

# Evaluation of Medical Scribes' effect on the Emergency Department's productivity - A before-after cohort study

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## Research Article

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# Abstract

## Background

Emergency department length of stay is increasing in Sweden. One contributing factor for the accelerating emergency department length of stay, is the rise in administrative workload on the physicians. Prolonged patient waiting time and overcrowding leads to an unsafe environment. The aim of this study was to evaluate whether the productivity of physicians at the emergency department of Kungälv hospital increased following the introduction of medical scribes.

## Method

We conducted a before-after study during 39 days at an emergency department. Data were collected from shifts worked by physicians with different work experience and medical specialties during two different summer periods, one period with medical scribes and the other without medical scribes. All patients visiting the emergency department and requiring healthcare during the period of medical scribes' presence, were eligible. Patients were excluded from the study if they denied the presence of a medical scribe, or if the physician refused the medical scribe's presence. We measured the physicians' productivity by evaluating the mean number of assessed patients per hour per physician. Independent Samples *t*-test was used for statistical analysis.

## Result

We documented a total of 584 physician-hours with a medical scribe and 584 hours without a medical scribe. A total number of 463 patients was assessed with a medical scribe during the period of 2018 compared to 362 patients assessed without a medical scribe in 2017. The physicians assessed significantly larger number of patients per hour with the assistance of a medical scribe, an increase of 0.22 (36%) patients per hour per physician, from 0.61 to 0.83 patients per hour per physician (95% CI 0.13–0.30).

## Conclusion

We conclude that scribes do improve physicians' productivity by increasing the number of assessed patients per hour per physician.

## Introduction

The total time interval from a patient's registered arrival at the Emergency Department (ED), to being discharged from ED, is defined as Emergency department length of stay (EDLOS)<sup>1</sup>. EDLOS is an important

indicator of crowding<sup>2</sup>. While hospital bed shortage being one of the most common reported reasons behind ED crowding<sup>1,3</sup>, EDLOS is also contributing factor<sup>2</sup>. EDLOS is increasing in Sweden<sup>4</sup>, and overcrowding is acknowledged as concerning global health problem<sup>5</sup>. By understanding and finding flaws in the input-throughput-output model of ED crowding, solutions can developed<sup>5,8</sup>.

A throughput factor which contributes to prolonged emergency department length of stay is patient-related administrative work, including electronic charting and order entries<sup>6</sup>. 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<sup>7</sup> (Figure 1).

A solution for more efficient documentation is the hiring medical scribes<sup>8</sup>. Their role is to assist the physicians by documenting patients' history and physical exam<sup>9</sup>, consequently reducing the physicians' administrative workload<sup>10</sup>.

With the implementation of medical scribes at the ED, the aim of this study was to evaluate whether the productivity of physicians increases at the ED of Kungälv hospital following the introduction of medical scribes.

## Methods

### Study design

A before-after single centered, non-randomized study.

### Study setting and population

This study was carried out from June to August 2018 at the ED of Kungälv Hospital, an emergency hospital, treating approximately 31 000 patients annually, where 10 000 being further admitted<sup>11</sup>.

All patients visiting the emergency department and requiring healthcare during the period of scribes' presence, were eligible. Both the physician and the patient could refuse the presence of a scribe during the consultation. The patient would then be excluded from the study. However, neither a patient nor any physician refused the presence of a scribe during any consultation.

Due to the lack of a Swedish translation and understanding of the title "Scribe"; all physicians presented the scribes in the beginning of the consultations as assistant colleagues who document the consultation. One scribe was allocated for each physician. A scribe could interchange between physicians if a physician was appointed to do another task outside the ED.

A physician allocated his/her name to a patient by using our electronic medical triage and registration system (ELVIS). The scribe was expected to attend all consultations with the physician, regardless the

complexity of the case.

We compared the productivity of the physicians together with scribes (scribed) during the summer of 2018 versus the productivity of the physicians without scribes (non-scribed) during summer of 2017. Physicians' productivity was measured by assessed patients per hour per physician.

## **Selection of participants**

- **Physicians**

In this study, emergency physicians were physicians working at the emergency department regardless of their 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 licensed physicians, except one, agreed to participate in the study. Most of the physicians were residents in either internal medicine or emergency medicine.

The usual routine for the physicians when assessing patients is to document manually at bedside and later dictate with a dictaphone or manually type in the information in the electronic health record (EHR) system. The physicians were offered one day of training with the new scribe. For routine purposes, every time a physician received a new scribe, one day of training was provided which was subsequently excluded from the study.

- **Scribes**

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

All scribes were familiar with the medical chart and software system used at the hospital as all medical students use the same systems during their clinical rotations. They received one day of administrative training with the medical secretaries for questions and further familiarization of the system. The training was delivered one week before the study.

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 together with the physicians. If demanded by the physicians, they ordered the investigations, wrote the medical referrals and completed the EHR for further admission. The physicians reviewed, edited and signed off all the documents. The scribes followed and documented all patient consultations including triage assessment, immediate assessment – trauma and regular consultations in the patient waiting room at the ED.

The scribes could work three possible shifts from Monday-Friday 8:00 AM - 4:30 PM, 9.30 AM - 6:00 PM or 1:00 PM - 9:00 PM. If the physician needed to work overtime, the scribe followed and documented the extra time in the sheet. The hours were included in the study. If a scribe was reported sick, that particular day would be excluded from the study.

Weekends, public holidays and night shifts after 9:00 PM 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.

The ED is divided in three major treatment teams; Medical, Surgical and Orthopedic teams. During the majority of the study period the medical scribes worked in the medical teams. However, emergency medicine residents and senior consultants assessed patients in all teams.

### **Intervention**

The scribes followed their physicians during their whole shifts. The scribes used a mobile laptop computer on wheels or carried them around into the examination room where tables were set for support. They were in the room during the whole consultation while the physician assessed the patient.

### **Measurements**

Physicians' productivity was compared between scribed and non-scribed workdays. These workdays included different shifts and physicians. From the data collected we extracted the physician work hours and number of patients seen by each physician during each shift to calculate patients per hour per physician. The mean patients per hour per physician was later calculated from the shifts of each workday. The mean result was compared with the matched non-scribed workday of 2017.

Total patients from the study period of 2018 and from the comparing period of 2017 were first registered in table sheets. Having in mind that a date of a weekday may differ between the years, we approached it by extracting data from the matched weekdays of each year. The included workdays were from week 26 to week 34. We could collect the total number of patients signed-off by the working physician each shift. In order to make an accurate comparison with the data of 2017, we extracted data from the matched shifts and hours as in 2018. If the shifts of the comparative years did not match in working hours, we extracted shifts with the closest working hours during that weekday.

One shift was usually worked by one physician. If a scribe happened to work with two physicians during one shift, it was counted as one physician. The physicians in the study group of 2017 were different and unrelated to the physicians in the study group of 2018.

The total number of patients were calculated by counting all the registered patients from June 26<sup>th</sup> to August 24<sup>th</sup>, 2018. The corresponding days of 2017 were from June 27<sup>th</sup> to August 25<sup>th</sup>.

All patients were given an identity number which was neither correlated to their Social Security number nor to their reason for visit.

## Data collection

- **Data collection during 2017**

We collected 2017 year's data digitally from the ELVIS system. This system does not register which patients were overhanded to or from a physician. It only registers the assessed and finished patients. There were no scribes during 2017 which made it easier to extract data from the physicians' log file. In addition, triage consultations by a physician were not registered during 2017. The physicians working at the emergency department during 2017 were senior consultants, residents in internal medicine or interns.

We extracted the data of 2017 from shifts where the physicians were either on the same or near the same level of competence as the comparing physicians of 2018. Competence was measured by looking at the physicians' career-levels (Table 1). 2018 was the first year Kungälv Hospital implemented residents in Emergency medicine. The closest comparison to these residents were physicians specializing in Internal medicine.

- **Data collection during 2018**

The scribes collected the data for 2018 manually by logging on paper sheets (Appendix). The manual approach was used since it was less time consuming, easier to track in comparison to the complex data management systems used at the hospital and also avoiding entering our data-base and putting patient's integrity at risk. Manual approach made it possible for the scribes to log both overhanded triage patients and patients that their respective physicians had already started assessing but not finished.

**Table 1:** Career level of physicians in 2017 and 2018

-	2017	2018
<b>Physician One</b>	Consultant Internal Medicine	Senior consultant, Emergency Medicine
<b>Physician Two</b>	End of residency, Internal Medicine	End of residency, Internal Medicine
<b>Physician Three</b>	2 <sup>nd</sup> year of residency, Internal Medicine	2.5 y of residency, Internal Medicine
<b>Physician Four</b>	2 <sup>nd</sup> year of residency, Internal Medicine	2 <sup>nd</sup> year of residency, Internal medicine
<b>Physician Five, Six and Seven</b>	1 <sup>st</sup> year of residency, Internal Medicine	1 <sup>st</sup> year of residency, Emergency Medicine
<b>Physician Eight</b>	Intern	Intern

## Statistical data and analysis

Mean result of patients per hour per physician for each scribed and non-scribed workday 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 we used IBM SPSS Statistics Version 27. Significance was set at  $p < 0.05$ . Independent- sample  $t$  tests were used to compare the mean values for both data set. For significance levels, we did a Levene's Test for Equality of Variances. We assessed the data distribution with Q-Q plots, Outliers and Histograms.

## Ethics

Permission to conduct this study was granted by the operations manager of the emergency department. All registered data could not be tracked to any patient. A patient and a physician were able to deny a scribe's presence. Due to no involvement of patients' personal information and medical records, no other agreements were needed for ethical purpose.

## Results

We compared the number of patients assessed per hour and physician during 73 shifts in both 2017 (non-scribed) and 2018 (scribed).

Data analysis was conducted on the mean patients per hour per physician of the 39 scribed and 39 non-scribed workdays. The number of patients assessed in 2018 was 463 compared to 362 patients in 2017. The use of a scribe was associated with a significantly greater number of patients assessed per hour per physician, an increase of 0.22 (36%), from 0.61 to 0.83 ( $p < 0.001$ ) (table 2).

**Table 2:** Statistical analysis of mean patient per hour per physician of the 39 Scribed and 39 Non-Scribed days.

	Mean (p/h/p) *	Sd	Minimum (p/h/p)	Maximum (p/h/p)	
<b>Scribed</b>	0.83	0.23	0.38	1.38	
<b>Non-Scribed</b>	0.61	0.13	0.25	0.88	
<b>Independent t-test analysis</b>					
	Non-Scribed	Scribed	Difference	P-value	95% CI
<b>Total patients</b>	362	463	-	-	-
<b>Total shifts</b>	73 (584h)	73 (584h)	-	-	
<b>Total days</b>	39	39			-
<b>Mean (*p/h/p) of the 39 days</b>	0.61	0.83	0.22 Ý	<0.001	0.13-0.30

\*p/h/p = patients per hour per physician. Sd = Standard deviation.

## Discussion

The findings in our study are in line with the observations made in other studies such as, Shuaib W et al.<sup>12</sup> and Graves PS et al.<sup>13</sup>, which conclude that ED physician's use of a medical scribe correlates with improved productivity as measured by patient per hour. Other results that resonates with our findings are those presented in Cabilan CJ et al.<sup>8</sup>, where they reviewed studies which presented a significant increase of 0.28 patients per hour in an US study and 0.32 in an Australian study, after the utilization of scribes. Arya R et al. also demonstrate an increase of 0.08 patients per hour, however no positive impact when measured by turnaround time to discharge<sup>9</sup>. Patients assessed per hour is a measurement related to the throughput system<sup>8</sup>, and increasing the throughput with scribes may be one of the answers to prevent overcrowding at the ED<sup>6</sup>.

Although we demonstrate positive overall results with the concept of working with medical scribes, there is one study showing negative impact on throughput metrics after the implementation of scribes during a 3-month period in an adult ED<sup>14</sup>. The same authors studied medical scribes' effect a year after their first study, during another 3-month period, where the scribes still had limited impact on throughput metrics in the same adult ED<sup>14</sup>. Despite the negative outcome, it appeared that medical scribes decreased patient time in the room and increased patients seen per hour with one patient per shift, during the afternoon shifts<sup>15</sup>.

Other benefits of having medical scribes is them alleviating physicians' documentation burden<sup>16,17</sup>. It is globally known about physicians' time-consuming documentation and the association with job

dissatisfaction<sup>8,18</sup>. Scribes, with the evidence presented, can help reduce the documentation burden<sup>15</sup> and increase the physicians' workplace satisfaction<sup>19</sup>.

One limiting factor is the impracticality with randomizations in these studies, which it is a common critique<sup>12</sup>. It has also been discussed that medical scribes' positive impact may vary from physician to physician and depend on the difficulty degree of the patients' medical conditions<sup>20</sup>. One can argue that these factors represent the reality and should not be seen as limiting. In our study we analyzed two comparable summer periods with large patient sample sizes and different physicians making it more just. Nonetheless, such case has been presented in Thomas K et al. s' study, where depending on which patient category the medical scribes had documented on, gave effective to ineffective patient throughput results<sup>21</sup>.

The summer of 2018, the ED at Kungälv Hospital had residents in emergency medicine (EM), which might affect the outcome as they may be quicker in patients' assessment. In spite of that, the difference in competence should not differ much when comparing first year Swedish EM residents with internal medicine (IM) residents due to the fact that IM residents' first year also start at the emergency department. In Sweden, the majority of the internal medicine residents have been working for a period of time as licensed physicians after internship in line to start their residency. Having this in mind, internal medicine physicians might be slightly more competent and assess more difficult and time-consuming patients as residents, compared to emergency medicine residents.

Our study shows that physicians' productivity increases with the assistance of scribes during the day and evening shifts, but we did not cover night shifts. The midday coverage tended to be the busiest shifts in terms of patient volume at our hospital. Agreeing with Arya, R et al., results may be influenced by the shifts and patient volume and thus should be further investigated<sup>9</sup>. Scribes should receive more training and work night shifts, weekends and holidays to cover the total worktime. Medical students can also fill in and work as scribes. Scribing can increase their knowledge and understanding of practiced medicine as well as developing them personally and professionally<sup>22</sup>.

To our knowledge there are few similar studies published the recent year evaluating medical scribes' effect on ED's productivity. It is the only study made in Sweden. Based upon our study, the studies presented above and the recent association between ED crowding and increased mortality within 30 days<sup>23</sup>, a solution is being presented.

Knowing the future is aiming towards developing a digital scribe with Speech Recognition and Natural Language Processing (a division of artificial intelligence), there are still challenges to meet<sup>24</sup>. While research is exploring clues for challenges such as clinical practice implications, high-quality audio with minimized errors and clinician-patient privacy concerns<sup>24</sup>, we can start utilizing the benefits of having a medical scribe to solve the current throughput problem in our emergency departments.

In conclusion, this study demonstrates, with a statistical significance that medical scribes positively impact physicians' productivity by increasing the number of patients assessed by physicians per hour.

## **Declarations**

### **Ethics approval and consent to participate**

Permission to conduct this study was granted by the operations manager of the emergency department of Kungälv Hospital. Verbal informed consent was obtained from all individual participants included in the study. Due to no involvement of patients' personal information or medical records, the need for additional ethics approval and consent was not considered necessary for this study, which was decided by the study group and the operations manager. All methods were performed in accordance with relevant guidelines and regulations

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

All the summarized and relevant data generated or analysed during this study are included in this published article. More detailed datasets are not publically available due to ethical purposes. However, the data can be sent in PDF from the author on reasonable request. In that case, a deidentified version will be available.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

The scribes and the physicians were payed regular salaries for their work. No other financial support was provided for this study.

### **Author contributions**

Kristina Bengtsson Linde and Muje El Noaimi developed the study design, created the tool for data gathering and collected the data. Muje El Noaimi with the help of Delér Shakely and Max Petzold wrote the main manuscript text, prepared the figures, tables and the data analysis and interpretations. All authors read and contributed to editing the final draft. All authors read the final manuscript and approved it for submission.

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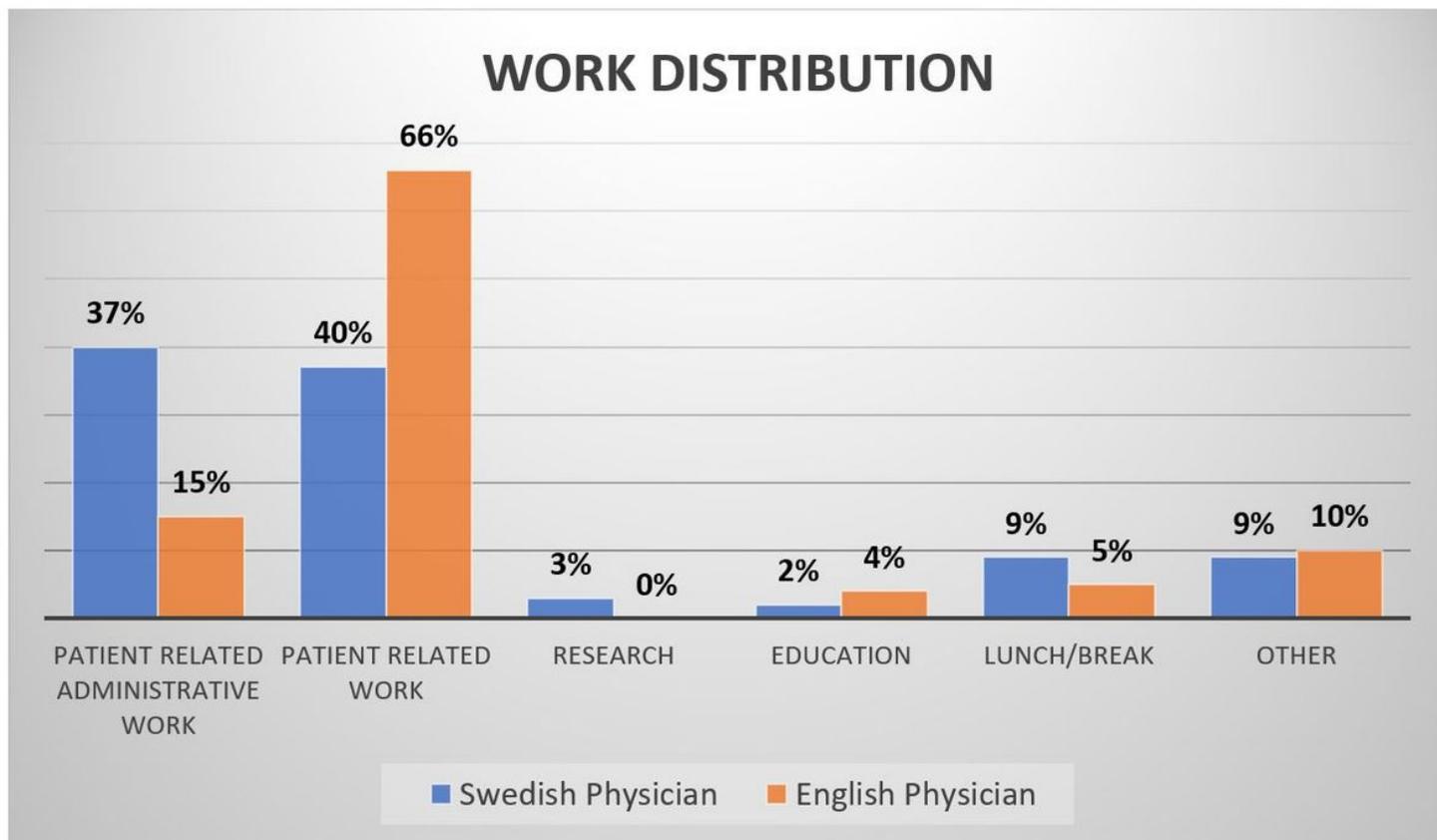
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## Figures



**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 the Author.

## Supplementary Files

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- [APPENDIX.docx](#)