the accuracy of the revised model**

The interviewees unanimously concurred that the revised model would better reflect the resource usage per patient. The current costing system was criticised by one interviewee as "rough and lacking of nuance" and the revised model would be an improvement in this regard. The empirical results did

however indicate that there are some sources of inaccuracy, specifically the accordion system and the backlog of patients.

The accordion-system is an efficient way to allocate resources, but adds a source of error to the model. The estimated average intensity difference between units is 3:1, but the accordion system means that the real intensity difference fluctuates. The fluctuations would be negligible, but for individual patients it adds a source of error.

In regards to the backlog of patients, the NICU has a variable amount of patient beds available, but generally operates 12 patient beds at the NICU, equalling 360 patient days each month. With between 8-30 patient days each month being backlogged, this implies a backlog rate of 2-8% and a source of error to the model.

All interviewees were of the opinion that the revised model was a better representation of reality than the current model. However, the accordion system and the backlog of patients add inaccuracy to the revised model. It would nonetheless incentivise their removal. As both result of suboptimal conditions at the clinic, the costing system would create incentives for managers to remove them.

The preference would be for the revised model to go hand in hand with the accordion system and become even more accurate. The clinic manager's suggestion to have the costing system work per bed instead of per unit would allow for an even more representative cost allocation. As healthcare professionals' systems and the hospital's cost allocation system become more integrated, a bed-based cost allocation system could be the next iteration of the revised model.

### **Implementation of the revised model**

The potential gain from implementing the revised model has to be weighed against the cost of creating and maintaining it. An important aspect to consider is employee job satisfaction as a model that would increase the reporting and administrative burden on employees would likely be met by resistance. The revised model would only require an accurate key, which would only have to be updated in connection to major changes at the clinic, to be implemented. The simplicity of the revised model makes a strong argument for its implementation.

Although we acquired an accurate key through interviews, a more cost-efficient way of doing this would be needed to implement the revised model on a larger scale. Managers agreed that nurses' schedules would be the best way to approximate resource-usage keys. If implemented using nurses' scheduling for appraising resource usage differences between units, the whole task of costing, depending on the scheduling software, could be automated, only requiring a minor change in the current cost allocation system software.



# Conclusions

The revised model could provide a simple and effective way to bring cost allocation closer to resource usage at the clinic without requiring more administration from healthcare professionals. The nurses' schedule would constitute a good starting point for the cost allocation key when converting from clinic-based to unit-based cost allocation. Implementation of the system would not add costs to the hospital as it modifies the current system.

The revised model would have little short-term impact on the incentives of healthcare professionals and would, according to themselves and our analysis, not change their decision-making. Managers, having incentives to be cost-efficient, could immediately use the increased accuracy to make more informed decisions and gain a better understanding of the cost-driving mechanisms at the clinic. In the long term, it could create incentives for reducing patient time spent in the NICU, make employees more mindful of cost-driving activities, and increase the value for patients by proper resource allocation at the clinic. It would also better reflect the potential cost savings from implementing new interventions that limit the time spent in the NICU.

An accurate cost allocation system is of value for all actors, from taxpayers to patients. The findings presented in this thesis provide a strong argument for implementing a unit-based cost allocation system.

## Recommendations for further research

Since a hypothetical research question was used to assess the revised model, there are no guarantees that the effects discussed in this thesis would materialise. Further research into how the revised model affects healthcare professionals after the model has been implemented would be required to understand the full practical implications. Another avenue for further research could be how the increased accuracy from the revised model affects upper management's decision-making. Lastly, a quantitative study examining which patient groups have been misrepresented in the current system would improve the understanding of which patient groups actually drive the costs at the hospital. It would also highlight the importance of accurate cost allocation.

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# Appendix

## Glossary

Word	Meaning
Agency Theory	Theory surrounding actions taken when one person or entity is able to make decisions on behalf of another
Clinical pathway	Swedish: <i>Vårdflöde</i> The entire care process flow for a patient
Controller	Someone supervising the quality of accounting and reporting of an organization
Coordinator	A nurse who coordinates the logistics of the patient transfers and stays
Costing	The activity of estimating costs for products or services
County	Swedish: <i>Landsting</i> , a political institution tasked with providing certain services
Discharge	The act of sending someone to another clinic or sending them home
DRG	Diagnosis-related groups
External motivation	Motivation stemming from external rewards
FCU	Family Care Unit
Healthcare organisation	An organisation providing healthcare
Healthcare professional	An individual providing healthcare
Healthcare provider	An entity providing healthcare. Can either be a healthcare professional or an healthcare organisation
Hospital Department	An organizational level of a hospital, made up of units
Hospital Unit	One of the smaller organizational units at a hospital, departments are made up of units
Huddinge	A town south of Stockholm, Sweden. Location of the Huddinge Hospital. Used as shorthand for the neonatal department in Huddinge or the Karolinska University Hospital located in Huddinge
Information asymmetry	When one actor has better information than another
Interhospital	Between hospitals
Intermediary Patients	Patient not critically ill nor ready to be sent to the FCU
Internal motivation	Motivation stemming from non-external rewards
Intervention	A change in procedure or routine
Karolinska Institute	Swedish: <i>Karolinska Institutet</i> , a medical university
KS	Swedish: <i>Karolinska Universitetssjukhuset</i>

	Karolinska University Hospital, a healthcare organisation
Landsting	County
Marginal Costs	The additional cost each new unit of production creates
Marginal Income	The additional income each new unit of production creates
Methodological triangulation	Drawing conclusions from several methodological sources
NCS	Normal Costing System
Neonatology	A sub-specialization within paediatrics concerned with the treatment of newborn infants
NICU	Neonatal Intensive Care Unit
NO-inhaler	Nitric Oxide Inhaler, treatment for certain types of respiratory failures
Patient-day	Swedish: <i>Patientdygn</i> 24 hours of care for a single patient
Paediatrics	Healthcare specialized in children and infants
Purposive Selection	A selection made with a specific purpose in mind
Semi-structured interview	Non-rigorous interview with a framework of themes
SLL	Swedish: <i>Stockholms Läns Landsting</i> Stockholm County Council
Socialstyrelsen	National Board of Health and Welfare in Sweden

## Quotes in Swedish

1. "Neonatal intensivvård är lite vad det är, fullt ut och utan begränsningar" - Nurse
2. "Våra chefer och vår ledning vill ju gärna att vi ska påverkas av det, att vi ska tänka kostnadseffektivt, jag tror att de flesta av oss håller emot lite granna, mot det tänket, därför att det är oviktigt när det gäller det rent medicinska." - Doctor
3. "Dyrare för vem? För oss, eller för landstinget, eller liksom... Skattepengar? Eller så, det är så diffust så det är svårt att tänka sig att det på något sätt skulle överrida mina medicinska beslut." - Doctor
4. "Ja, det gör det eftersom att ju närmare kostnaden ligger en själv, det skulle jag kunna känna, alltså belasta vår enhet, där jag liksom är en del av ledningen och så, då skulle jag ha närmare att ta in det i min kalkyl när jag hur jag ska agera, än när det ligger på en sånhära ospecifik landsstinget eller mina skattepengar, jag betalar så mycket skattepengar ändå... Då känner jag att det inte kommer att gå in i mina argument." - Doctor
5. "Ibland kan vi skriva ut barn för tidigt för att gå hem, och det kan kännas lite obekvämt" - Nurse

6. *"Skulle påverka, om det kostar mer på IVA så skulle man vara mer mån om att få bort det snabbare"* - Nurse
7. *"Ja, skulle kunna göra att man får upp ögonen mkt mer för ekonomidelen som är ganska viktig men som vi till vardags inte tänker på [...] skulle tydligöra att en del uppgifter är viktigare än andra [...] att det är viktigare med IVA-Vård än Neo-Vård."* - Nurse
8. *"Jag tycker att [regarding the costing system] det är ett jättegrovt och onyanserat system."* – Manager
9. *"Det som är vår begränsande faktor idag, anledningen till att vi inte har alla vårdplatser öppna, är pga brist på sjuksköterskor. Vi har läkare så att det räcker, men inte tillräckligt med sjuksköterskor."* – Manager
10. *"... men eftersom att vi alltid begränsas av att det stas i systemet så ligger ju inte alltid patienterna där de bäst hör hemma"* – Manager
11. *"[about the accordion-system]... Nej, blir inte alltid rättfördelat personalmässigt, inte rätt kompetens på rätt plats"* – Nurse
12. *"Personalen är inte intresserade av att få kostnader redovisade för sig, men läkarna är lite mer intresserade, men på verksamhetsnivå är det jätteintressant att kunna koppla utfall till kostnad, hur mycket varje patient tar."* - Manager

## Interview schedule

These were the topics we sought to answer during our interviews. These weren't meant as direct questions, but rather as topics that was to be discussed and answered.

### *First section of interview, concerning current systems & resource intensiveness*

- *Topic 1:* How much does the interviewee know about the DRG system?
- *Topic 2:* How much does the interviewee know about the current costing system?
- *Topic 3:* Is the interviewee aware of the link between the DRG system and the costing system?
- *Topic 4:* How much do financial incentives affect the interviewee's day to day work?
- *Topic 5:* Does the interviewee believe that other people at the clinic are affected by financial incentives in their work?
- *Topic 6:* Do you believe there is a difference in resource intensiveness between the two units at the department? If so, which unit is more resource-intensive? How much more resource-intensive is the more resource-intensive unit compared to the other unit?

### *Second section of interview, concerning the revised model*

- *Topic 7:* How would our proposed change impact the interviewee's day to day decision-making?

- *Topic 8:* How does the interviewee believe other people might be affected by our proposed change in their day to day decision-making?
- *Topic 9:* What potential impact, if any, does the interviewee believe the proposed change will have on the clinic?
- *Topic 10:* What is the interviewee's opinion of the proposed change?

***Interviewee positions***

- Director of Neonatology at KS and Doctor
- Quality Controller at the neonatology clinic and Nurse
- Manager of the neonatology department in Huddinge and Doctor
- Neonatal Doctor at the neonatology department in Huddinge
- Neonatal Doctor at the neonatology department in Huddinge
- Head Nurse at the neonatology department in Neonatal Huddinge
- Specialist Nurse at the neonatology department in Huddinge
- Specialist Nurse at the neonatology department in Huddinge
- Specialist Nurse and Coordinator at the neonatology department in Huddinge

***Interviewed for empirical background:***

- Controller at the neonatology clinic