What are the consequences for patients and the treating hospital if patients are admitted to the Emergency Department at a hospital outside their own catchment area?

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ABSTRACT

Patients often face long waiting times in the Emergency Department (ED) before being consulted by a physician. This is regardless of whether or not the patient is admitted to the hospital within their catchment area, also known as their home hospital. The main differences if a patient is admitted to their home hospital or not, is the access of medical records for each individual patient. Given that a patient has been admitted before, medical records will be readily available for this patient in the computer system if the current treating hospital is also their home hospital. When being admitted to a hospital other than your home hospital, no medical records will be readily available for this patient at the point of time arriving in the ED. When medical records are unavailable, the health care personnel have less information about the patient, which possibly could compose a threat to patient safety.

A hospital is a complex structure, and to totally understand how the ED is structured and operates, one must understand the infrastructure of the hospital as a whole. This thesis therefore takes on a descriptive approach, using data from Diakonhjemmet hospitals´ databases as well as relevant literature, to build thorough knowledge and understanding of how patients and the hospital itself is affected when a patient is admitted to another hospital than their home hospital.

Based on the findings in the process of writing this thesis, the conclusion is that not having access to medical records is not the biggest threat to patient safety in the ED. For incoming patients triaged at high levels, there is no time to look at past records before lifesaving treatment is started. Patients triaged at low levels, hence incoming with less severe conditions, can often assess for self-perception of own health status, and nurses and physicians can receive necessary information from the patient itself. Having access to medical records are more important when the patient is transferred to the ward, and an overall overview of history of disease is necessary in order to choose the best treatment.

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Oddvar Kaarbøe (my supervisor at UiO) for guiding me through the process of writing a thesis.

The two persons who let me tell their story to give the reader a better understanding of how this topic become so important to me. Their stories can be found on the next page.

Also a huge thank you to my study colleagues, Marie Hella Lindberg, Leila Yousif, Natasha Bhagat and Maria Maningding, for the countless coffee breaks over the course of the semester.

TWO STORIES FROM REAL LIFE

I would like to begin this master thesis somehow untraditional with two stories from real life. I think this is important to gain an understanding in how this topic caught my attention. These stories are shared with permission from the persons they concern, however, they will be portrayed in a way that they cannot be identified.

The first story is about a chronically ill patient who, in addition to one main diagnosis, have also gained different secondary diagnosis (co-diagnosis). This patient often experiences fast onset of symptoms, meaning they are in need of acute care. Due to these co-diagnosis, this patient has been treated at many different hospitals – once even at different hospitals simultaneously. What struck me then, was that different doctors at different institutions did not know what was going on with treatment of this patient in other hospitals. The reason for this was that they did not have access to any medical records other than the one already existing in their own hospital. In the end, when picked up by an ambulance one early morning, it was decided by the ambulance staff that this patient should be referred to the hospital that had most knowledge and experience regarding the main diagnosis now and in the future. The goal was to start linking everything together, in order to detect whether there was any linkage between these different co-diagnoses in which kept occurring, or if there were any medication this patient was given in which could interfere with other ongoing treatment. Therefore, this hospital started to collect all medical records on this patient from the other hospitals. The patient was discharged after one week of in-hospital stay, and during this time only one other hospital had sent over the medical record from their institution. The question therefor arose: Is this safe practice? Can the patient, as well as the doctor, assume the optimal treatment were given to this patient?

The other story is about a patient who, without any history of disease, got acute sick when traveling (in Norway). Hence, the patient got acute care treatment at a hospital outside her hospitals catchment area. Once well enough to be moved, this patient was transferred to her "home" hospital for further treatment and observation. The transfer was done by ambulance, so she was in the hands of the system the whole time. However, the medical record containing all information about current condition and medical procedures done remained at the first hospital. This patient happens to be very allergic to morphine, which the receiving hospital staff would have known if they had access to any information about this patient. Instead, this patient had to argue against receiving morphine, in a state of poor health. For the patient this was experienced as draining and unnecessary. What would have happened if the patient was not able to clarify this herself? In addition, when transferred from one Norwegian hospital to another, all tests in which are run on incoming patients (may vary according to symptoms) were run again, as no results from the tests run earlier were possible to get a hold of. Again: is that safe practice? Does this build trust between the patient and the hospital?

These are just two stories of many. However, these are stories that usually do not see the light of day for other than those involved. The purpose of these stories is not to create fright or discontent towards our health care system and hospitals, however, as a dependent to someone ill, you do learn the good´s and the bad´s of the system and how it functions. You also learn that the system is complex, maybe lacking necessary resources and that it is very unpredictable. The purpose of this thesis is therefor to shed light on the problem and to recognize that the system has flaws in order for less people to go through the same in the future.

CONTENT

1 Introduction

1.1 Background

Crowding is one of the main problems many hospitals are facing today (Vicellio et al., 2009). Population growth, as well as an ageing population, results in an increased pressure on hospitals. OECD has suggested a maximum occupancy rate at 85 percent. However, many Norwegian hospitals face occupancy rates above 100 percent. Worst out, in 2014, was Akershus University Hospital, Ahus, with an occupancy rate of 108 percent (Dommerud, 2015). An occupancy rate of 108 percent equals 7000 patient days spent in the corridor over the course of one year. Having corridor patients may be seen as a threat to patient safety in different ways.

To solve the issue with overcrowding at Ahus, the hospital signed a contract with Diakonhjemmet hospital, DHS, for them to receive a set number of acute care Ahus patients daily, from the parts of city Alna, Grorud and Stovner, to relief Ahus from overcrowding. Initially, only patients from the parts of city Vestre Aker, Ullern and Frogner were referred to DHS. These patients make up the group of patients who lives within the catchment area of DHS, and therefore receive care at their home hospital. Patients from Alna, Grorud and Stovner who lives within Ahus´ catchment area, but are now referred to DHS, are those patients who will then receive treatment outside their own catchment area.

In 2015, after the implementation of referring a given number of Ahus patients to DHS daily, the occupancy rate at Ahus had been considerably reduced to 96 percent (SSB, 2015).

The aim of this thesis is to investigate the relationship between patients' length of stay in the Emergency Department (ED) based on whether they are admitted to their home hospital or a hospital outside their catchment area, and also which effects it has on the hospital itself receiving patients from outside the catchment area. The thought behind this is that the hospital will have readily available information about the individual patients in the patient group within the catchment area, reckoning they have been admitted before, while health records for the Ahus patients will not be as easily accessible. Hence, does the access to medical records for patients affect how much time they spend in the emergency department? The thesis also looks into the financial aspect of running a hospital, and how this can affect the patients as well as the hospital.

1.2 Definitions

Important expressions to know to gain an understanding of the operation of the ED, as well as the hospital as a whole, will be defined in this chapter.

1.2.1 Length of stay

Length of stay is in this text defined as the total number of hours the patients spend in the Emergency Department overall, before being allocated to another department (the ward) for treatment, or being discharged.

According to Bernstein et al. (2008), longer waiting times in the ED is considered a risk of increased in-hospital mortality, which is why length of stay may also be used as a quality indicator in the ED. Patients having to wait > 8 hours, face significantly higher rates of mortality compared to patients with waiting times < 8 hours. (Olshaker, 2009, Bernstein et al, 2008).

This paper will look at the length of stay in the ED for patient's resident in Vestre Aker, Ullern and Frogner (DHS patients), compared to the length of stay in the ED for patient's resident in Alna, Grorud and Stovner (Ahus patients), and what may cause these two patient groups to have different length stays in the ED. The length of stay for selected triage groups will also be discussed.

The terms waiting times and length of stay (LOS) will be used interchangeably in this paper, meaning that the two terms are used to explain the same issue; the time a patient spends in the ED from arrival to discharge or transferal to the ward. Hence, in this paper the two terms will be used to explain the same phenomenon. The reason why two concepts are used to explain the same matter, is that both expressions are used in the literature. Hence I would like to remain the possibility to use the different terminologies when talking about different literature.

1.2.2 Patient safety

Patient safety is highly prioritized in all departments in a hospital setting, along with quick and accurate diagnosis and treatment. In a hospital environment there are many threats to

patient safety. An occupancy rate above a given threshold, which will be discussed later, is one of them.

Corridor patients is an indicator of an occupancy rate exceeding capacity, which again is an indicator that medical staff have more patients to care for than the proper amount. Occupancy rates exceeding a certain level (85 percent) may influence patients' safety, as personnel faces less time to care for each patient and a more stressful work environment (Myrbostad and Lauvsnes, 2013). Corridor patients may experience reduced patient safety, as they are positioned in a place where conversation may be easily overheard, and therefor choose to withhold important information from the doctor (Dommerud, 2015).

Another issue regarding patient safety in which may occur in a situation where patients are admitted to a new hospital, is the transferring of medical records between the different institutions. As of today, there is no easy or totally safe procedure for such transfer of medical records between institutions, and there is a risk that patient information can leak during this process. This process is also time consuming, and the medical records are therefore not always readily available in the time of need (Personal communication with staff at DHS).

1.2.4 Emergency Department (ED)

The emergency department (ED) is the department in a hospital in which the patient is first admitted to. In order to be admitted to the ED, one must be referred by a general practitioner (GP), an emergency physician, or ambulance services.

1.2.5 Triage

All Emergency Departments in Norway utilizes the Manchester Triage System (MTS). The word triage is French, meaning sorting, and originates from times of war when soldiers had to prioritize whom to save. The use of MTS is a measure to improve both efficiency and patient safety in the ED. The main reasoning for implementing a triage system in the ED is to make sure the most severe and urgent cases are seen by a doctor first, and less severe cases may face longer waiting times (Christ et al, 2010, Mackway-Jones, 2012). Which triage group the patient is placed in depends on the condition the patient is in at time of arrival in the ED. MTS consists of five categories, from blue indicating little urgency to red indicating life threatening

conditions and need of immediate response. See table below for further explanation of the five groups and urgency of consultation.

Priority level	**Waiting time for nurse**	**Waiting time for doctor**
Red – life threatening	No waiting time	No waiting time
Orange – very urgent	< 10 minutes	< 10 minutes
Yellow – urgent	< 30 minutes	< 60 minutes
Green – standard	< 60 minutes	< 120 minutes
Blue – non-urgent	< 120 minutes	< 240 minutes

Table 1 – Manchester triage codes.

1.2.5.1 Under triage

Under triage happens when the extent of injury in a severely ill or injured person is underestimated, and therefore not prioritized to receive quick treatment (Rehn et al, 2009).

1.2.5.2 Over triage

Over triage, on the other hand, is the opposite situation, in which a less injured patient receives unnecessary treatment; treatment that should rather have been targeted towards the more severely injured (Rehn et al, 2009).

Both under triage and over triage is a threat to patient safety (Rehn et al, 2009).

1.2.6 Patient flow

Patient flow is the path that the patients follow when arriving and admitted to the ED. In general, the flow goes like described in the figure below:

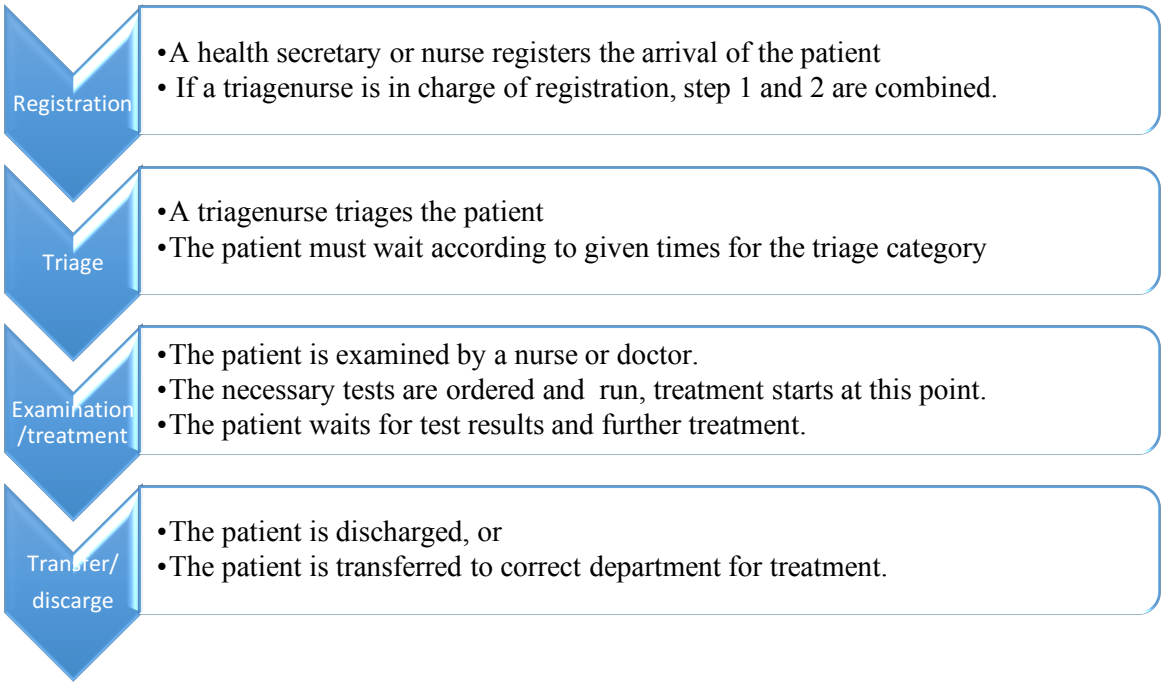


Figure 2 – Patient flow in the Emergency Department. Holmberg (2013).

In order for the ED to work efficiently, and to maintain the highest level of patient safety, the ED staff must follow close routines. Once a patient arrives at the ED, the incoming patient must be registered, followed by triaging. This might be merged into one step, depending on how the ED is structured. At DHS, this is, for the most part, done in one step. It is necessary that patients are triaged as soon as possible after arrival, in order for a nurse or doctor to know the status of each patients and to prioritize correctly. The physician operating the ED runs necessary tests and starts the appropriate treatment. In this phase, all possible information about the patient is gathered; from personal information to history of disease (The Norwegian Board of Health Supervision, 2008,). This is where the issue arises whether or not the patient has a medical record in the hospitals databases or not. The patient is then either discharged or transferred to the ward for further treatment. How quickly the patient is transferred from the ED, depends somewhat on the number of available beds in the other departments (The Norwegian Board of Health Supervision, 2008).

1.2.7 Medical records

A medical record contains necessary information about the patient´s history of illness, injury and former treatment, and is first and foremost a property of the institution the patient was treated at.

1.2.8 Occupancy rate

The occupancy rate is the percentage of beds occupied by patients at all times. It is measured by the number of patients divided by the number of available beds (Forster et al, 2003). An occupancy rate of 100 percent means that all beds are occupied; when the occupancy rate exceeds 100 percent, patients are placed in beds placed in corridors.

1.2.9 Catchment area

A catchment area is a "geographical area delineated around an institution or business that describes the population that utilizes its services" (Schuurman et al, 2006).

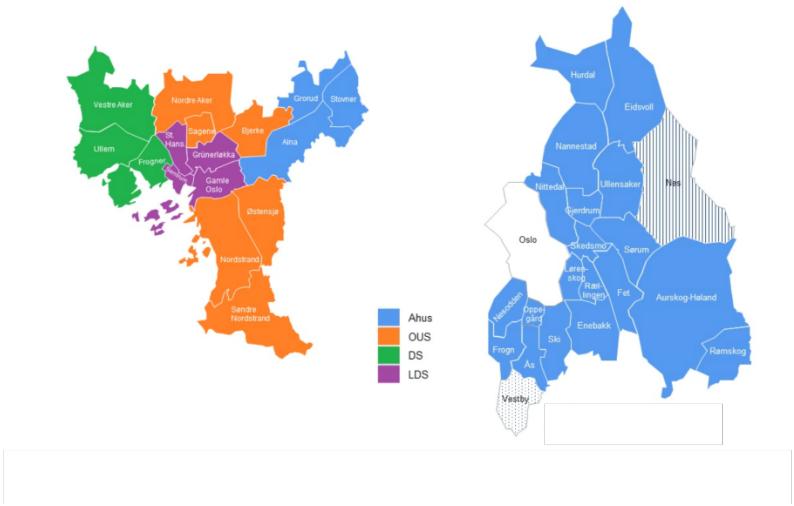


Figure 2. The blue districts are the districts in which originally belongs to Ahus´ catchment area, including Alna, Grorud and Stovner. This area contains approximately 500 000 inhabitants. The green area are the parts of city that belong to DHS´ catchment area. Approximately 135 000 persons lives within this area.

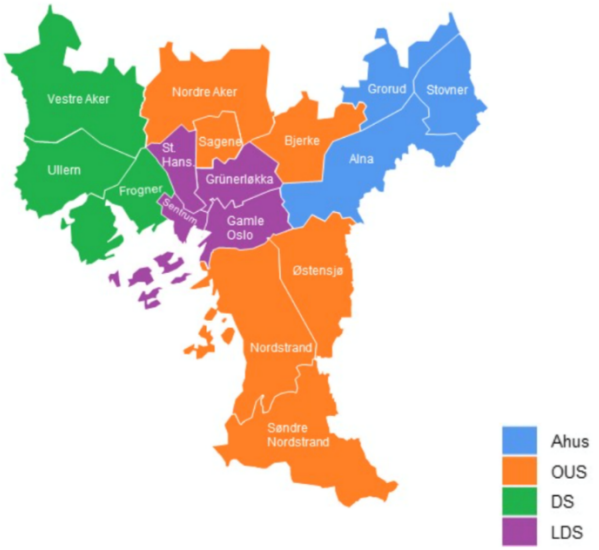


Figure 3. The blue parts of the city, here marked as Ahus´ catchment area, are the ones now being sent to DHS after the deal between Ahus and DHS were implemented in 2014.

2 Hospital operations

2.1 Akershus University Hospital and Diakonhjemmet

Akershus university hospital, hereby referred to as Ahus, is a university hospital located in Akershus, Norway. Ahus´ catchment area was expanded coherent with the completion and opening of the new hospital building at Nordbyhagen in Lørenskog in 2008. Ahus´ catchment area involves 500 000 patients, and 9000 employees. That means 56 patients per health care personnel.
Diakonhjemmet hospital, DHS, on the other hand, is a smaller scale, private non-profit hospital. The original catchment area houses 135 000 inhabitants, partitioned on 1740 employees; 78 patients per employee.

A main challenge in operating a hospital is the large variation in incoming patients and patient flow. As the majority of incoming patients are categorized as acute care patients, it is difficult to anticipate the number of patients hospitalized at a specific time (Myrbostad and Lauvsnes, 2013). This especially applies to the ED, where the patients are first assessed by health care personnel before allocated to the correct departments for treatment. Another challenge in newer hospital buildings, like Ahus, is the way the buildings are constructed. It is not

facilitated to hold patients in the corridor. Not only may it affect patient safety, however, it may also impact the working conditions and make it harder for personnel to perform their tasks (Myrbostad and Lauvsnes, 2013).

International standards are suggested for hospital occupancy rate is to not exceed 85 percent (Dommerud, 2015). In 2014, Ahus had, at its highest, an occupancy rate of 108 percent (Dommerud, 2015). That means that individual departments faced occupancy rates even higher than the 108 percent. According to SSB´s prognoses, there is expected that Ahus´ catchment area will see a population growth of 2-3 percent from 2013 to 2020, as well as a growing elderly population, which will cause even higher pressure on hospital capacity (Myrbostad and Lauvsnes, 2013).

In 2012, patients resident in Alna, Grorud and Stovner faced a high number of in-hospital stays (127-135 stays/1000 inhabitants) as well as the longest average length of inpatient stay (3,7-3,8 days). As a reference, patients from other districts within the same catchment area with approximately the same number of stays per 1000 inhabitants had significantly shorter average length of stay with 3,2-3,4 days. These averages are numbers of length of stay in the wards, and does not include the time spent in the ED (Myrbostad and Lauvsnes, 2013). However, total length of in-hospital stay is also an indicator of state of health at time of arrival in the ED, as well as the number of arrivals in the ED, as all patients are passing through here before transferred to the correct ward.

There is a diverse population residing in Ahus´ catchment area. This area houses a quite high share of people with immigrant background. This specifically applies Alna, Grorud and Stovner, the areas from which some patients will be admitted to DHS for immediate care. There are no data which suggests grouping patients according to ethnicity when looking at ED length of stay, despite the fact that there are reasonable to assume that ethnicity may influence burden of disease, medical care consumption and communication skills (Myrbostad and Lauvsnes, 2013). There is reason to assume that at least communication difficulties may affect the length of stay in the ED for some patients.

Ahus is continuously working on improvements in their operations. Improving capacity is a main priority in which will reduce operational difficulties. One of the measures taken is to reallocate patients within the existing health authorities (Myrbostad and Lauvsnes, 2013).

Helse Sør-Øst, which is the regional health facility in which both Ahus and DHS belongs to, has reacted to the problem by reallocating certain patients from Ahus to DHS. So far the solution is a so called "hybrid solution" where the patients are still living in Ahus´ catchment area, and all information about the patients (if there are any, depending on whether the patients are returning or first time admission) are located at Ahus, but the patient is offered emergent care at DHS. This means that the patients´ affiliation does not change even though location of point of service changes (Høie, 2014). Approximately 30 beds at DHS are occupied by Ahus patients at all times (Helse Sør-Øst, 2016).

2.2 Risks linked to hospital cooperation

DHS rebuilt and opened a brand new ED in 2013. Before the remodeling, the ED had a capacity of receiving 12 000 patients annually, while after the re-opening the capacity was extended to allow for 4000 more patients annually to become a total of 16 000 patients annually (DHS, 2013). Due to increased capacity, starting beginning of December 2013, DHS´ ED received between two to five acute care patients from Alna daily. This was later also expanded to include the districts Stovner and Grorud. Progressively increasing the capacity to, from February 1st, 2014 onwards, receiving full capacity of ten patients from Ahus daily, as well as patients from its own catchment area like before. This solution resulted in decreased waiting times for patients, as well as increased patient safety they said – so why could there possibly be a disadvantage being consulted in an ED in a hospital outside one's catchment area?

In a risk analysis conducted by Helse Sør-Øst, they evaluated the current organization of the hospital cooperation as "high risk". The reason behind this conclusion is the high level of uncertainty for the people in Alna, Grorud and Stovner. There is little predictability in whether they will receive immediate help at Ahus or DHS. Likewise, the current solution also creates uncertainty for the given hospitals. When one part of the gatekeeping system refers an Ahus patient to the emergency department, they now have to call to see which hospital has capacity to receive these patients. That means that neither the patient nor the receiving hospital knows for sure where the patient will end up. Also, any further follow-up of the Ahus patients admitted to DHS, will happen at Ahus, which makes the flow of treatment inconsistent. Helse Sør-Øst also concludes that the current solution is not optimal, due to

"inefficient sharing of necessary information due to lack of integrated systems for medical records" (Helse Sør-Øst, 2016).

Each time a person seeks medical consultation it is noted in the patient's personal medical record. These records stay at the institution in which the patient went to for consultation or treatment, whether it is a general practitioner, a hospital or another institution offering medical assistance. It is safe to say that the medical records contain important information about the patients´ health related history and conditions, which can be useful for the doctors to know when examining an incoming patient in the ED. If a patient has been admitted to the hospital before, their medical records can be found readily available in the data system. Likewise, if the incoming patient is admitted for the first time, no medical record will exist for this person in the hospitals data system, but will be created this time and available during future hospitalizations. That is, if you are a DHS patient. DHS are not obligated to store medical records for patients coming from Ahus.

It is reasonable to make the assumption that there is more likely that patients who lives within the catchment area of the hospital have existing medical records from former hospital visits readily available in the data system, than patients from outside the catchment area. Patients from outside the catchment area will have their health care records stored at the hospital within their catchment area.

More issues with sharing of health care records will be discussed in the following chapter.

3 Medical records

Why is it so important for medical staff to have access to patients´ medical records? First of all, the medical record informs about the patients´ history of illness and former received treatment and medication. It informs about any cases of allergies or intolerances, which is important to know when deciding on a treatment scheme. Giving the patient a medicine whom he or she is allergic to may cause more damage to an already weak patient. It will also give information on whether or not certain treatments were sufficient in the past. This is especially important nowadays as resistance to antibiotics are on the rise (The Norwegian Directorate for e-health, 2016).

Since 2016, the health care system has implemented two different types of health care records per patient (The Norwegian Directorate for e-health, 2016):

Health care record

The health care record is the record in which contains the most information about a patient´s history, and is created at each institution the patient receives consultation or treatment.

Core records

The core record is a measure which was implemented recently as an addition to the original health care record. The core record contains only the most necessary information about a patient, such as allergies to medication and major conditions. The purpose of the core record is that it can be accessed online by both the patient itself and authorized health personnel, meaning that the most important information about a person´s history of disease are easily accessible also when the main health care record is not retrievable within the data system (The Norwegian Directorate for e-health, 2016).

3.1 Critical view on core records

As a response to the Norwegian Directorate of Health´s Report 2.0 ”*Critical information on core records – A national standard for the integration of core records* (*Rapport 2.0 ”Kritisk informasjon for kjernejournal” – En nasjonal standard for integrasjon mot kjernejournal),* The Norwegian Board of Health Supervision offers a critical view on the implementation of core records. First of all, they are asking for a narrow definition of what core information is. The Norwegian Board of Health Supervision perceive it in such ways that a core record

should not contain information about the actual process of treatment, but rather information in which could have fatal outcomes if not considered before or during treatment, such as allergies, intolerances, implants, and such. The Norwegian Board of Health Supervision is also asking for clarification on who is responsible for adding and editing information to the record.

3.2 Sharing of personal medical records

For the patients who lives in Ahus´ catchment area, but are admitted to the ED at DHS, yet another issue arises. These patients might have been admitted at Ahus in the past, in which their medical record can be found in Ahus´ data system. However, the patient is now at DHS in need for medical treatment. In a situation like this, there is not possible for the health personnel at DHS to easily access the patients´ medical records from Ahus. Even though all hospitals utilize data systems to store medical e-records at this point in time, and most hospitals even utilizes the same data system, a record cannot be retrieved from other institutions. As of today, only a few of the units in "health care Norway", like the minor ED and Ullevål Hospital, have digital ways to transfer records between the institutions, the rest of the hospitals are lacking such system. The general flow of information between the different health facilities is in general poor, and the fact that everything has to be done the old fashion way contribute to delayed treatment for some patients (Fossheim, 2014).

The process to transfer a medical record from one institution is the following: A doctor from hospital B makes a phone call to hospital A to request a patient´s medical record. Staff at hospital A must then look up the medical record for the correct patient, print out a paper copy in order to eliminate all information which can identify who this patient is. This is usually done by covering necessary information with black marker, nothing fancy. The record must then be scanned and sent to hospital B via a fax machine. A fax machine system is not flawless, and there is always a risk that information sent by fax will land in the wrong hands. Also, in a busy hospital setting, there is no guarantee that personnel have time right away to fulfill this process – it might take days, or even weeks, before hospital B receives the information they requested. There might even be that the patient is already discharged before the medical record arrives.

3.3 Patient safety and sharing of medical records

In this subsection, all facts have come about from conversations with the head of the emergency department at DHS.

The process of transferring medical records between institution, as described above, is not flawless, and can even pose a threat to patient safety. First of all, sending sensitive information via fax is not the safest way, and information may end up in the wrong place. Hence the process of marking out any identifiable information. Second, if medical records are requested for several patients at a time, these might all be received in the same "shipment". It happens that pages gets messed up and mixed together, and naturally, when there is no information indicating who the patient is, it can be difficult to distinguish which information belongs to which patient. Also when a medical record is received by fax, the receiving hospital must scan it into their own computer system, which makes it useless for anything else than reading off information. One can for example not draw any extracts from it, as it will be a regular pdf file.

The argument to why fax is still utilized rather than transferring information digitally is, ironically enough, patient safety. The data systems are yet not safe enough for confidential information to be shared, even though fax is. However, the goal is to implement such safe data system that health records can be shared more readily and efficiently, as well as core records (if functioning correctly) being a step in the right direction as they can be accessed online.

4 Emergency Department

4.1 The Norwegian Emergency Department system

In Norway, the system of emergency departments differs from the system utilized in many other countries. I will explain how the emergency primary health care center system works in this chapter. As mentioned earlier, the hospital ED utilizes a gatekeeping system as a part of how it is organized. One of the gates, the emergency primary health care center also holds the function of an emergency department, however, for minor injuries or less severe illnesses. Therefor I will refer to it as ED minor, while the emergency department linked directly to a hospital can be referred to as ED major. Cases coming into ED minor may be referred to the ED major, hence the gatekeeping function. It may also work the other way around; when people show up unannounced in the ED major, they may, after a quick consultation, be referred to the ED minor.

The patients usually refer to their GP if their condition is not in need of immediate consultation, and when they seek help during their office hours. GP offices also offers same day consultation for acute situations. However, GP´s have limited office hours, and acute situations may occur outside of these hours. The ED minor, on the other hand, runs 24/7. Therefore, when acute situations occur outside the GP office hours, patients consult the ED minor. The ED minor will then make a decision on whether or not further referral to the ED major is necessary for each individual patient.

In other countries, ED minor and ED major is the same operation, usually linked directly to the hospital. Therefore, the gatekeeping system we utilize in Norway do not apply in countries where the two are emerged.

4.2 Operation of the DHS Emergency Department

There are three main ways in which patients may arrive in the ED. Firstly, patients may be referred by their GP or from the minor emergency department. These two facilities serve as gatekeepers for the ED. These patients´ arrival in the ED are known beforehand, and their

arrival is therefore expected by the staff. These patients have also usually received a preliminary diagnosis before entering the ED, and the staff on duty may therefore plan the reception for these patients, and quick diagnosis can therefore be expected.
The second way patients may arrive in the ED are by ambulance services. These incoming patients may have severe injuries or illness, in which fast response time at the hospital is important. Also these patients´ arrivals are known to the hospital beforehand, however, not down to the point of exact time of arrival.
A third way is that the patient shows up in the ED unannounced. This means that the patients have not been referred by neither a GP nor by ambulance services. There are several reasons why patients arrive this way, however, they commonly arrive with diagnosis that could have been treated in a minor ED facility. Having patients arrive unannounced may negatively impact the treatment for severely ill patients, as the personnel are also obligated to consult these patients, causing longer waiting times for the other patients. This is one reason why the ED and hospital in general prefer to utilize the gatekeeping system (Helsetilsynet, 2008).
In order to maintain the highest possible level of patient safety, as well as efficiency, the ED must be well organized and utilize a sufficient triage system. A well-organized ED is especially important during times of high demand to ensure that the most severely ill or injured receives care first.
Patient safety is an important factor to maintain in the ED as well as in the rest of the hospital. Mistakes can happen in every segment of a patients´ flow through the ED; mistakes may happen at registration of patients' arrival, when meeting with health care personnel, during treatment, observation, and also at time of discharge (Holmberg, 2013).

The proportion of emergency admissions to elective admissions in a hospital setting is steadily increasing towards more emergency admissions; the ratio being 56:44 in 1992, and 61:39 in 1999 (Bagust et al, 1999). That means that hospitals face an environment which is more unpredictable and fluctuating, and to a lesser extent planned. Also, at this time they did expect that the rate of emergency admissions would continue to increase in the future (Bagust, 1999). They were right. Therefore, one of the strategies which must be implemented in a hospital setting is to plan for the unexpected.

4.3 Reasons why Ahus patients face longer length of stay in the emergency department at Diakonhjemmet hospital compared to DHS patients

There are several reasons to why investigating whether or not Ahus patients face longer waiting times/longer length of stay in the ED than DHS patients in the ED at DHS. First of all, DHS catchment area houses, for the most part, quite a homogenous patient group from the west part of Oslo, whereas the patients from Alna, Grorud and Stovner are more diverse, especially when it comes to ethnicity. In the district of Alna, 51 percent of the inhabitants are of immigrant background, while the numbers for Grorud and Stovner are 47 percent and 53 percent, respectively. To compare, Ullern, Vestre Aker and Frogner have a share of inhabitants with immigrant background of 18 percent, 17 percent, and 28 percent, respectively. These numbers are from 2015 (Otterlei, 2016). Also, the trend suggests that people resident in the west of Oslo on average are higher educated and have more resources. Assumptions can be made that persons of immigrant background residing in the west of Oslo have attained better language skills than those residing in the east. Therefore, communication may become an issue when patients do not master neither Norwegian nor English very well. The problem may escalate when patients are elderly, as the older generations tends not to master the Norwegian language too well.
According to the Grossmann model (2000), persons with higher levels of education are more efficient producer of health investments; e.g. they have better knowledge of harmful effects of smoking and therefore make the choice not to smoke (Grossman, 2000). This example is actually suitable with the burden of disease of the two patient groups at DHS; the higher educated population in the west smokes less than the lesser educated population in the east. However, higher wages make it costlier to take time off work to invest in health, and might affect health stock negatively (Grossman, 2000). Wages are higher in the west. The Grossman model will be explained further in chapter 6.1.

Another issue is the different burden of disease. From conversations with the head of the ED at DHS, I learn that the DHS patients have more alcohol-related conditions, while smoking-related conditions is the bigger issue in Ahus patients.
A third issue, according to the head of the ED at DHS, was that the staff at DHS did not know what to expect concerning the issue with male/female doctors, execution of different medical tests and so on, as culture and religion may play a part in how the patients perceive the

thought of being examined by a doctor of the opposite sex. If there are issues with who executes the consultation, waiting time may arise when having to call in another physician.

5 Occupancy rate

5.1 Occupancy rate and patient safety

According to the Norwegian Medical Association (NMA), the 2015 average occupancy rate in Norwegian hospitals were as high as 93 percent. This means that on average, the occupancy rate was eight percentage points above the international recommended level of 85 percent. There are proofs that some hospitals have even had an occupancy rate above 100 percent average all departments, and single departments facing rates as high as 120 percent (NMA, 2015).

An occupancy rate of 85 percent means occupancy reaching the limit 310 days per year, assuming reduced occupancy during national holidays and other holidays (Myrbostad and Lauvsnes, 2013). An occupancy rate of 92 percent equals full occupancy 329 days per year, making the same assumption about holidays and bank holidays.

Research has shown that an occupancy rate above 92.5 percent increases the chances of delay of patient flow, higher incidence of in-hospital infections, as well as higher mortality amongst patients (Kuntz et al, 2013). Based on this, one can argue that high occupancy rates in the hospital setting may lead to reduced quality of care, which is a threat to patient safety (NMA, 2015).

An occupancy rate above 92.5 percent also induces the number of fatal mistakes done, due to busy personnel. British health authorities have set the maximum occupancy rate at 85 percent, and the Norwegian Medical Association (NMA) wishes to introduce the same limit in Norway (NMA, 2015).

Bagust et al. (1999) found that an occupancy rate of 85 percent or lower were of minimal risk to the patients. However, once the occupancy rate exceeds this level, risks may be substantial. Occupancy rates above 90 percent may trigger regularly bed crisis, where there are not

enough beds for all patients (Bagust et al., 1999). Patients are then placed in the corridor in anticipation for a bed to become available. Having patients in the corridor is yet another threat to patients safet. As mentioned before, patients placed in the corridor may withhold important information, in fear of other people overhearing confidential conversations with doctors and other health care personnel (Dommerud, 2015). Also, more modern hospital buildings are not constructed to house patients in the corridor, and, worst case scenario, these beds may hinder personnel from working efficiently and fulfilling their tasks (Dommerud, 2015)

5.2 Occupancy rate and mortality

Geelhoed and Klerk (2012) conducted a study to detect any changes in patient mortality rates after implementing a 4-hour rule in the ED at Western Australian hospitals, meaning that length of stay in the ED should not exceed four hours for any given patient, when the program was fully implemented. The 4-hour rule was adopted by the government in 2008. First goal was to have 85 percent of patients, and then slowly increasing to reach 98 percent of patients to be discharged or admitted to the ward within four hours of arrival in the ED. Data was gathered from six different hospitals in Perth, whereby three were tertiary hospitals and three were secondary hospitals. The results showed that implementing not only led to improvement in overcrowding, but it was also associated with lower mortality rates and fewer deaths in the three tertiary hospitals. The three secondary hospitals saw no difference in either overcrowding or mortality.

Even though a 4-hour rule is proved to be efficient in certain EDs, questions were raised on whether such time pressure would lead to poorer patient outcomes as a result of rushed decisions and inappropriate transfer of patients to the wards. Implementing a 4-hour rule also means that old practice must be adjusted to the new way of handling patients, which can be challenging for the staff. What they experienced in Perth was that the wards faced a higher burden of tasks in which used to be fulfilled in the ED, but where now transferred to be done in the different wards instead (Maor et al., 2011).

There is important to emphasize the differences between the Norwegian ED and the Australian ED, and why implementing a four-hour rule in Norway would not work. Norway is the few countries which uses gatekeeping to control the entrance to the ED. In Australia, patients are directly admitted to the ED without any prior consultation or treatment, and are met by specially educated emergency physicians. In Norway, the ED is staffed with triage

nurses and interns (Buskop et al, 2016). The fact that interns usually have less knowledge than physicians, waiting times may be prolonged in the process of interns having to approach the doctor on duty for assistance. Even interns themselves have questioned this organization of the ED.

In a feature article in Dagens Medisin, intern Jo Inge Myhrer, criticize how the ED´s in Norway are run by interns. One of his arguments is how having interns responsible for receiving and diagnosing patients is good business for the hospital. Interns admits more patients for inpatient treatment compared to more experienced doctors. In addition, interns misdiagnoses patients more frequently than doctors, which may cause longer inpatient stays. Patients may even receive several diagnoses, which means more reimbursement to the hospital (Myhrer, 2013). A study conducted by Geelhoud et al. (2008) concluded that having experienced doctors in the ED reduced the number of admitted patients by 27 percent. At Gjøvik hospital in Norway, they implemented a pilot of having a chief attending physician available in the ED from 12 pm to 4 pm daily, as this time lot is usually busy with incoming patients. However, this study did not conclude whether or not implementation of this routine had a positive effect, but it is a sign that Norwegian hospitals recognize the problem, and that measures are done to improve (Wangberg et al., 2011).
Myhrer even takes it to level where he suggests to add a new diagnostic code – code Y: "Exposed to interns in the ED" – a code in which would give the hospital zero reimbursement, or even negative reimbursement. Maybe then more experienced doctors would be more present and visible in the ED (Myhrer, 2013). This is of course put a little to the extreme, but then again no one knows the pros and cons, and the routines in which are in need of improvements, of the health care system better than the health care personnel themselves.
Having more experienced physicians in the ED is, of course, more expensive than having interns (Skog, 2007). However, thorough analysis must be done to investigate which solution is more expensive; to pay more in salaries, but having less admissions, readmissions and wrong diagnostics, or paying less in salaries, but have higher costs due to readmissions and wrong diagnostics. Another important issue for a hospital is to maintain a good reputation. If patients feel insecure and scared, and have doubts towards the hospitals credibility, it may negatively affect their response to treatment, and worst case, worsen the outcome of the illness.

6.0 Financing

6.1 A brief introduction to health economics

Health policy varies in different countries, however, there are two superior goals in which tends to be universal; efficiency and fairness. Efficiency – "attain the highest level of health possible at a given economic level". Fairness – "equal access for equal needs", or to "reduce inequalities in health" (Olsen, 2006). Health is a complex field to work with. Health itself is a qualitative unit, and is commonly measured at an ordinal level; is this given level of health better than, worse than or equal to another health. One can also measure health in a quantitative way, then usually measured in life years. Total life years in a population is easy to measure, however, to measure it a little more nuanced in "good life years" and "bad life years" makes it harder to measure (Olsen 2006).
The overall health goals are not about offering as many health care services as possible, but to obtain as much health as possible. Health care services can be measured and counted in the number of services provided, the number of medications prescribed, etc., but to compare the health outcome in different patient groups is difficult. In other words, while measuring the amount of health services given ("input") is easy, measuring how much health comes out ("output") is much more difficult (Olsen, 2006).

Peoples health is influenced by three main factors; environment, heritage and lifestyle. Heritage is the predisposition to develop different diseases, as well as sex, ethnicity and possible handicaps. Environment is something that is somewhat more controllable – one can, to a certain degree, choose the environment to live in. Lifestyle is the most controllable factor – one's health related behavior mirrors one's autonomous preferences (Olsen, 2006).

Two commonly used indicators of health is mortality and morbidity. Over the last decades, there has been a shift from communicable diseases being the most prevalent, to non-communicable diseases being a more and more prominent issue. This is an important factor to consider in health policy development, and when designing the health care system (Olsen, 2006).

The World Health Organization defines health a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. This definition has received criticism for being too broad, and for making health difficult to measure (Olsen, 2006). One of the task of a physician is to measure health – objectively - in a patient as an external observer.

When asking an economist why an individual requests a good or service, the answer will be that the consumer considers the benefit of that good or service to be higher than the price. The lower the price, the higher the demand. Health services differs from these goods in the way that they are not goods which offers benefits themselves. Therefor health care services can be considered instrumental – they are demanded to the degree they are expected to have a positive outcome on health. Situations in which people demand health care services have certain characteristics; 1. Acute illness or injuries, 2. Gradually worsened health (opposite of acute), 3. Individual suspects illness, 4. Palliative care, and 5. Preventative care in healthy individuals (Olsen, 2006).

One factor that may affect the demand for health care as a good, according to Olsen (2006) is the discomfort which may arise in consuming that good, so called side-effects. People will therefore weight the positive effect of better health with the possible negative side-effects of the consumption of the good. One can say that health services "produces" health because these services intends to better people´s health. Production of health services is mainly the process of transforming health care input to finished services, an example being surgeries.

A well-known model describing the demand for health is the Grossman model, developed by Grossman for the first time in 1972, and then revised in 2000. This is based on the 2000 version of the model. According to Grossmans model of investment for health, the demand for health differs from the demand for traditional consumer goods in four ways: (1) The consumers wants good health rather than health care. Hence, demand for health care is derived from a rational demand for health. (2) The consumer does not only consume health passively from the market. He also produces it by spending time investing in health. Physical activity and medical goods are two inputs he uses to produce health. (3) Health lasts for more than a single time period, which is why health can be treated as a capital good. (4) Health can be treated as both (a) a consumption good and (b) an investment good. (a) The consumer gets benefits directly from good health itself. (b) Good health gives the consumer the opportunity

to have more time to spend working, and thereby earn more income and gain the ability to buy other goods from the market (Grossman, 2000).
Grossman differentiates health capital from other types of human capital. Human capital, like education, increases the productivity in the market sector, which again are used to generate income to purchase more goods and services. Health capital, in addition, increases the time one can spend in this market sector. By having a large health capital, one reduces the risk of becoming ill and will have more time to work. When working more, one will have the opportunity to either consume more goods and services, or to have more leisure time, which is also considered a good for the consumer (Grossman, 2000).

To maximize utility, the consumer must (Grossman, 2000):

1. Allocate time between work and leisure
2. Spend remaining leisure time on health and non-health activities
3. Spend income earned on health and non-health resources
4. Produce or invest in health capital for future use

The individual's utility function is given in equation (1):

$$(1)\ U = U(G_tH_t,Z_t), \quad t=0,1,\ldots,n$$

H_t: Stock of health capital
G_t: Service flow per health stock
$G_tH_t=h_t$: total consumption of health/healthy days
Z_t: considered a vector of other goods
n: length of life

H_0 is given, but the stock of health capital is at all times endogenously decided. n is length of life, decided endogenous so that life ends when $H_t \leq H_{min}$. H_{min} is an exogenous given level of health stock capital which is not compatible with life. Hence, length of life is decided by the amount of health capital that maximizes the utility given certain production- and resource limitations.

An individual´s net investment in health capital is given by equation (2):

$$(2)\ H_{t+1} - H_t = I_t - \delta_t H_t$$

The above equation shows that net investments are gross investments, I_t, minus the depreciation rate. δ_t is the discount rate ($0 < \delta_t < 1$). The discount rate is exogenous, but are assumed to increase with age (Grossman, 2000).

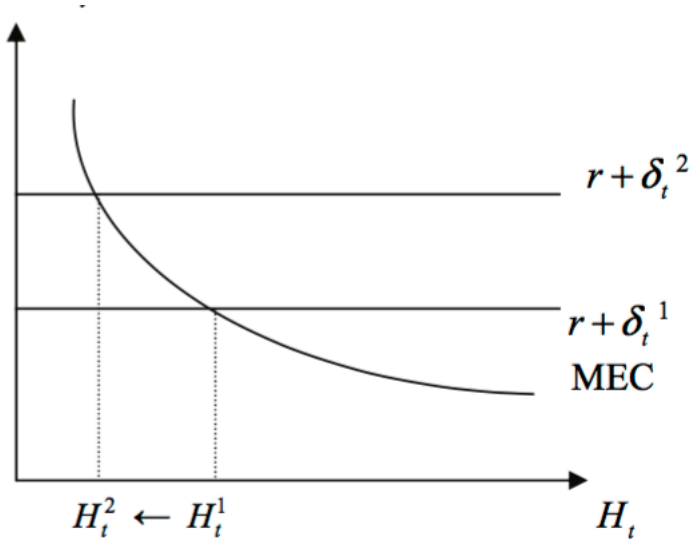


Figure 4. The effect of increased depreciation rate at optimal level of health stock capital. Grossman, 2000.

In health economics, it is not enough to be cost efficient – that we produce every health service in the least expensive way. One must also be efficient in allocation – one must produce a combination of different health services in which best corresponds with the health care service organs priorities. There is a separation between fixed and variable inputs. Typical fixed inputs are buildings, machines, and equipment. Variable inputs vary with quantity produced, for example labor. Health care must be efficient for one simple reason: If it is not efficient, it means that patients are missing out on treatment in which they are in need of (Olsen, 2006).

In a simple market model there are two parties; seller and buyer. In a health service model there are three parties; seller, buyer and insurance/tax channel of financing. However, the buyers contribute with the largest part, either as tax-payers or insurance customers (Olsen, 2006).

6.2 Financing of Norwegian hospitals

Jegers et al. (2002) describes two dimension to sort financial models for hospitals. First, whether it is a prospective or a retrospective payment system. In a retrospective payment system, the hospitals are reimbursed based on their spending. In a prospective system, a given framework budget is decided beforehand - dependent or independent of activity. This is the other dimension – whether the financing system is activity based or framed (Jegers et al., 2002).

A retrospective, activity-based financing system is uncommon today, as it provides low cost-efficiency as well as low cost-control. Under such system, the hospital has no incentives to choose the most cost-efficient treatment because all costs are reimbursed.
In Norway we had a retrospective, activity-based financing system until 1979, when the system changed to a prospective, frame-based system in 1980. Since 1997, Norway has implemented a partly prospective, activity-based system.

It is common that hospitals wish to take into account both professional considerations (in this case attain the highest level of health for those who needs it the most) as well as economic considerations. This will be up to each individual hospital to decide. However, the professional and economic considerations will be balanced when those patients that are the most profitable patients are also the patients with the highest needs.

No financial model is perfect. Frame-based financing lacks incentive to cost-efficiency, while activity-based financing might create little cost-control as well as an incentive to prioritize the most profitable patients – who might not be the patients with the highest demand.

6.3 Activity-based Costing

Economic efficiency is defined by maximizing the utility of resources (Falvo et al., 2007). When the number of ED beds occupied by non-acute care patients increases, the hospital´s marginal cost of providing care to each additional patient is decreased. (Falvo et al., 2007). Hence, improving production efficiency by treating a larger number of patients in the already existing treatment spaces may improve a hospital´s net return on ED operating expenditures. (Falvo et al., 2007).

Somatic specialist health care services applied activity-based costing in 1997. Activity-based costing is granted by the National Budget based on activities accomplished by the regional health facilities. The financing system is a two-part system; one part is a basis funding calculated based on the number of patients within the catchment area and the demographics of the given patient group, and the other part is financed on the basis of activity level. In 2017, these two parts makes up approximately 50 percent each. The activity level reimbursements are calculated from historical treatment costs within DRGs at some Norwegian hospitals (The Norwegian Directory of Health, 2016).

Variables used for DRG classification are, usually:

- Diagnoses – split into main diagnosis and co-diagnosis´. The variable for co-diagnosis usually just differ between complicated or non-complicated DRG.
- Procedures – differs between medicinal and surgical DRGs
- Sex – only applies when diagnosis is related to organ systems which are sex-specific
- Age – usually used to distinguish between patients older and younger than 18. Infants also have own DRGs.
- State of health at time of discharge – whether the patient is alive or dead at time of discharge, or if transferred to another institution, might affect the DRG.

Each medical condition is given a DRG code in which is used both as a statistical measure and a financial measure. Within some DRG groups, there are again two DRGs; one for the given condition without any co-conditions or complications, and the other one for the given condition together with other co-conditions. The DRG including other co-diseases gives higher reimbursement rates compared to the other one.
DRGs are also distinguished as medicinal or surgical, and a few are only for outpatient treatment. An activity goes under the surgical category if surgery done in an operating room (OR) is done, all other inpatient activities, as well as smaller procedures done outside an OR is considered medicinal. A central point here is the 5-hour rule, if outpatient treatment lasts for more than five hours, and are grouped as medical DRG, the hospital earns the right to higher reimbursement levels. A stay for less than five hours will be counted based on outpatient DRGs (The Norwegian Directorate of Health, 2016).

The regional health authorities received 30 billion NOK through activity-based financing last year, that were distributed to the different health facilities within the regions. Even though each DRG point is weighted 42 753 NOK in 2017, the activity-based financing scheme gives the health authorities 21.040 NOK per DRG-point reported to the Norwegian Patient Register (NPR) (Dagens Medisin, 2017).

Reimbursements based on DRG are for the most part independent of length of stay. However, if the stay exceeds a given threshold for length of stay within each DRG group, the level of reimbursement increases (Tande and Munch-Ellingsen, 2010). Additional reimbursement is given when stays who are given a DRG with trim point of more than 20 days where length of stay exceeds this given point with more than 10 days. A trim point is the upper end of a statistically derived range of length of stay expected for a given DRG group (Avery, 2009). In such cases, 0.09 additional points are given each day until the patients is ready to be discharged or to a maximum of 100 days (The Norwegian Directorate of Health, 2016).

Additional to activity-based financing, each regional health authority (RHA) is given a block grant as a baseline funding per financial year. The RHAs are then responsible of allocating the grant between the somatic specialist care hospitals within each region (Ringard et al., 2013). The size of the grant is calculated based on different factors, such as the numbers of inhabitants within the region and the demographics of the population. The block grant is independent of activity level (Ringard et al., 2013). In 2017, the block grant and the activity-based costing are weighed approximately equal; 50 percent each (The Norwegian Directorate of Health, 2016).

In a hybrid solution like the one between Ahus and DHS, where the patients still belong to the old catchment area, but are now treated as they belong in DHS catchment area, Diakonhjemmet receives about 80 percent of the baseline funding for this patient group, while the remaining 20 percent of the baseline funding goes to Ahus. This deal was negotiated and decided on by all three parts; DHS, Ahus and Helse SørØst (the regional health facility in which both Ahus and DHS are subordinate) (Helse SørØst, 2016).

Because the ED admits the most patients, and a large amount of these patients are discharged after being treated in the ED, the ED is an important place for revenue generation (Falvo et al, 2007). The ED operates with set prices per incoming patient, and at this point DRG´s are not

taken into account. For an incoming patient who is consulted in the ED and later discharged as an out-patient, the hospital will be reimbursed approximately 900 NOK. For patients staying overnight one night, the reimbursement rises to 9000 NOK (approximate numbers given by the head of the ED at DHS). Even though the costs also raise by having a patient overnight in the ward, the profit will be higher than when discharging within a certain number of hours. This is why one may argue that there exist economic incentives to transfer patients to the ward for an overnight stay, even if the patients could have been discharged.

6.4 DHS specific financing

As the deal between Ahus and DHS were set into effect February 2014, and progressively implemented to full capacity, it is interesting to look at how funds from Helse SørØst Regional Health Authority (RHA) towards DHS has changed. The first table below is the funding of DHS in 2013. Numbers are in 1000 NOK.

Baseline funding/block grant	1 022 471
Research	17 070
National competency services	2 000
State funding	321
Activity-based reimbursements	290 614
Total income 2013	1 332 476

Table 2: DHS 2013 budget. Activity based reimbursements is settled based on actual activity-level.

Helse Sør-Øst RHA have set the following amount disposable for Diakonhjemmet hospital in 2017. Numbers in 1000 NOK.

Baseline funding/block grant	1 094 944
Research	14 485
National competency services	2 150
State funding	331
Activity-based reimbursements	507 626
Total income 2017	1 619 535

Table 3: DHS 2017 budget. Activity based reimbursements is settled based on actual activity-level.

One can read from the chart that the baseline funding is approximately the double amount of the activity-based reimbursements. These numbers are calculated based on the former years´ activities. In case DHS were to report DRG-points exceeding the given amount in the budget for the current year, the hospital would only receive 40 percent of each DRG-point exceeding

the budget, so called "overproduction" of DRGs. If they were to under produce, no punishment is given, meaning they would receive the amount given in the budget even though too few DRG-points are reported (Baaske, 2009).

According to the Norwegian Directorate of Health´s *Activity-Based Financing 2017 (Innsatsstyrt Finansiering 2017)*, the activity based financing and the block grant should contribute to the budget with 50 percent each. However, it is the regional health facility that allocates the money within the region, meaning that the proportions of funding may be different in different hospitals within the same region (Ringard et al., 2013).

In addition to DHS now having more patients to report DRG-points for, the DRG-point reimbursement levels have also increased from 2013. As one DRG point gave 39 447 NOK in 2013, the same DRG-point in 2017 is worth 42 753 NOK. This increase contributes to change seen in activity-based reimbursements, as well as more patients to report DRG for.

Year	**DRG-point reimbursements (NOK)**
2013	39 447
2014	40 772
2015	41 462
2016	42 081
2017	42 753

Table 4: Development of DRG-point reimbursements from 2013 – 2017.

6.5 Diagnose-Related Groups and financial incentives

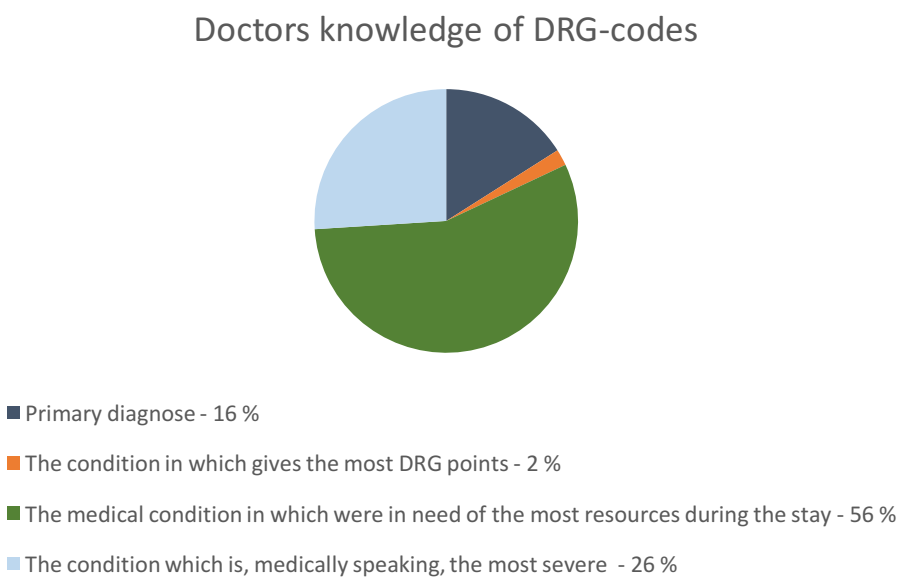


Diagram 1. Doctors knowledge of DRG-codes. Riksrevisjonen, 2016-2017.

In a survey among doctors in Norwegian hospitals, Riksrevisjonen (2016-2017) assessed doctors´ knowledge on how to utilize DRG-codes correctly. Two percent replied that they would use the code in which gave the most DRG points, meaning more reimbursement to the hospital. The survey does not say whether reporting the highest DRG points were connected to reimbursements levels, but one may assume so (Riksrevisjonen, 2016-2017).

6.5.1 Incentives to board patients

Waiting times in the ED is, in most cases, related to how many patients are waiting, as well as the burden of disease or injury and the patients´ condition and severity both in the ED itself and in the rest of the facility. If no beds are available in the wards, patients may be held longer in the ED to wait for a bed to become available, a concept known as “boarding” (Vicellio et al., 2009).

However, patients may be held for longer than necessary for other reasons than high occupancy rates. Hospitals runs on given budgets, and in order to maximize profit, it might be tempting to take advantage of the system. One example of converting boarding hours into potential patient revenue is given below (Falvo et al., 2007).

Converting boarding hours into potential patient revenue:

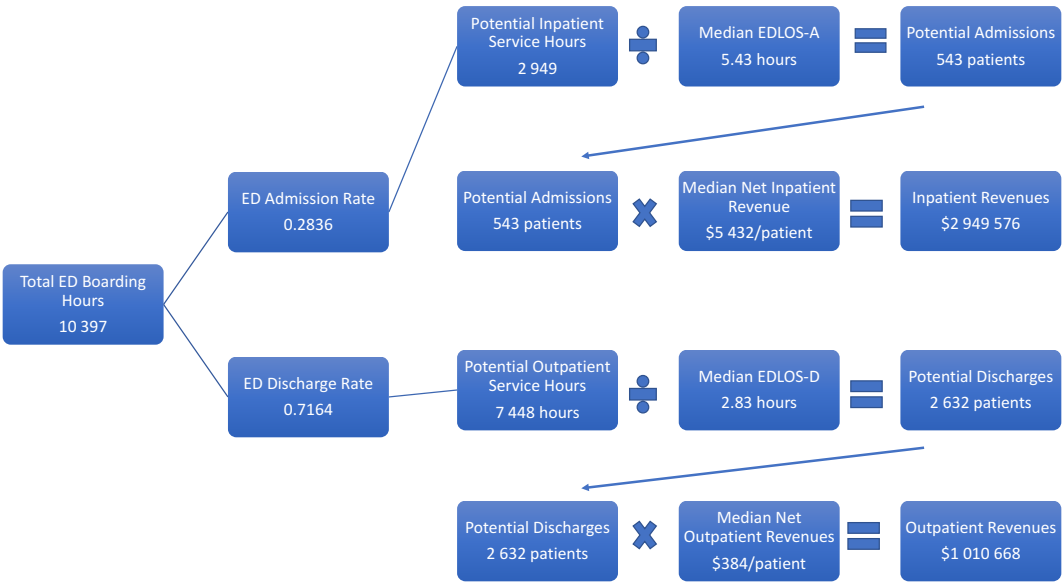


Figure 5. The conversion of ED treatment into patient revenue (Falvo et al., 2007)

This figure developed by Falvo et al. (2007) illustrates the incentive to board patients. First, they divided the number of patients into potential inpatients and outpatients. The potential inpatients hours were calculated by multiplying total ED boarding hours by the probability of hospital admission. To find the number of hospital admissions likely to result from more effective use of the lost hours of treatment bed occupancy, the expected inpatient hours were divided by the median length of stay for admitted patients. The same procedure was done for outpatients. For inpatients, all charges were bundled together to estimate revenue. Outpatient revenues were calculated from the percentage of total billings that the hospital are left with (Falvo et al., 2007). Even though the rate of inpatients is approximately one third of outpatients, having inpatients generates, in this case, quite higher revenues compared to outpatients. Hence, it may be tempting to refer patients to inpatient treatment as it generates more revenue. However, if boarding were not an issue, and the ED could potentially still face a surplus if the rate of bed turnover were at its optimal level (Falvo et al., 2007).

A simplified version of the *Converting boarding hours into potential patient revenue*:

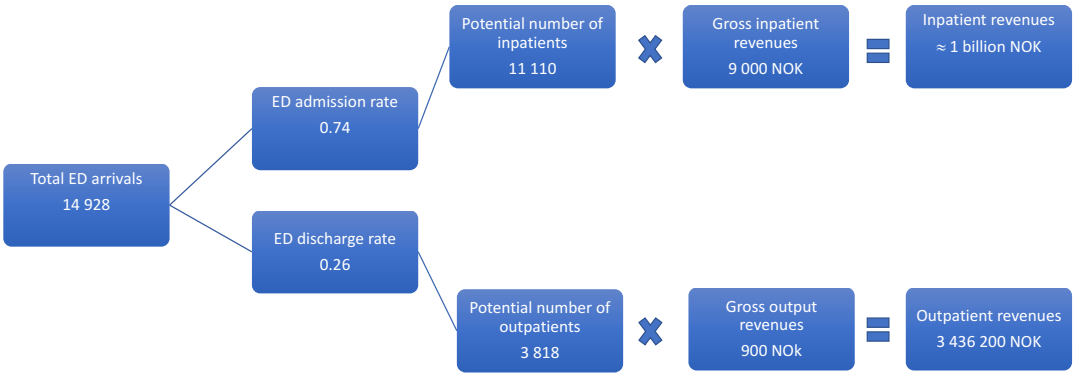


Figure 6. Incentive to practice boarding in the ED. Simplified model from Falvo et al. (2007).

We here make the assumption that all inpatients are reimbursed 9000, while outpatients are compensated 900 NOK. This assumption does not paint a picture of the real world, but is rather an illustration on the incentive to board patients overnight in the ward, or with times exceeding the threshold for higher level of reimbursement.

The ED is reimbursed with regards to two factors: time and DRG-codes. At the same time that DRG-codes are reported for arrivals in the ED, there is a time limit taken into consideration. The approximate numbers in the Norwegian activity-based reimbursement system for emergency departments are, as mentioned earlier, 900 NOK for short-term patients, and 9000 NOK for patients staying for over a set threshold of five hours. The fact that these numbers differs as much as they do, and that 9000 NOK leaves room for a surplus also after the increased costs associated with keeping the patients longer, there have been debates about whether or not this is an inventive for boarding. We use gross income due to the fact that net revenue per inpatient stay in the ED will differ in different cases. Therefore, this figure serves as nothing more than an illustration that there are incentives to keep patients in the ED longer than what is really necessary.

Even though it is difficult to calculate whether or not hospitals are tempted to “trick” the system, either by unnecessary boarding or by demanding too high levels of reimbursement, there are proof that such activity has occurred also at Norwegian hospitals. One case was Drammen hospital, which in 2011 incorrectly registered DRG-codes for 1.500 patients, meaning that they got reimbursed from the National Budget more than if the codes had been filed correctly (Næss, 2010). Also Lillehammer Hospital admits to have stated incorrect

DRG-codes and gotten too high amounts reimbursed (Næss, 2010). According to former Director of Health, Bjørn Inge Larsen, a sample of 4000 hospital stays were randomly selected, where of 400 stays were incorrectly coded in such way that reimbursements given were higher than necessary (NRK, 2011). However, conclusions cannot be drawn that DRG-codes were incorrectly reported with the sole purpose of generating more revenue.

7 Patient allocation

Chapter 7 examines the allocation of incoming patients at the DHS ED in 2016, both from the DHS and Ahus patient groups.

7.1 Inpatients versus outpatients

Number of medical and surgical patients combined: 4346+10582 = **14 928**

Inpatients: 11 110 (74%)

Outpatients: 3818 (26%)

Of all patients consulted in the ED at DHS in 2016, 74 percent were in need of inpatient care, while the remaining was referred to outpatient treatment. Sorted into medical and surgical patients, the distribution looks like in the figure below.

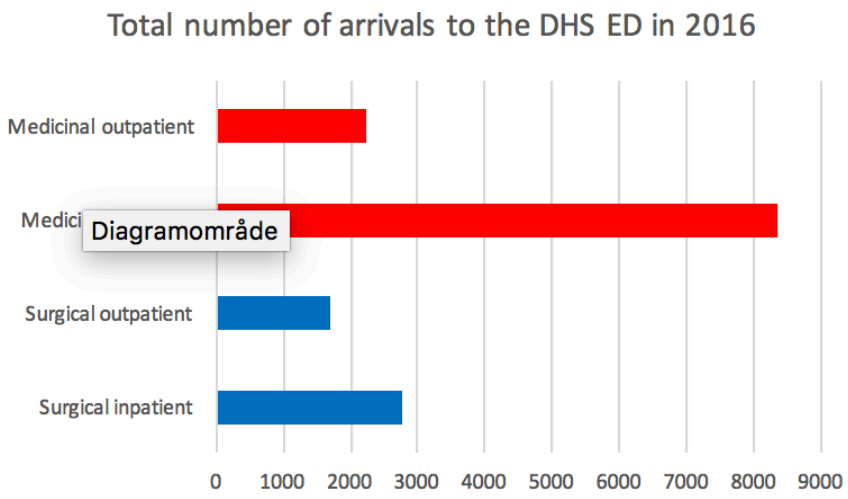


Diagram 2. Arrival of patients sorted by medical and surgical categories.

Total medical patients: **10582**

Medical inpatients: 8351

Medical outpatients: 2231

Total surgical patients: **4346**

Surgical inpatients: 2759

Surgical outpatients: 1587

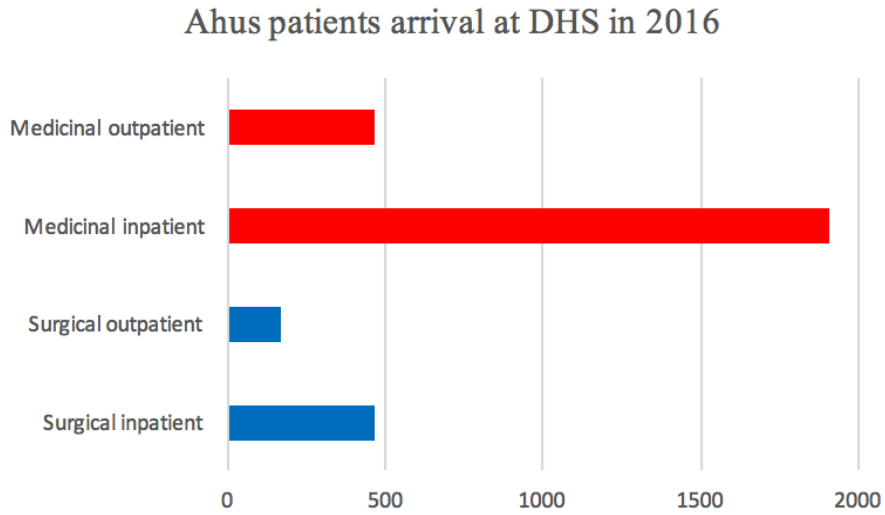


Diagram 3. Number of patients originally in Ahus´ catchment area arriving in the ED at DHS in 2016.

Total medical patients: **2367**

Medical inpatient: 1903

Medical outpatient: 464

Total surgical patients: **635**

Surgical inpatient: 464

Surgical outpatient: 171

A total of 3002 incoming patients Ahus patients in 2016 means an average of 8.20 incoming patients each day. This calculation takes into account that 2016 was a leap year. This is below the capacity in which DHS is capable of receiving. Full capacity is 10 Ahus´ patients daily, as well as “their own” patients.

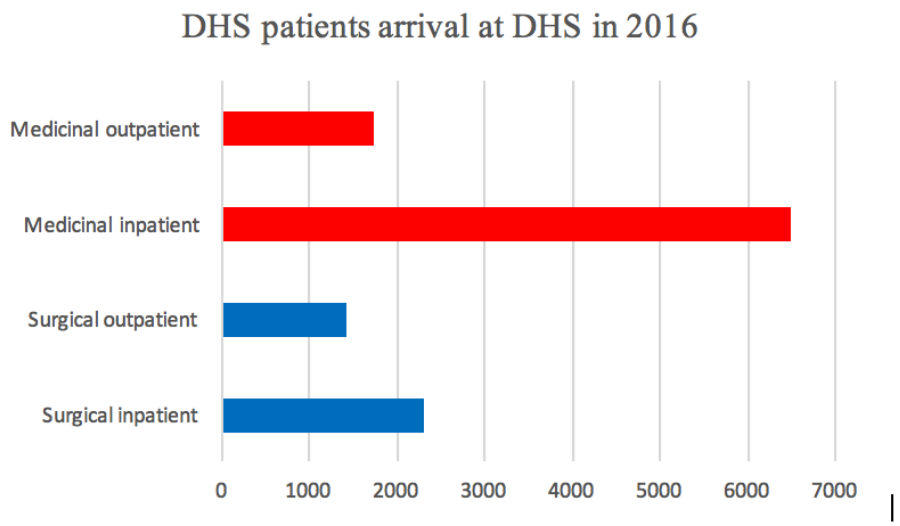


Diagram 4. The number of DHS patients arriving in the ED at DHS in 2016.

Total medical patients: **8214**

Medical inpatient: 6490

Medical outpatient: 1724

Total surgical patients: **3720**

Surgical inpatient: 2301

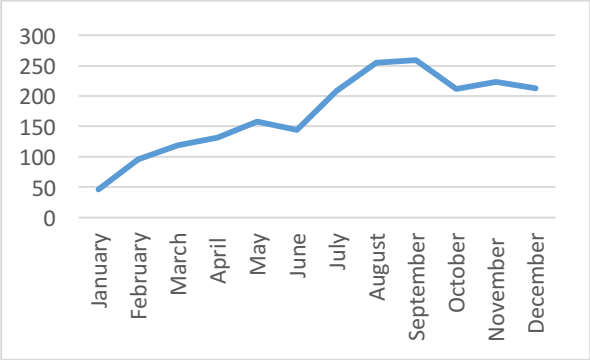
Surgical outpatient: 1419

From DHS catchment area, an average of 32.6 patients arrived in the ED daily in 2016. The patient flow varies some from month to month, and of course, no day is similar to another.

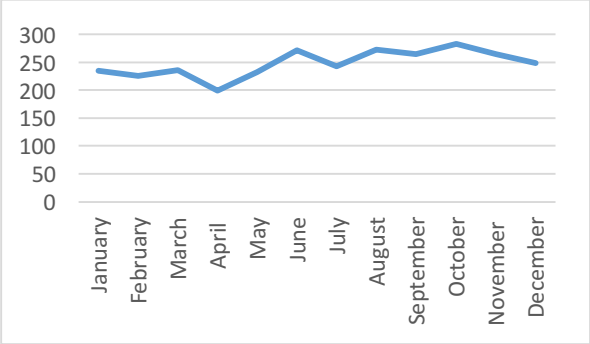
A monthly distribution of arriving patients, years 2014 – 2017, looks like this (diagram 13 – 20 next page):

Ahus

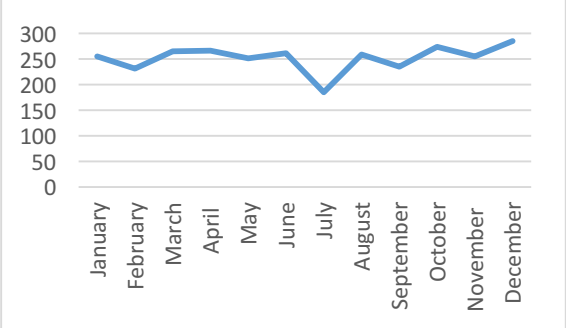
2014 - Monthly distribution of patients
Total number of patients: 2065



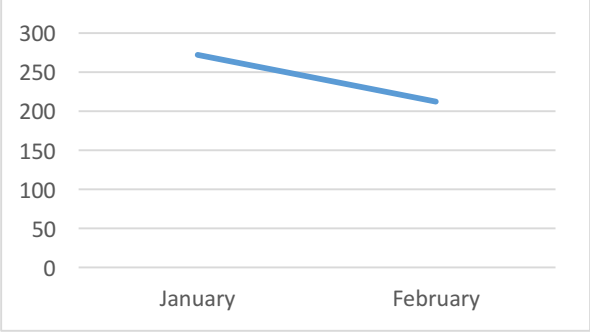
2015 - Monthly distribution of patients
Total number of patients: 2978



2016 - Monthly distribution of patients
Total number of patients: 3026

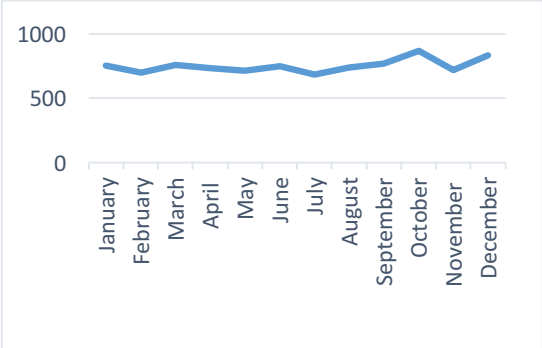


2017 - Monthly distribution of patients
Total number of patients: 484

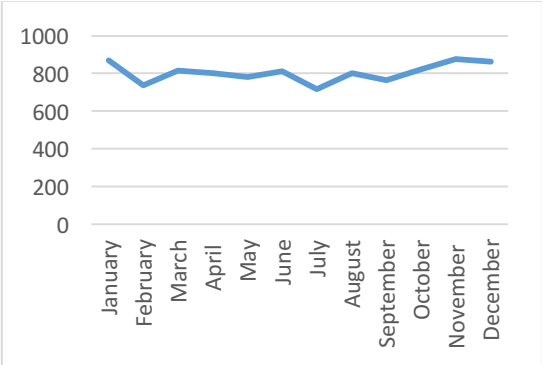


Diakonhjemmet (DHS)

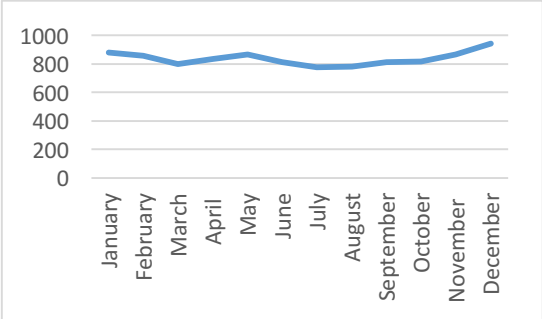
2014 - Monthly distribution of patients
Total number of patients: 8994



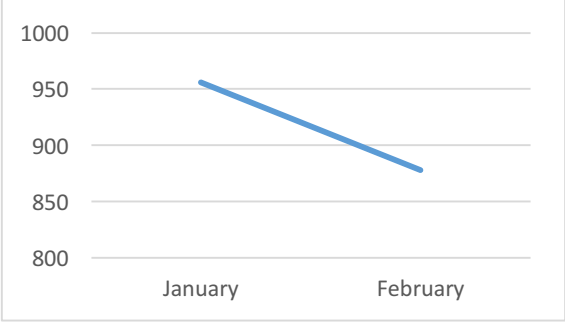
2015 - Monthly distribution of patients
Total number of patients: 9662



2016 - Monthly distribution of patients
Total number of patients: 10038



2017 - Monthly distribution of patients
Total number of patients: 1834



One can see that the number of arriving patients is quite similar from year to year, both for Ahus and DHS patients. The exception is arriving Ahus patients in 2014, as this is when the arrangement was implemented. However, what one can tell from the curve showing the number of arriving Ahus patients in 2014 is that it was efficiently implemented. The plan was to start with a few patients daily and progressively increase until reaching the limit of 10 patients in a day. Otherwise the distribution is pretty equal between months. The winter months tends to have a little higher occupancy rate due to the flu season, a trend one can also see in these charts.
However, one can see that no months have the exact same number of arriving patients from year to year, which is an indicator that a hospital is an unpredictable and fluctuating environment. The exact numbers of monthly arrivals can be found in appendix I.

7.2 Allocation of inpatients

Arriving patients are in different states of health at the time of arrival. Patients are usually referred to the ED if they are suffering from something in which a GP or the ED minor cannot treat. As explained before, patients are triaged by specialized triage nurses when arriving in the ED. Based in their condition, and how long it is proper to let a patient wait before a physician consultancy, patients are prioritized in the ED. In 2016, the pattern of triage of arriving patients looked like this:

Ahus (diagrams 21, 22, 23 and 24)

2014 - Patients distributed by triage
Total number of patients: *2065*

Red	1 %
Orange	38 %
Yellow	33 %
Green	23 %
Blue	0 %

2015 – Patients distributed by triage
Total number of patients: *2978*

Red	3 %
Orange	43 %
Yellow	31 %
Green	22 %
Blue	0 %

2016 – Patients distributed by triage
Total number of patients: *3026*

Red	2 %
Orange	40 %
Yellow	35 %
Green	22 %
Blue	1 %

2017 – Patients distributed by triage
Total number of patients: *484*

Red	1 %
Orange	42 %
Yellow	34 %
Green	22 %
Blue	0 %

Diakonhjemmet (diagrams 25, 26, 27 and 28)

2014 – Patients distributed by triage
Total number of patients: *8994*

Red	1 %
Orange	34 %
Yellow	30 %
Green	28 %
Blue	1 %

2015 – Patients distributed by triage
Total number of patients: *9662*

Red	2 %
Orange	37 %
Yellow	29 %
Green	28 %
Blue	1 %

2016 – Patients distributed by triage
Total number of patients: *10038*

Red	3 %
Orange	34 %
Yellow	31 %
Green	39 %
Blue	2 %

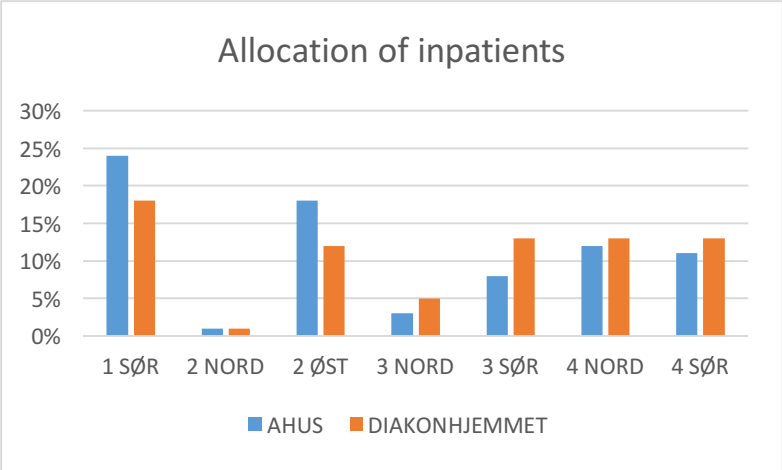
2017 – Patients distributed by triage
Total number of patients: *1834*

Red	3 %
Orange	35 %
Yellow	32 %
Green	26 %
Blue	1 %

All charts do not add up to 100 percent, but that may be due to incoming patients who are arriving in a state in which is there is no time for triage.

By looking at the distribution of triages in tables 13 – 20, one can see that orange is, for most years, the category in which the largest group of patients fall within. This means that the majority of patients, when all five triage groups are seen as individual groups, should wait less than 10 minutes before consulted by a physician. When combining red and orange into one group, as patients triaged in these categories should have significantly lower waiting times than patients in triage categories yellow, green and blue, and the latter three mentioned into one group, it is clear that the majority of patients can have waiting times of more than one hour and it would still be within the proper time limit. This means that there are a higher number of patients arriving who are not in too urgent need of help compared to patients in need of immediate help.

It is interesting to look at distribution of patients transferred to each ward. In the diagram below one can see the distribution for both Ahus and DHS patients. Numbers are from 2016.



1 SØR- heart/lung
2 NORD – orthopedics
2 ØST – general medicine
3 NORD – elderly with stroke
3 SØR – geriatric
4 NORD – infection
4 SØR – gastrointestinal

Diagram 29. Allocation of inpatients at DHS. Explanation of each ward to the right.

From the diagram one can see that the highest number of patients, both from Ahus and DHS, are referred to the lung/heart department. The ratio of patients from Ahus referred to the heart/lung department is significantly higher than from the DHS patient ratio. The term ratio is important as there are a significantly lower number of Ahus patients, and the exact numbers can therefore not be used. However, the ratio of Ahus patients being the largest in the heart/lung department may be an indicator that the trend is that Ahus patients´ burden of disease are more affected by smoking than DHS patients.

DHS patients have higher ratios for both elderly with stroke, geriatric, infection and gastrointestinal wards than Ahus patients. Even though no conclusions can be drawn from this diagram, it is an indicator that the burden of disease is different in the two areas.

7.2 Patient allocation and emergency department length of stay

DHS patient group	Average EDLOS	Median EDLOS
All patients	3.0	2.7
Surgical (all)	3.1	2.8
Surgical (inpatient)	3.3	3.0
Surgical (outpatient)	2.8	2.5
Medical (all)	2.9	2.7
Medical (inpatient)	3.0	3.0
Medical (outpatient)	2.7	2.5

Table 5. Allocation of arriving DHS patients in 2016. Numbers in hours.

Ahus patient group	Average EDLOS	Median EDLOS
All patients	3.1	2.8
Surgical (all)	3.3	3.0
Surgical (inpatient)	3.4	3.1
Surgical (outpatient)	3.2	2.8
Medical (all)	3.1	2.8
Medical (inpatient)	3.0	2.7
Medical (outpatient)	3.5	3.3

Table 6. Allocation of arriving Ahus patients in 2016. Numbers in hours.

Looking closer at the numbers in the two tables above, there are slight differences in length of stay for the two patient groups. At a first glance, it is quite obvious that average EDLOS for Ahus patients are higher than for the DHS patients. The overall average of 3.0 (DHS) and 3.1 hours (Ahus) are not so different, there are only minutes in which makes up the difference. However, when looking at the different groups in a more broken down manner, the patient group who faces the absolute longest length of stay is medical outpatients from Ahus. The reasons for this is not given, but when having some insight to the EDs operational structures, it can be assumed that possible reasons are the following:
Patients ending up receiving outpatient care are often triaged at lower levels, meaning that their conditions are not too severe. Hence, they are of low priority and must wait longer to be consulted.

Medical DHS outpatients had a total ED length of stay of 2.7 hours in 2016. This is the shortest length of stay for all patients group indicated in the two tables above. The same Ahus

patient group, medical Ahus outpatients, however, had the absolute longest length of stay of 3.5 hours. The most natural explanation for this difference in length of stay is that the process of organizing outpatient care for Ahus patients is more complicated than for DHS patients. Ahus patients will receive outpatient care at Ahus, not DHS, which means that the two institutions must communicate in order to plan further care, while for DHS patients all that has to be done is to set up an appointment. An important factor to take into account is the differences in the size of the two patient groups; there are more DHS patients than Ahus patients, which may also affect the outcome.

7.3 Emergency department length of stay distributed on time of arrival

Time of arrival	Overall average LOS	Average LOS Ahus	Average LOS DHS	Overall median LOS	Median LOS Ahus	Median LOS DHS
08.00 – 11.59	3.1 hours	3.1 hours	3.1 hours	2.8 hours	2.9 hours	2.7 hours
12.00 – 15.59	3.3 hours	3.4 hours	3.2 hours	3.0 hours	3.1 hours	3.0 hours
16.00 – 19.59	3.0 hours	3.2 hours	3.0 hours	2.8 hours	3.0 hours	2.8 hours
20.00 – 07.59	2.6 hours	2.7 hours	2.5 hours	2.3 hours	2.3 hours	2.3 hours

Table 7. Emergency department length of stay distributed on time of arrival.

Emergency departments are complex operating systems. The demand of ED services tends to be stochastic and levels of interdependency are high. Neither arrivals or discharges happens in a linear fashion (Falvo et al., 2007, Bagust, 1999). However, reasonable estimates of demand of services as well as case mix can be calculated based on former data (Falvo et al., 2007). Norwegian ED´s are in most cases run by interns, with assistant doctors and doctors on call, however, during the night shift the interns are often on their own. This may cause a delay in waiting times, but seems to be evened out with less patients coming in at this time of day (Myhre, 2008). By reading the above chart, one can see that patients arriving in the ED between 8 pm and 7.59 am on average waits a shorter amount of time compared to patient arriving any other time of day. The average waiting time does not impose a big difference for patients coming in any other time of day.

8 Regression analysis of emergency department length of stay

So far this thesis has explored the topic in a very descriptive way. I, as the researcher, found it important to thoroughly explore the topic in-depth to gain insight in how the ED operates itself, and in cooperation with the rest of the hospital. Generally, descriptive studies try to explain a concept without giving any explanations, while analytical studies try to detect any causal relationships (Stoltenberg, 2014).

Any numbers in this thesis describing patient distribution is retrieved from DHS´ archival databases. Using archival records have multiple strengths – it is usually very precise and quantitative, it is discrete as it is not created as a result of the given study, information is usually broad and covers long time spans, many events, and many settings. One main limitation, in which this thesis also fell under, is the limited accessibility of data due to privacy reasons (Sloan and Hsieh, 2012).

Despite the fact that this thesis is lacking data, I will in this chapter try to implement a more analytic level of research by explaining the process of making and solving a linear regression.

8.1 Quantitative method

"A quantitative research method emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon" (Babbie, 2010).

In addition to gathering as much information about the patient as possible, the ED is also responsible for registering the patients time of arrival in the ED. This is for the ED to have an overview over how much time the individual patient has to wait for consultation by a physician. Also, it allows the staff to track how long it takes from consultation until transferal as well. Long waiting times may increase the risk of patients getting worse, it may cause confusion in some cases, or patients do not receive sufficient amounts of painkillers. However, it is important to note that the waiting time itself does not represent an indication of

what is sound treatment of patients. The most important is that the patients are thoroughly and sufficiently taken care of while waiting (The Norwegian Board of Health Supervision, 2008).

Study Design. Multiple regression analysis. The main purpose of the study is to detect whether or not there is a causal relationship between length of stay in the emergency department and if the patient is admitted to their home hospital or another hospital.

Study Setting and Participants. The study would include patients from the two patient groups (Ahus/DHS) admitted to the emergency department at DHS for acute care. Patient samples from the two patient groups would be drawn, using the DHS patients as a baseline to compare length of stay for the Ahus patients. One criteria for the first regression in order for DHS patients to be included is that they have been admitted before, so that there is an existing medical record accessible in the computer system. For the second equation this is not necessary, in order to detect if there is any difference in length of stay for patients from the two different patient groups regardless of presence of medical records for either group.

Databases Used. Data primarily from the DHS databases.

8.2 Emergency department length of stay

Regression 1:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon_i$$

Y: Length of stay in Emergency Department (EDLOS)
β_0: intercept
X_1: age
X_2: gender
X_3: area of origin (Ahus/DHS)
X_4: illness
X_5: ethnicity
ε_i: error term (assumed to be 0)

In this regression, the variable for area of origin also indicates whether or not there is an existing medical record for each patient.

Regression 2:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon_i$$

Y: Length of stay in Emergency Department (EDLOS)

β_0: intercept

X_1: age

X_2: gender

X_3: area of origin (Ahus/DHS)

X_4: illness

X_5: ethnicity

X_6: presence of a medical record in the DHS data system

ε_i: error term (assumed to be 0)

In this second regression, we want to investigate whether patients from DHS without an existing medical record have different length of stay than Ahus patients with no medical record. A limitation for this regression is that there might not be easy to draw a sample large enough to state the level of significance, as fewer DHS patients lack access to medical information compared to the Ahus group. Hence, the regression line would be adjusted to make the two groups as comparable as possible.

Outcome (dependent) Variables. Total ED length of stay would the main outcome variable of interest. An individual patient´s ED length of stay is measured from the time of arrival in the ED until the patient is transferred to the ward, or discharged.
Independent variables are age, gender, ethnicity of patients, type of disease/injury, and the area of origin, her denoted as Ahus or DHS.

DHS patients´ length of stay are the baseline in which Ahus patients´ length of stay are compared to. The purpose of running a multiple regression is to detect any correlation between the dependent variables and the coefficients. It is important to remember that correlation does not necessarily mean that there is a causal relationship.

In the above two regressions there are several dummy variables. Dummy variables, in this case, takes on two values: 0 or 1. In other settings, dummy variables can take on multiple levels. Both sex, area of origin and presence of medical records are dummy variables used to indicate the presence or absence of the variable (Newbold et al., 2013).

Assuming that the coefficient for presence of medical records takes the value (using regression 2 as an example):

0 Not present

1 Present

Applying this to the equation when medical records are not present, it becomes:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6(0) + \varepsilon$$

When a medical record is present, the following will happen:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6(1) + \varepsilon$$

Data Analysis. The regression is run in the program Stata.
In order to run a regression in Stata, all data must be gathered in a .dta file. Data can be exported from an excel file. Stat is run by running different commands together with the regression. Stata then provides an output describing the relationships between the independent variables and the dependent variable.
The first thing to consider is the constant, in which gives the intercept for the regression line. Hence, it is the value the dependent variable will have if all other variables are equal to zero.

When looking at the values given for the independent variables, there are multiple things to consider. First it is how big the coefficients are, meaning that if the variable increases by 1, how much does the dependent variable increase or decrease. The other thing is to look at the level of significance, to decide the statistical significance of the estimated coefficient. The level of significance is given by the p-value in the Stata output. Each variable has their own p-value. Depending on the confidence level given, the value of the p-value tells if it is significant or not. At 95% confidence level, which is a golden standard often used in

regression, $p < 0.05$ is significant. If the p-value shows up as $p < 0.000$ in the Stata output, it means that the coefficient is significant at the 99.99% level (MIT).

As discussed earlier, the demographics of the two districts are somewhat different. The challenge with that is to find a large sample from both groups with comparable characteristics. The Ahus cohort have a higher number of inhabitants with immigrant background compared to the DHS cohort, and the burden of disease is a little different.

8.3 Emergency department length of stay on total length of stay

Liew et al. (2003) conducted a study on whether there is a correlation between length of stay in the ED and total length of stay in the hospital. They concluded that patients who stayed in the ED for less than four hours had an average total length of stay of 0.39 days, while those patients who stayed in the ED for more than 12 hours had a total length of stay averaging 2.35 days.

Regression 3:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k$$

Y: Total length of inpatient stay (TOTLOS)

X_1: EDLOS

X_2: age

X_3: sex

X_4: illness/injury

8.4 Results

The first two regressions are run to investigate which factors plays a part in how long a patient stays in the emergency department before transferred to the ward or discharged. One of the most interesting independent variables to look at is whether or not having access to a patient´s medical records has an impact on a patient´s length of stay in the emergency department.

The third regression is made to detect any possible correlation between length of stay in the emergency department and total length of inpatient stay. That means that patients discharged directly from the ED or patients who are referred to outpatient treatment are not eligible. This regression does not differentiate between patients from the two patient groups.

If length of stay in the ED has an impact of total length of stay, as well as Ahus patients having longer length of stay in the ED compared to DHS patients, conclusions might be drawn that being admitted to a hospital outside one's catchment area does have an impact on ED length of stay, depending on the level of significance in the results.

9 Discussion and Conclusion

Despite the lack of data, this thesis is able to detect consequences for both patients and the treating hospital if patients are admitted to the ED outside their own catchment area. However, no conclusions can be drawn on any causal relationship between affiliation to a hospital and length of stay in the emergency department. Not having a strong conclusion is the main limitation of this thesis.

When conducting descriptive research one must be sure to keep an objective angle on the topic, as it is a pitfall to become subjective in the process. The researcher can influence the outcome of the study more so than when conducting analytical research. The researcher has in this case tried to look into the topic from different perspectives, as it is in the best interest to remain neutral.

Strengths of this thesis is the thorough descriptive structure. It clearly explains the important aspects in understanding how the health care system works, and how patients and hospitals are affected when the receiving hospital is located in another catchment area than the patient is resident in. Another strength is that in a descriptive approach, data remains data, while in a regression analysis the transformation of data into numbers may result in loss of information about the data.

A hospital is a very complex structure – both economically and operatively. It must, at all times, be prepared for the unknown, as the environment is very fluctuating and unpredictable. A good health care service is knowledge-based, meaning that sufficient information must be available in order for physicians to give optimal treatment.

One cannot evaluate the ED without looking at the whole hospital symbiosis and how it operates. The ED itself are not guilty of long waiting times alone. The hospital as one must function and cooperate at an optimum level in order for the ED to be efficient. Hospital beds in the ward must be ready for the incoming patients at the time they are ready to be transferred from the ED in order to avoid boarding and unnecessary waiting times.

In order to maintain a sufficient level of patient safety in the ED, all staff in the ED must have the same perception of how tasks are fulfilled. Their roles should be clear, however, they

should also have a good understanding of and knowledge about the tasks fulfilled by other colleagues. All nurses doing triage should have the same fundamental understanding of the system, and how to correctly triage patients. All staff should have the same interpretation of level of severity and interpretation of test results, in order to give all patients necessary treatment within appropriate time limits.

How hospitals are financed can, to a certain degree, induce incentives to higher reimbursements than necessary. It is possible at all stages in a hospital stay to "trick" the system and earn more money on one patient. If the time the patient spends in the ED exceeds a threshold of five hours, more money will be reimbursed. Trust is important in the hospital setting. Humans can make mistakes and humans can have wrong intentions. One must trust that health personnel are there first and foremost for the human aspect of the medical sector, and not the money.

The issue with not having access to all patients´ medical records keeps imposing a threat to patient safety until a common data system where all medical records can be retrieved across the borders of the different hospitals. The first step is taken by implementing core records which can be retrieved online, however, these records are not necessarily complete to the extent in which it fulfills all information needed for safe and efficient diagnosis and treatment in the ED. The core records are yet not functioning at its optimal level, one reason being that it is unclear what information should be deemed necessary to include in such record, and also who are responsible for entering the information into the record.
The way medical records are transferred from one hospital to another today is both time consuming and imposing a threat to patient safety. However, it is interesting that the argument for doing it this way is exactly that – patient safety.

By looking at raw data from DHS, there are evidence that patients from Ahus spend somewhat longer time in the ED compared to DHS patients. However, these numbers are general and not comparable between the two groups on an individual level, as enough data to compare at such level was not retrieved. Therefor it cannot be concluded what causes these patients to stay slightly longer. However, one possible reason is different burden of disease, which would make these two groups difficult to compare anyway. The different burden of disease may be caused by the fact that these two patient groups are from two separate areas known to have a class distinction between them. In addition, people living in Alna, Grorud

and Stovner have a significant higher number of immigrants, which may impact the burden of disease. Another issue with one group having more immigrants is the issue of communication. Some patients may not speak Norwegian at all, or at poor levels, which imposes difficulty of communication.

The conclusion is that not having access to a patient's medical record dose impose a threat to patient safety, however, the way the records are transferred may impose an even higher risk to patient safety – something I learned when doing research. When patients in need of immediate care are rushed into the ED, there are no time to look at the records anyway. The health records will then come into play at a later stage, when the situation is less urgent. Hence, for patients triaged at lower levels, and in less hurry of diagnosis and treatment, updated health records should be readily available.

9.2 Recommendations for further research

An idea that came up was to investigate whether Diakonhjemmet patients faced longer waiting times after Ahus patients were also admitted to the ED, compared to before when there were less patients. However, this was not applicable because the ED were actually remodeled and expanded in order to have capacity enough to receive more patients, which makes the basis for comparison weak.

First step is to actually run the regressions explained in this thesis to detect any correlations and causal relationships between the variables in order to draw a conclusion.

Secondly, referring back to chapter 7.2 which indicated that medical outpatients for the two groups faced quite different length of stay, there is an idea to look further into this. Is it solely due to lack of medical records and communication with another institution that causes the delay for Ahus patients, are other factors also playing a part?

9.3 Personal reflections

When starting doing research for this project, I was probably very unilateral in my point of view on the topic. I knew a lot about being a user of the ED, while I knew little about the actual operating of an ED. I learned in the process that having access to medical records then and there is not the most crucial aspect when a patient arrives in the ED; it is the structure and timeliness that first and foremost secures patient safety. However, that does not mean that my opinion has changed about the importance of implementing e-health and a common computer system where medical records can be shared between institutions. Having access to the medical history for all patients is important to assure the best possible treatment.

Again, being a dependent, I know that chronically ill patients can be demanding patients in ways that chances are they know their own diagnose better than any doctor, and they might come off as a little "Mr. know-it-all". If at ambulatory state at time of arrival, they are likely to be able to discuss treatment with the doctor. However, as these patients may be demanding, they may also be a good resource. The time they have spent observing the hospital environment and the efficiency of the infrastructure can be of great worth. They should be utilized in quality assurances and development.

10 Bibliography

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11 Appendix

Monthly distribution of incoming patients from the two patient groups at the DHS ED years 2014 to 2017. The tables below are an extension of the tables on page 35.

Patient group	**Year**	**Month**											
Ahus	2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		46	96	119	132	158	144	208	255	259	212	223	213

Patient group	**Year**	**Month**											
Ahus	2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		235	226	236	199	232	272	243	273	265	283	265	249

Patient group	**Year**	**Month**											
Ahus	2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		255	232	266	267	251	262	185	259	235	274	255	285

Patient group	**Year**	**Month**	
Ahus	2017	Jan	Feb
		272	212

Patient group	**Year**	**Month**											
DHS	2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		750	697	757	734	713	748	680	735	766	865	718	831

Patient group	**Year**	**Month**											
DHS	2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		871	736	816	800	782	812	717	801	764	823	876	864

Patient group	**Year**	**Month**											
DHS	2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		879	856	797	836	865	814	774	781	813	818	865	940

Patient group	**Year**	**Month**	
DHS	2017	Jan	Feb
		956	878