DEGREE PROJECT IN MEDICINE

Evaluation of Medical Scribes' effect on the Emergency Department's productivity

A prospective, before-after cohort study

Muje El Noaimi

Gothenburg, Sweden 2019

UNIVERSITY OF GOTHENBURG

THE SAHLGRENSKA ACADEMY

Evaluation of Medical Scribes' effect on the Emergency Department's productivity

A prospective, before-after cohort study

Degree Project in Medicine

Muje El Noaimi

Programme in Medicine

Acknowledgment

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

LIST OF ABBREVIATIONS

ED   Emergency department

EDLOS   Emergency department length of stay

EHR   Electronical health record

EMR   Electronical medical record

ER   Emergency room

HIS   Health information systems

ID   Identity document

Q1   Question One

SD   Standard Deviation

ABSTRACT

Degree project in Medicine – Programme in Medicine	
University of Gothenburg – The Sahlgrenska Academy – Gothenburg, Sweden 2019	
Author:	Muje El Noaimi
Title	Evaluation of Medical Scribes' effect on the Emergency Department's productivity - *A prospective, before-after cohort study*

Abstract

Introduction
Emergency department length of stay or patient waiting time, is increasing in the emergency departments of Sweden. A contributing factor for the increasing patient waiting time is the administrative workload on the physicians, including electronic charting and order entries.

  A solution for more efficient documentation and administration is the hiring of medical scribes. The primary object of a medical scribe is to reduce the physician's administrative workload and increase productivity. However, specific data investigating scribes' benefits to physicians' productivity are limited.

Aim
The aim of this study is to evaluate whether the productivity of physicians increases at the emergency department of Kungälv hospital following the introduction of medical scribes. The research question answered is: Has the number of assessed patients per hour per physician increased with a scribe compared to without a scribe?

Methods & Data collection
A prospective, before-after cohort study was conducted during 39 days in a community-based emergency department. Data was collected from scribed and non-scribed shifts worked by physicians during two different summer periods. We measured the physicians' productivity by assessed patients per hour per physician. Statistical significance was assessed by Independent Samples t-test.

Results
We documented a total of 576 (72 shifts) physician-hours, with and without a scribe.
The shifts with a scribe was associated with a significantly greater number of assessed patients per hour per physician, with an increase of 28%, from 0.56 to 0.84 ($p < .001$).

Conclusion
To our knowledge, this is the first conducted study of medical scribes in a Swedish emergency department. We conclude that scribes do increase physicians' productivity by increasing number of assessed patients per hour per physician. Thus, scribes may offer a solution to increased productivity and decreased burden of documentation. However, further research and larger studies need to be conducted.

Keywords:	Medical scribe - emergency department –administration – productivity - overcrowding
Finalized:	July 4, 2019

1. Introduction

Emergency department length of stay (EDLOS), an indicator measuring the time spent at the emergency department (ED) from a patient's arrival to departure,[1] is increasing in Sweden.[2] Contributing factors to prolonged emergency department length of stay, or increased patient waiting time, have been found to be lack of competence among the physicians and overcrowded hospital departments.[3] Excessive number of patients waiting to be seen at the ED leads to overcrowding, which is a concerning global problem.[4] In Sweden, prolonged patient waiting time and overcrowding has become a reason behind unsafe environment.[5]

Another contributing factor to prolonged EDLOS is a throughput factor such as patient administrative work, including electronic charting and order entries.[6] A Swedish physician spends around 37% of his/her worktime on patient related administrative work, and 40 % on actual patient-to-physician work in comparison with an English physician who spends 15% and 66% respectively of his/her time (Figure 1).[7]
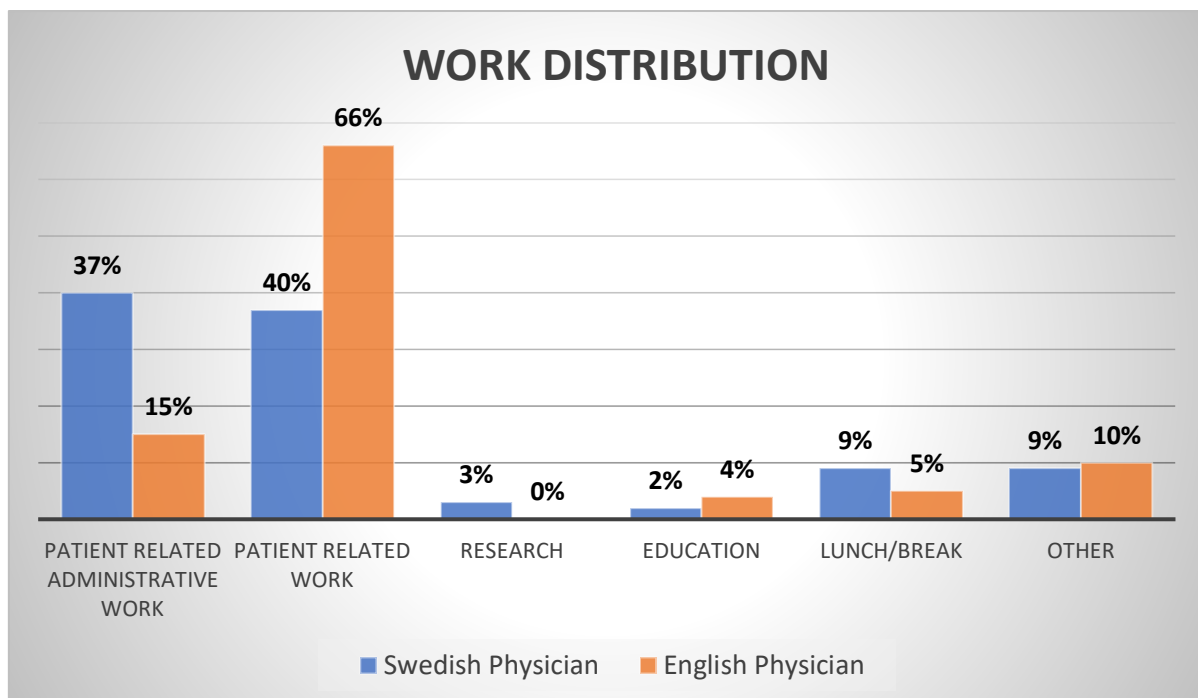
Figure 1: Comparison of work distribution between a Swedish and an English physician. *Data retrieved from Edvardsson, J. et al (7). Designed and translated by Muje El Noaimi.*

.

In the past five years, the percentage of administrative work for a Swedish physician has increased from 31 % to 37 % (Figure 2).[8]

Several healthcare workers have expressed the difficulty of cleric work comparing to earlier years.[9] From 2010 to year 2017, the amount of hired administrative personnel increased with 36 %, compared to hired physicians which increased with 16 %.[9] The physicians are also dissatisfied with the administrative work load.[7]
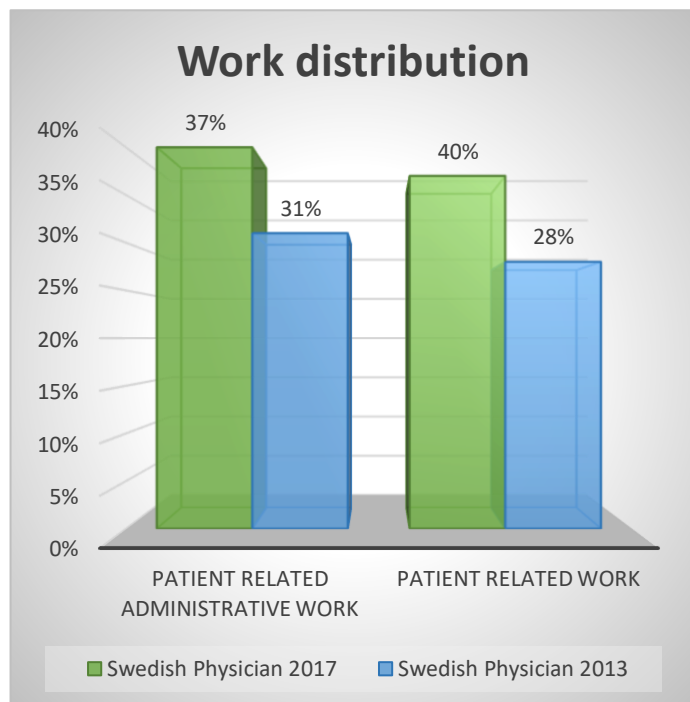
Work distribution

Figure 2: Work distribution for Swedish physicians during 2013 and 2017.
Data retrieved from Edvardsson, J. el (7) at. and Antti, N. et al (8). Redesigned and created by Muje El Noaimi

They express the ''fear of missing out'' important information when reading in these massive and hard-navigated patient journals.[7] The consequence of increased burden of administrative work may lead to decreased time for education and research among physicians.[7] Less education leads to insufficient knowledge.

A solution for more efficient documentation is the supporting suggestion of hiring medical scribes.[10] A medical scribe works with the clerical aspects of the patient care.[11] Their role is assisting the physician with documenting patient's history and physical exam.[12] The primary object of a medical scribe is to reduce the physician's administrative work load.[13]

The data published with the specific aim to examine the medical scribes' benefits to physicians' productivity are limited. With the earlier studies and data presented, this project thus seeks to fill the gap through conduction of a clinical study at the emergency department

4

of Kungälv hospital. With the implementation of scribes at the emergency department, the aim of this study is to increase physicians' productivity.

By improving our understanding of the burden of documentation required by electronic health records, medical scribes may offer increase in number of patients assessed per hour, which also may prevent overcrowding.[14]

1.1 History of Scribes

The profession of Scribe dates back to the ancient times of Egypt and Mesopotamia.[15] In Mesopotamia, the scribes were known as the ''dubsars''. [15] They were trained and worked in administration and accounting.[15] In Egypt, the scribes or ''sesh'', were taught the arts of writing and arithmetic.[15] The idea of medical records was born when the scribes started to translate Egyptian hieroglyphic inscriptions and papyri from 1,600-3,000 BC.[16] However, the implementation and regular usage of paper medical records did not start until the beginning of the 1900s.[16]

After many centuries of modifying writing symbols from ideographs to phonetic scripts, the popularity of scribes has today risen to a high level and they have been incorporated in the medical field.[17] With the current education, they are able to transcribe oral medical data and possesses the basic knowledge of medical terminology.[17] The Joint Commission currently define them as ''*A documentation assistant or scribe may be an unlicensed, certified, (MA, ophthalmic tech) or licensed person (RN, LPN, PA) who provides documentation assistance to a physician or other licensed independent practitioner (such as a nursing practitioner) consistent with the roles and responsibilities defined in the job description, and within the scope of his or her certification or licensure.*''[18]

Medical scribes are strategically used to decrease clerical burden by assisting the physicians in charting.[12] They accompany the physicians into patients' waiting rooms and support the physicians' workflow with entering all data and consultation in electronical health records

(EHR) enabling physicians to spend more time on the clinical aspect and bedside patient care.[19]

They can be employed by a healthcare organizations and work in hospitals, emergency departments and long-term care facilities or hired by licensed independent practitioners. With the latest technology and the computerized health care being an important factor in the field of medicine, the physicians with insufficient knowledge or help will greatly suffer with reduced productivity.[17]

The foundation of EHR started with the new computer technology in the 1960s and 70.[16] It made patients' medical records easier to read and available from anywhere in the world.[16] In 2004, the government of USA urged and ordered every hospital nationwide to implement electronic health records by the year of 2014.[17] The order increased the usage of health information systems (HIS) by hospitals.[17] HIS is an information system used to store patient information, schedule appointments, manage billing and track ED staff's schedule.[17]

However, the usage of HIS came at a cost, physician burnout.[20]

1.2   The burden of documentation

The introduction of EHR, a vital component of modern health care has its downside. It has become a leading cause of physician burnout.[20] Physicians are working longer hours because of digital recording with many having to complete their work at home during their time off.[20] More than half of a physician's time per shift is spent on cleric work.[21]

Several studies show that although EHR serve a promising role in the quality and safety of patient health care, it is time-consuming and disrupts in the patient encounter.[21][20] It also has a negative effect on colleagues where a physician describes it as *''we sit side-by-side doing data entry and interacting with our machines without interacting with each other.''*[20]

The direct patient face-to-face contact is also negatively affected, with 43% of the physician's time spent on cleric work, compared to 28% on the direct patient care.[21] The

burden of documentation is likely to lead to stress, job dissatisfaction and prevention of an ED physician from assessing another patient, ending up in contributing to overcrowding.[10] To have assistants help the physicians with the systems could lighten the electronic burden and make the physicians utilize their time more wisely, by treating more patients and provide better care.[17]

1.3 Overcrowding

The Australasian College for Emergency Medicine's definition of overcrowding is ''the situation in which ED function is impeded primarily because of the excessive number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure comparing to the physical or staffing capacity of the ED.''[4] It has been identified as a national crisis in some countries.[4] Crowding is a threat to the quality and safety of the patients with an association of increased mortality, increased numbers of patients left unseen and delayed treatment to the patients.[10]

The aetiology of crowding has three main components.[6] The input; such as the increased demand overwhelm the capacity, the throughput; the patients care processes and the output; having insufficient resources for the patient final destination after the ED.[10] One solution to increasing the throughput, which has gained popularity in America, is that of increasing documentation efficiency.[10]

1.4 Earlier studies and outcome

Research on medical scribes is limited. There are studies arguing the potential benefits of implementing scribes in health care settings, however, there are also studies opposing the action.

Implementing scribes in a community-based emergency department has shown decrease in the average patient visit by 3 minutes.[22] Medical scribes have demonstrated improvement in patient throughput and physicians' productivity, such as increased patients per hour.[23] Similar

result has also been presented from a university-based academic medical centre, treating 59.000 adult patients per year.[12] Although scribes have shown to improve patients per hour and relative value units per hour, no changes in turnaround time to discharge has been presented.[12]

From a multi-centre clinical setting, scribes have had a positive impact on physicians' productivity with a 16% gain outcome in patients seen per hour per physician.[24] They have also reduced the median length of stay for patients by 19 minutes.[24] In comparison, a pilot study, in a single-centred setting showed no significant increase in patient waiting time or door to discharge.[25] There is also no difference in scribes' impact on busy days of the week comparing to quiet ones.[25]

Implementations of medical scribes have not only shown promising results in measured values but also in satisfactory levels.[26] Scribes are considered valuable to work with.[26] They decrease the consultants' stress and reduce brain overload giving the physicians the opportunity to multitask.[30] However, the physicians have expressed the wish of having the same scribe every shift.[30] Opposed opinions has been expressed by independent physicians whom do not favour in having a medical scribe, due to the concern of losing touch over the documentation of a patient.[30] Physicians are also worried about the accuracy or timeliness of documentation when working with a scribe.[30] On the other hand, physicians without a scribe have been noticed to make quick notes and finish them later with less accuracy and quality.[27] Patients have also noticed the delay in documentation without a scribe.[27] Physicians have admitted that without scribes, they only make notes consisting of high points, brief phrases or partial sentences.[27]

Medical scribes offer physicians the ability of greater focus and connection with their patients.[28] Other physicians debate the opposite, expressing concerns about patients' privacy.[28] Some patients have expressed hesitations in presences of a scribe.[27] However, both

the patients and the physicians agree that the physicians should not document.[27] Patients see the computer, the physician's digital tool, as a competitor for the physician's attention.[27] Scribes help remove the computer a distraction creating a positive atmosphere in-between the patient and the physician during consultation.[27] Patients have also described how their relationship develop with a scribe personally.[27] Scribe serves them as a reminder in forgotten asked medical history.[27] Scribes also check diagnostic results frequently on behalf of a physician without being disruptive during the encounter.[27]

Benefits of scribes come at cost. Staff members argue that adding another team member alters workflow and increase chaos.[26] Scribes have also shown no impact in communicatory skills with other care team members.[28] Physicians have suggested to not have a scribe when working with a medical student to avoid overcrowded space.[28]

While EHR being a burden today, medical scribes decrease the amount of time spent with the EHR by a physician.[21] Scribes may be a strategy to decrease clerical documentation burden.[21] While scribes may decrease clinical documentation burden, they have shown no impact on decrease in preparation time, such as reviewing medical records or placing orders.[21] They also do not affect the time spent at patient bedside.[21]

The production value of a scribe is greatly dependent on the number of patients, how busy the ED rooms are and how complex the medical cases are.[29] Overall physicians feel more productive and enjoy the scribe's presence contributing to less stress, the ability of multitasking, see complex patients and being less fatigued.[30] Some physicians with slower workflow have a greater benefit and gain more from using scribes, while fast working physician may not benefit at all.[29]

1.5   Scribes as Medical students and their impact

Scribes become medical scribes when they are put in health care settings. Scribes can be premedical or medical university students, however, personnel with different background can also work as scribes.[31] Often, they are students working and studying towards an eventual career in medical sciences.[12]

The experience for students has been identified as valuable with a potential aid in acceptance into medical programs.[18] Medical students are highly satisfied with their learning experience as medical scribes.[32] Scribes enable physicians to dedicate more time to teaching and feedback and being in more related and attentive state.[32] Students also appreciated their role in a team.[32] Working as scribe served the medical students as an EHR resource which students often find difficult due to inadequate documentation training.[32]

Physicians' deficiency of time and space affect medical students by them being excluded from exam rooms and hospital wards.[13] The presences of scribes could increase teaching capacity, however, further research in both academic and community settings are needed.[13]

1.6   Kungälv Hospital

Kungälv Hospital is an emergency hospital located 20 km north of Gothenburg, Sweden. The hospital receives patients from 16 years old and above,[33] offering both emergency and specialist care.[34] Kungälv hospital forms a part of Sweden's network of health-promoting hospitals and care organizations with close relationships to primary care clinics.[3434]

The area of responsibility the hospital covers for has 129 440 inhabitants.[35] There are 1640 employees, with 32% being registered nurses, 26% assistant nurses and 16% physicians.[36] With 214 beds, the hospital receives around 10 893 admissions in somatic close care and 995 admissions in psychiatric care.[3535] 133 180 visits in the outpatient care (somatic, & psychiatric clinic, emergency department and child and adolescent psychiatric clinic).[3535]

While their goals are to achieve the highest possible quality in delivering care and medical treatment,[36] the increased waiting time for patients in the emergency department has been a continues battle.[37]

Based on data from the United States, Canada and Australia, we tested the hypothesis that medical scribe usage in the emergency department could increase physician's productivity. In this study, we assessed the effect of introducing medical scribes in Kungälv's emergency department. The focus of this study lies in the difference in physicians' productivity between scribed and non-scribed shifts.

2. AIM

The aim of this study is to evaluate whether the productivity of physicians increases at the emergency department of Kungälv hospital following the introduction of medical scribes. The research question answered is: Has the number of assessed patients per hour per physician increased with a scribe compared to without a scribe?

3. METHOD

3.1 Study design

This was a prospective before-and-after cohort, single centred, non-randomized study.

3.2 Study setting and population

This study was carried out from June 2018 to August 2018 in the ED of Kungälv Hospital, an academic and emergency hospital, treating approximately 31.000 patients annually, where 10.000 being further admitted.

All patients visiting the emergency department during the period of scribes' presence, requiring healthcare, were eligible. Patients were excluded from the study if they denied the presence of a scribe or if the physician denied the scribe's presence, e.g. sensitive consultation. Neither a patient nor any physician denied a scribe during any consultation. All

physicians presented the scribes in the beginning of a consultation as assistant colleagues who documents, due to the lack of Swedish translation and understanding of the title ''Scribe''. One scribe was allocated for one physician after routine schedule. A scribe could interchange between physicians if a physician was appointed to do other tasks outside the ED.

Physicians allocated their name to a patient by using our electronical medical record system ELVIS. The scribe was expected to attend all consultations with the physician, regardless the complexity of the case.

We compared the productivity of a physicians' scribed shifts during the summer 2018 with summer of 2017, which was non-scribed shifts. Database used for further research and preparation was PubMed.

3.3 Selection of participants

3.3.1 Physicians

In this study, emergency physicians were physicians working at the emergency department regardless of specialty. The physicians who participated were selected by the clinical supervisor of the emergency department. Those who provided the clinical supervisor with a verbal consent had a scribe allocated behind them during their routine shifts. Participation was voluntary. All the physicians except one agreed to participate in the study. Most of the physicians were residents in either internal medicine or emergency medicine (Table 1).

Table 1 - Table of participated physicians and their career levels.

Physicians	Career level
Physician One	Senior Consultant
Physician Two	End of residency, Internal Medicine
Physician Three	2,5 years of residency, Internal Medicine
Physician Four	2nd year of residency, Internal Medicine
Physician Five, Six and Seven	1st year of residency, Emergency Medicine
Physician Eight	Intern

The physicians were offered one day of training with the new scribe following them that week/s. For the reason of chemistry and routine purposes, every time a physician received a new scribe, one day of training was provided which was subsequently excluded from the study. The study physicians continued their daily work in accordance to their routine at the Emergency department.

As in other hospitals, this hospital uses senior physicians and residents for medical triage during or after the nursing triage.[23] They recognize potential medical emergencies, diagnose, investigate and treat the patient before they are seen by another physician. The triage physician can also discharge patients with no further need of emergency medical help. Other physician met the patients after they were triaged and located in a treatment room.[23] Triage consultations were included.

Medical records for physicians were both electronic and paper systems. Paper systems for triage and electronical for documentation of later consultation, further evaluation and investigation.

When the scribes were not present, the physicians usually document manually at bedside, during triage or consultation and later dictate with a Dictaphone or type in the information in the EMR system at desktop computer.[23]

3.3.2 Scribes

The scribes were medical students under clinical rotation in their 6-8th semesters of their medical studies. They were handpicked from a student emergency medicine group. Participation was voluntarily. They were salaried employees who were paid per month and entitled physician's assistants/scribes.

Training was delivered a week before the study. All the students were familiar with the electronic medical records and systems due to same system used during their medical education. They received one day of administrative training with the medical secretaries for questions and further familiarization of the systems.

The total number of scribes were five, all employed at once and rotated between physicians according to their work schedule.

The scribes performed all medical documentation for each patient they attended with the physicians. If demanded by the physician, they ordered investigations, wrote the medical chart and completed an EMR for further admission. The physician reviewed, edited and signed the charts.

If a scribe were reported sick, that day was excluded from the study. The scribes could work three possible shifts: 8-16:30, 9:30-18:00 or 13-21:00. If the physician needed to work overtime, the scribe followed and documented the extra time in a sheet (Appendix, Sheet 1). The hours were included in the study. The scribes followed and documented all patient consultation; triage, immediate assessment – trauma and regular consultations in the patient waiting room in the ED.

Weekends, public holidays and night shifts were excluded. If the appointed physician was sick, the scribe followed another colleague with the similar level of experience and was included in the study. When the physician had administration time during the shift, the scribes helped other physician document or assist the nurses. These hours were included, even though no patients seen. (Table 2).

The ED is divided in four major treatment teams; Medical, Surgical, Orthopaedic and Psychiatric teams. Medical scribes followed and worked under the medical teams. However, emergency medicine residents and senior consultants could assess patients regardless of cause and assigned treatment teams.

Table 2 - Description of other tasks done by Scribes when not recording or documenting in electronic health records.

Other tasks done by scribes

- Assist in taking blood samples
- Assist with suturing
- Translate between patient and physician
- Assist during lumbar puncture
- Assist nurses during patient treatment
- Assist with agitated patients
- Assist the physicians during emergency situations such as stroke and cardiac arrest

3.4 Intervention

Scribes followed their physicians during their whole shifts. The scribes used a mobile laptop computer on wheels or carried them around into the exam room where tables were set for support. They were in the room during the whole consultation while the physician assessed the patient. All the documentation made by the scribe were reviewed by the physician, edited if needed and finally signed-off.

3.5 Measurements

Physicians productivity was compared between scribed shifts and non-scribed shifts. We measured the physicians' productivity by assessed patients per hour per physician.

Total patients from the study period of 2018 (data set one) and from the comparing period of 2017 (data set two) were registered in table sheets first. The exact same weekdays from 2018 was compared with 2017. Days where scribes were sick or did not work were excluded from 2018. The parallel days in 2017 were also excluded. Curb side consultations were also excluded from data set one. Data set two did not have any.

  The total hours of one shift was defined as eight hours, retrieving it from an average of the three usually worked shifts. One shift was worked by one physician. If a scribe happened to work with two physicians during one shift, it was included as one physician. Data from the same physician working both summer periods were excluded from 2017.

   Patients registered before a started shift or after an ended shift were not included. For total patient number, we counted all registered patients between June 26th to August 24th of 2018.

  All patients were given an identity number which was nor correlated to their Social Security number neither to their reason for visit. All patients who were registered and assessed at the EHR and were signed-off by a physician, were included in the study regardless to their reason for visit.

  Measurement of patients per hour per physician was reached by calculating total patients during the study day, divided by (total shifts multiplied by eight hours), (Table 3).

Table 3 - Example of calculated measurements.

Calculations	**Day 1:** 9 patients assessed during 3 shifts (3 physicians). Average shift hours = 8.
	Patients/shift => 9/3 = 3 patients/shift **Patients/h/physician** => 9 / (3 x 8h) => 0.4

3.6 Data collection

3.6.1 Data collection during 2018

To determine the impact of the intervention on physicians' productivity, scribes collected the data for 2018 manually by logging on paper sheets (Appendix, Sheet 1). The scribes followed the appointed physician during their routine shift and documented every patient encounter on the sheet. The included patient encounters could be: triage assessment, trauma or high prioritized patients, normal patient encounter in treatment room, if the appointed physician was overhanded an unfinished patient from an earlier shift or if the appointed physician started the investigation and had to overhand the patient to next coming physician. The scribe documented during the hours of the shift. If the physician had to work overtime, the scribe continued to document patient encounters and change the workhours to the correct end time. By the end of a shift, we had the total number of patients per shift during a mean of 8 hours per shift.

The reasoning behind the manual approach in 2018 was to avoid entering patient journals in these massive data systems to track the number of patients' scribes documented on. This approach could not have been done digitally due to fact that the last person signing the patients' records is the responsible physician. It would be very difficult and time-consuming to find out which patients scribes assessed clerically.

3.6.2   Data collection during 2017

We collected 2017 year's data digitally from the EHR system (ELVIS). The reason behind was that scribes were not implemented at that time due to the fact that the idea was born before summer of 2018. We collected the data from 2017 for the same number of workdays of 2018. Having in mind that date differ between the years, we approached it by looking at same weekdays from each year. The included workdays were from week 26 to week 34. Going day by day, comparing 2017 with 2018, we could collect the total number of patients signed-off by the working physicians each day. To have a fair comparison with the data of 2017, we extracted data from the same worked shifts and hours as 2018. The shifts are usually the same during the summers. If a shift that was worked during 2018 differed from a shift of 2017, we extracted the shift with the closest working hours of that particular day (Figure 3).
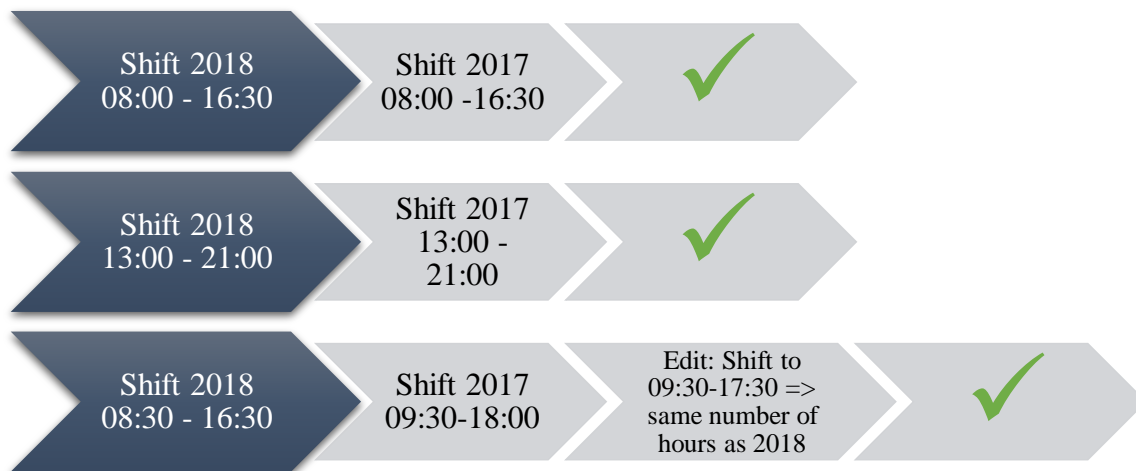
Figure 3 - Explanation of the comparison between shifts. Shift of 2018 compared to shift of 2017. Also, explanation of how we approached shifts with different start time.

The number of patients assessed is dependent on the competence level and workflow of the physician. We extracted data of 2017 from physicians that were either on the same or near the same level of competence as 2018. Competence was measured by looking at which stages the physicians were at during their career. This was difficult to manage due to the fact that 2018

was the first year Kungälv Hospital implemented residents in Emergency medicine. Closest comparison we could find was residents in Internal medicine.

Our EHR system, Elvis, does not register which patients were overhanded to or from a physician. Triage consultation by a physician during 2017 was also not registered. The physicians working in the emergency department during 2017 were either senior consultants, residents in internal medicine, interns or junior physicians.

3.7 Statistical data and analysis

Data from 2018 was already recorded manually by scribes. Records from the hospital were used to extract data from 2017. Total number of scribed and non-scribed patients and shifts were tabulated into Microsoft Excel worksheet. Patients per hour per physician were calculated in Excel according to above explanation (see Measurements). The means for the variables were calculated for each day of 39 days. For Statistical analysis and significance, we used IBM SPSS Statistics Version 24. Significance was set at $p < 0.05$. To analyse the data Independent- sample t tests were used to compare the mean values for both data set. To test our significance levels, we did a Levene's Test for Equality of Variances.

To conduct a parametric test, the data must be normally distributed for each group. We tested the data sets and distribution with Q-Q plots, Outliers and Histograms.

3.8 Ethics

Permission to conduct this study was granted by the operations manager of the emergency department. Due to no involvement of patients' personal information or medical records no other agreements needed for ethical purpose. All scribes and physicians gave consent before participation in the study.

4. RESULTS

We documented a total of 576 (72 shifts) physician-hours with and without a scribe.

Data analysis was conducted on each shift and hour of the 39 days from each year. A total

number of 464 patients for 2018 and 327 patients for 2017 were documented. The use of a

scribe was associated with a significantly greater number of patients assessed per hour per

physician, which increased by 28%, from 0.56 to 0.84 ($p < .001$) (table 4). Our visual

interpretation of the data from Q-Q plots, Outliers test and Histogram (see figure 4) showed

normal distribution on an acceptable level, which motivates for a parametric test.

Table 4 - Summary of productivity and data.

Descriptive Statistics					
	Group	**Mean**	**SD**	**Minimum**	**Maximum**
Patient/h/physician	Scribed	0.84	0.23	0.4	1.4
	Non-Scribed	0.55	0.16	0.1	1.0

Table 5 - Statistical analysis assessed with independent sample t-test.

t-test Analysis				
	Non-scribed	**Scribed**	**Absolute Differences**	*P* **Value**
Total Patients	327	464	-	-
Total Shifts	72 (576 h)	72 (576 h)		-
Mean patients/h/physician	0.55	0.84	0.29 increase	<0,001
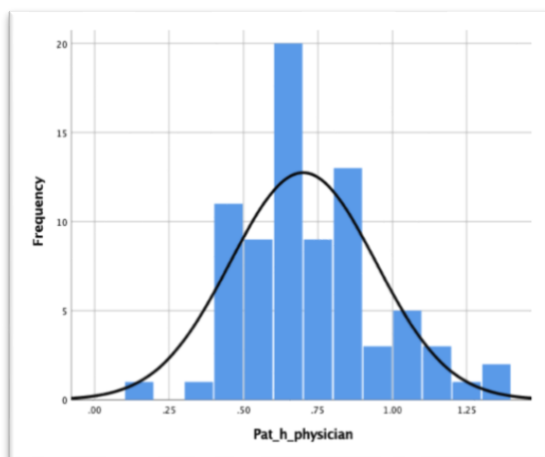
Figure 4 - Histogram showing normal distribution of current data.

5. DISCUSSION

5.1 The study

In this prospective, before-after, cohort study, we investigated whether the productivity of physicians increases following introduction of medical scribes at the department of emergency at Kungälv Hospital. The study shows that medical scribes are associated with a positive impact on physicians' productivity, with increase in patients/hour/physician. The result is also statistically significant. This supports the idea of hiring medical scribes as one solution to overcrowding at the department of emergency. Moreover, the findings in our study are in line with observations made in other studies such as, Shuaib, W et al.,[23] which concludes that ED physician's use of a medical scribe correlates with improved productivity as measured by patient per hour. Other studies that resonates with our findings are those presented in Cabilan CJ et al.,[10] were an increase of six patients per shift (12 hours) was found with the utilization of scribes.

One of the factors to prevent overcrowding is increasing patient throughput.[6] An outcome related to the throughput system is patients per hour.[10] With our results and the implementation of scribes, this may be a future solution for increasing the throughput and minimizing the risk of overcrowding. The association of increased patient throughput and implementation of medical scribes has also been described in Shuaib, W et al.[23]

Understanding that the gains of a working with scribe is greatly dependent on the number of patients and the complexity of the medical cases, we disagree that slow working physicians will benefit the most. We believe that physicians working with scribes at triage, acute/trauma rooms and fast-track areas may benefit greater than physicians working with scribes were deeper and time-consuming investigations is needed before final assessment is made. Supporting our theory, the Australian emergency departments benefited the most when

scribes worked at triage, acute/resuscitation and paediatric areas.[24] However, fast track areas showed little benefit from having a scribe. [24]

By increasing the patients seen per hour, we could decrease the average patient waiting time.[29] Thus, with our study that indicates that medical scribes improve productivity metrics, we may reduce patient waiting time by utilizing medical scribes,

One of the reasons behind decrease in patient throughput metrics is the documentation burden on the physicians.[23] Residents have been used to decrease the documentation burden, however, when no residents are available, the EMR burden is still falling on the physicians.[23] Instead of using residents for documentation, we could utilize the scribes. Our findings suggest that scribes could undertake the task of documentation that can allows physicians to deploy their time and resources on patients' management and thus prevent the decrease throughput metrics.

5.2 Limitation

Our cohort has some limitations. Randomizations was impractical in this study and it is a common critique.[23] Other factors than data sources of error, are the physicians' experience in combination with crowding at the ED and the degree of difficulty of the medical conditions of the patients. These may also contribute to the workload and number of patients seen.

The scribes were medical students – making communications and investigations easier to predict and prepare because the medical students have the same basic education as the physicians.

The variability of residents and background may play a significant role in this study. The summer of 2018, the ED at Kungälv Hospital had residents in emergency medicine, which might affect the outcome as they may be quicker in patients' assessment. The physicians were also aware of the study's aim. This may have led to overestimation of the effect of scribes. The Scribes variable performance indicators differed when paired with different physicians,

making interpersonal interactions between scribes and physician a considering factor to the promising results.

Generalizability about the number of patients can be argued. This study may be limited in size and scope. Furthermore, the investigation may be susceptible to researcher bias as the author were involved as a working scribe and investigator of this study.

The data must be interpreted in the context of several limitations. Firstly, the documentation time or patient care was self-reported data from 2018 by the scribes. A portion of the data is dependent on the scribes' best recall and captured notes. Secondly, the scribes logged both overhanded patients, triage, fast, stream team patients, patients that their respective physicians had already started the investigation on but not finished. This cannot be seen or measured in the data of 2017. Thus, the argument and risk of larger number of patients in the data of 2018 is high. Third, the schedule and workhours of 2017 was adapted after the shifts and hours of 2018. This might leave patients out of the data collection if they were assessed minutes earlier or later than the shift time that was set as an inclusion criterion.

Day shift tended to be busiest. Occasionally, we were forced to compare day shifts from 2018 with evening shifts from 2017. Both shifts had the same number of working hours, however, the patient volume may differ between these shifts.

5.3 Future research

Although the study shows an increase in productivity, further research, work and testing in other ED settings need to be done. The future studies should be randomized, controlled and if possible, double blinded. They should have a bigger sample size with more dependent variables such as physician's experience and cause of visit.

Scribes should not only be medical students instead but also medical secretaries, the ones actually working with the cleric aspect of the patient assessment. Medical students can be an alternative for during summer periods. Scribes should receive more training and work night

shifts, weekends and holidays to cover the total worktime. The day coverage tended to be busiest shifts in terms of patient volume. The benefit of scribes may be influenced by such circadian variation.

Agreeing with Walker, K. et al.,[24] future work should be done to identify the harms and benefits of scribes with the aim on quality and risk. Data should be collected from one system, either digitally or paper form to minimize source of error.

Implementation of medical scribes may be a future solution for increased productivity. This first Swedish study highlights the promising opportunities and set the foundation for further research at the Emergency department.

CONCLUSION

With this study, we conclude that scribes do increase physicians' productivity in a Swedish emergency department. Scribes increase in number of patients seen per hour per physician, thus may offer a solution to overcrowding and decrease burden of documentation for Swedish physicians. However, further research, more precise and larger studies needs to be conducted.

POPULÄRVETENSKAPLIG SAMMANFATTNING

Utvärdering av Medicinsk Scribes effekt på akutmottagningens produktivitet

Patienters väntetider på akutmottagningen fortsätter att öka över hela landet. Bidragande faktorer har visat sig vara bristande läkarkompetens och överbelagda vårdavdelningar. Orimligt många patienter som väntar på läkarbedömning leder till överfulla akutmottagningar.

En annan bidragande faktor till ökad väntetid för en patient är genomflöde, t.ex. administrativt arbete. Många inom vården har uttryckt att det administrativa arbetet är betungande idag jämfört med förr. Mellan 2010–2017 hade administrativ personal ökat med 36 % jämfört med läkare, 16%. En svensk läkare spenderar ca 37% av sin arbetstid på patientrelaterat administrativt arbete och 40% på patienten i jämförelse med en engelsk läkare som spenderar 15% respektive 66 % av sin tid. Svenska läkare är missnöjda gällande det administrativa arbetet. Mycket tid går åt dokumentation och journalläsning. Många läkare uttrycker en rädsla för att missa viktig information gällande patienten till följd av svårigheter att hitta rätt information i massiva och svåröverskådliga patientjournaler. Konsekvensen av ökat administrativt arbete kan leda till mindre tid för utbildning och forskningsarbete. Mindre utbildning leder till otillräcklig kunskap.

En lösning för mer effektiv dokumentation är att anlita Scribes. En Scribes primära uppgift är att följa en läkare och sköta dokumentationen samt den administrativa delen av patientbesöket i realtid med hjälp av en laptop. Med införandet av Scribes på akutmottagningen kan läkaren fokusera på patienten, minska sitt administrativa arbete och öka sin produktivitet.

Denna studie syftar till att utvärdera de medicinska scribes effekt på akutmottagningens produktivitet. Studiens fokus ligger på läkarnas produktivitet med och utan scribes. Frågan

som besvaras i denna studien är: Har antalet patienter per timme per läkare ökat med jämfört utan en scribe?

I denna prospektiv före-efter kohortstudie, inkluderades totalt 39 dagars data från skift med läkare och scribes. Data från sommaren 2018 jämfördes med data sommaren 2017, då läkarna jobbade utan scribes.

Resultaten visar att skift där läkare jobbar med scribes ökar antalet patienter per timme per läkare med 0.29.

Slutsatsen av denna studie är att scribes ökar läkarnas produktivitet. Scribes ökar antalet patienter per timme per läkare. Detta kan vara en potentiell lösning för att öka produktiviteten genom att reducera administrativt arbete men mer forskning och större studier av samma karaktär med mer noggrannhet behövs.

REFERENCES

[1]Rathlev, Niels K., Dan Obendorfer, Laura F. White, Casey Rebholz, Brendan Magauran, Willie Baker, Andrew Ulrich, Linda Fisher, and Jonathan Olshaker. "Time Series Analysis of Emergency Department Length of Stay per 8-Hour Shift." *Western Journal of Emergency Medicine* 13, no. 2 (2012): 163-68.

[2]Socialstyrelsen. ''Tillgänglighet i hälso- och sjukvården: rapport februari 2018''. (2018). Retrieved from: https://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/20872/2018-2-16.pdf

[3]Socialstyrelsen. ''Väntetider och patientflöden på akutmottagningar: rapport februari 2017''. (2017). Retrieved from: https://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/20493/2017-2-16.pdf

[4]Yarmohammadian, Mohammad, Fatemeh Rezaei, Abbas Haghshenas, and Nahid Tavakoli. "Overcrowding in Emergency Departments: A Review of Strategies to Decrease Future Challenges." Journal of Research in Medical Sciences 22, no. 1 (2017): 23.

[5]Andersson, J. ''IVO underkänner tre av sex akutmottagningar i Stockholm''. Läkartidningen, December 4, 2017. Retrieved from: http://lakartidningen.se/Aktuellt/Nyheter/2017/12/IVO-underkanner-tre-av-sex-akutmottagningar-i-Stockholm/

[6]Cheng, Ivy S. ''Emergency Department Crowding and Hospital Patient Flow: Influential Factors and Evidence-Informed Solutions''. (Doctoral thesis, Karolinska Institutet, Stockholm). (2016). Retrieved from: https://openarchive.ki.se/xmlui/bitstream/handle/10616/45227/Thesis_Ivy_Cheng.pdf?sequence=4&isAllowed=y

[7]Edvardsson, J., Arnholdt-Olsson, A., & Jeppsson, B. ''Mer tid för patienten hos läkare i England - En jämförande tidsstudie av svenska och engelska läkares arbetsdag''. Läkartidningen, July 10, 2014. Retrieved from: http://www.lakartidningen.se/EditorialFiles/WE/%5BCUWE%5D/CUWE.pdf

[8]Antti, N., & Köhler, J. ''Varför tar Sveriges läkare emot så få patienter? Tre empiriska studier om läkare som har svaga eller inga gränser''. (Dissertation, Luleå Tekniska Universitet, Luleå). (2017). Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-64088; Edvardsson, J., Arnholdt-Olsson, A., & Jeppsson, B. ''Mer tid för patienten hos läkare i England - En jämförande tidsstudie av svenska och engelska läkares arbetsdag''. Läkartidningen, July 10, 2014. Retrieved from: http://www.lakartidningen.se/EditorialFiles/WE/%5BCUWE%5D/CUWE.pdf

[9]Cederberg, J ''Administrativ personal har gått om antalet läkare i vården – med råge''. Läkartidningen, May 29, 2018. Retrieved from: http://www.lakartidningen.se/Aktuellt/Nyheter/2018/05/Administrativ-personal-har-gatt-om-lakarna/

[10]Cabilan, Cara J, and Robert M Eley. "Review Article: Potential of Medical Scribes to Allay the Burden of Documentation and Enhance Efficiency in Australian Emergency Departments." *Emergency Medicine Australasia*27, no. 6 (2015): 507-11.

[11]Pearson, Elsa, and Austin Frakt. "Medical Scribes, Productivity, and Satisfaction." *JAMA* 321, no. 7 (2019): 635-636.

[12]Arya, Rajiv, Danielle M. Salovich, Pamela Ohman-Strickland, and Mark A. Merlin. "Impact of Scribes on Performance Indicators in the Emergency Department." *Academic Emergency Medicine* 17, no. 5 (2010): 490-94.

[13]DeWitt, Dawn, and Leila Harrison. "The Potential Impact of Scribes on Medical School Applicants and Medical Students with the New Clinical Documentation Guidelines." *Journal of General Internal Medicine* 33, no. 11 (2018): 2002-004.

[14]American college of Emergency Physicians. ''Emergency Department Crowding: High Impact Solutions''. May 2016. Retrieved from:
https://www.acep.org/globalassets/sites/acep/media/crowding/empc_crowding-ip_092016.pdf

[15]Patel, S., Rais, A., & Kumar, A. ''The Use of Scribes in the Emergency Department''. *ACEP Now.* March 1, 2012. Retrieved from: https://www.acepnow.com/article/use-scribes-emergency-department/?singlepage=1

[16]Evans, R S. "Electronic Health Records: Then, Now, and in the Future." *Yearbook of Medical Informatics* Suppl 1, no. S 01 (2016): S48-61.

[17]Al-Adwan, Stanford, and Hamner. "Examining the Utilization of Medical Scribes in a Hospital Emergency Department Environment." *Procedia Computer Science* 118 (2017): 34-47.

[18]The Joint Commission. ''Standards FAQ Details''. Accessed June 8, 2019.
https://www.jointcommission.org/standards_information/jcfaqdetails.aspx?StandardsFaqId=1908&ProgramId=46

[19]Al-Adwan, Stanford, and Hamner. "Examining the Utilization of Medical Scribes in a Hospital Emergency Department Environment." *Procedia Computer Science* 118 (2017): 34-47; Dunlop, William, Lachlan Hegarty, Margaret Staples, Michele Levinson, Michael Ben-Meir, and Katherine Walker. "Medical Scribes Have No Impact on the Patient Experience of an Emergency Department." *Emergency Medicine Australasia* 30, no. 1 (2018): 61-66.

[20]Collier, Roger. "Electronic Health Records Contributing to Physician Burnout." *CMAJ : Canadian Medical Association Journal = Journal De L'Association Medicale Canadienne* 189, no. 45 (2017): E1405-E1406.

[21]Heaton, H.A., Wang, R., Farrel, K.J., Ruelas, O.S., Goval D.G., Lohse, C.M., Sadosty A.T., Nestler, D.M. ''Time Motion Analysis: Impact of Scribes on Provider Time Management''. *Journal of Emergency Medicine, Volume 55, Issue 1*(2018); *135 – 140*.

[22]Graves, Peter S., Graves, Stephen R., Minhas, Tanvir, Lewinson, Rebecca E., Vallerand, Isabelle A., and Lewinson, Ryan T. "Effects of Medical Scribes on Physician Productivity in a Canadian Emergency Department: A Pilot Study." *CMAJ Open* 6, no. 3 (2018): E360-364.

[23]Shuaib, Waqas, John Hilmi, Joshua Caballero, Ijaz Rashid, Hashim Stanazai, Alan Ajanovic, Alex Moshtaghi, Ahmed Amari, Kerolos Tawfeek, Anjit Khurana, Hesham Hasabo, Abdulrehman Baqais, Ahmed A Mattar, and Theodore J Gaeta. "Impact of a Scribe Program on Patient Throughput, Physician Productivity, and Patient Satisfaction in a Community-based Emergency Department." *Health Informatics Journal*, 2017, 1460458217692930.

[24]Walker, Katherine, Michael Ben-Meir, William Dunlop, Rachel Rosler, Adam West, Gabrielle O'connor, Thomas Chan, Diana Badcock, Mark Putland, Kim Hansen, Carmel Crock, Danny Liew, David Taylor, and Margaret Staples. "Impact of Scribes on Emergency Medicine Doctors' Productivity and Patient Throughput: Multicentre Randomised Trial." *BMJ* 364 (2019): L121.

[25]Walker, Katherine J, Michael Ben-Meir, David Phillips, and Margaret Staples. "Medical Scribes in Emergency Medicine Produce Financially Significant Productivity Gains for Some, but Not All Emergency Physicians." *Emergency Medicine Australasia* 28, no. 3 (2016): 262-67.

[26]Imdieke, B.H., Martel, M.L. ''Integration of Medical Scribes in the Primary Care setting: Improving Satisfaction''. Journal of Ambulatory Care Management. 40(1) (2017): 17–25.

[27]Yan, Chen, Susannah Rose, Michael Rothberg, B. Mercer, Mary Goodman, and Beth Misra-Hebert. "Physician, Scribe, and Patient Perspectives on Clinical Scribes in Primary Care." *Journal of General Internal Medicine* 31, no. 9 (2016): 990-95.

[28] Pozdnyakova, Anastasia, Neda Laiteerapong, Anna Volerman, Lauren Feld, D. Wan, Wen Burnet, and Deborah Lee. "Impact of Medical Scribes on Physician and Patient Satisfaction in Primary Care." *Journal of General Internal Medicine* 33, no. 7 (2018): 1109-115.

[29]Friedson, A.I. ''Medical Scribes as an Input in Health-Care Production: Evidence from a Randomized Experiment''. *American Journal of Health Economics*, 4:4, (2018): 479-503.

[30]Cowan, Timothy Luke, William A Dunlop, Michael Ben-Meir, Margaret Staples, Ainsley Treadwell, Eliza Gardner-Brunton, and Katherine Justice Walker. "Emergency Consultants Value Medical Scribes and Most Prefer to Work with Them, a Few Would Rather Not: A Qualitative Australian Study." *Emergency Medicine Journal* 35, no. 1 (2018): 12-17.

[31]Shultz, Cameron G, and Heather L Holmstrom. "The Use of Medical Scribes in Health Care Settings: A Systematic Review and Future Directions." *Journal of the American Board of Family Medicine: JABFM* 28, no. 3 (2015): 371-81.

[32]Hafer, Julia, Xibin Wu, and Steven Lin. "Impact of Scribes on Medical Student Education: A Mixed-Methods Pilot Study." *Family Medicine* 50, no. 4 (2018): 283-286.

[33]Kungälv Sjukhus. ''*Akutmottagning*''. Date published: October 07, 2016. Date Accessed: 15 April 2019 from, https://www.vgregion.se/s/kungalvs-sjukhus/avdelningar-och-mottagningar/akutmottagning/

[34]Kungälv Sjukhus. ''Kungälvs Sjukhus''. Date accessed: 15 April 2019 from, https://alfresco.vgregion.se/alfresco/service/vgr/storage/node/content/workspace/SpacesStore/a2344c42-d2a8-43b0-b0c2-efea8af00d85/Kung%C3%A4lv%20Hospital.pdf?a=false&guest=true

[35]Kungälv Sjukhus. ''Om Kungälvs sjukhus''. Date published: August 30, 2016. Date accessed: 15 April 2019. https://www.vgregion.se/s/kungalvs-sjukhus/om-kungalvs-sjukhus/

[36]Kungälv Hospital. ''Kungälv Hospital'' Date accessed: 15 April 2019. https://alfresco.vgregion.se/alfresco/service/vgr/storage/node/content/workspace/SpacesStore/a2344c42-d2a8-43b0-b0c2-efea8af00d85/Kung%C3%A4lv%20Hospital.pdf?a=false&guest=true

[37]Kungälvs Sjukhus. ''*Delårsrapport – Kungälv Sjukhus - Mars 2018*''. (March 2018). Date accessed: June 8, 2019. Retrieved from: https://alfresco.vgregion.se/alfresco/service/vgr/storage/node/content/workspace/SpacesStore/1b6b49f1-6209-491c-af5f-9e182cda8874/Kung%C3%A4lvs%20sjukhus%20del%C3%A5r%20mars%202018.pdf?a=false&guest=true

APPENDIX

För Scribes

Dagens datum:
Arbetspass:

	Triagebedöm.	Inlägg. (färdig)	Hemgång (färdig)	Konsultation	^Tar över /avslutar pat.	*Lämnar ifrån pat.	Prel. Bedöm/besöksorsak	Egna kommentarer
Pat 1								
Pat 2								
Pat 3								
Pat 4								
Pat 5								
Pat 6								
Pat 7								
Pat 8								
Pat 9								
Pat..								

Läkaren du jobbade med ....
Fick du göra andra uppgifter än realdokumentering: Ja / Nej
Om ja, beskriv:

(Ringa in)
Beläggningssituation på sjukhuset: Lätt – Medel – Svår   Kommentar:
Belastning på akutmottagningen: Lätt – Medel – Svår   Kommentar:
*Innebär att man lämnar ifrån sin patient pga avslutat pass (ex)
^Innebär att man tar över en patient från jour/avslutar en patient från jour

Sheet 1 - Copy of the manual sheet scribes used to log patients, hours and other data.