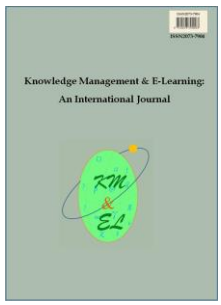
Knowledge Management & E-Learning, Vol.13, No.4. Dec 2021

Effects of medical scribes on patients, physicians, and safety: A scoping review

Lisa M. Shah
Elizabeth M. Borycki
University of Victoria, BC, Canada
Justin A. Shah
University of British Columbia, Victoria, BC, Canada
Andre W. Kushniruk
University of Victoria, BC, Canada



Knowledge Management & E-Learning: An International Journal (KM&EL)
ISSN 2073-7904

Recommended citation:
Shah, L. M., Borycki, E. M., Shah, J. A., & Kushniruk, A. W. (2021). Effects of medical scribes on patients, physicians, and safety: A scoping review. *Knowledge Management & E-Learning*, *13*(4), 559–629. https://doi.org/10.34105/j.kmel.2021.13.030

Knowledge Management & E-Learning, 13(4), 559–629

Effects of medical scribes on patients, physicians, and safety: A scoping review

Lisa M. Shah*

School of Health Information Science
University of Victoria, BC, Canada
E-mail: lmshah@uvic.ca

Elizabeth M. Borycki

School of Health Information Science
University of Victoria, BC, Canada
E-mail: emb@uvic.ca

Justin A. Shah

Division of Gastroenterology
Department of Medicine
University of British Columbia, Victoria, BC, Canada
E-mail: justin.shah@viha.ca

Andre W. Kushniruk

School of Health Information Science
University of Victoria, BC, Canada
E-mail: andrek@uvic.ca

*Corresponding author

Abstract: A scoping review was conducted to investigate the effects of medical scribes on physician and patient satisfaction, physician burnout, the educational experience of medical students and residents, risk, and safety. The databases PubMed, EMBASE, and CINAHL were searched for the years 2000-2020. Relevant studies were analyzed qualitatively. Literature analysis found that medical scribes increase physician satisfaction and decrease physician burnout, while having minimal impact on patient satisfaction. Patient impressions of scribes tend to be neutral to positive. The effects of scribes on medical student and resident education appear positive in preliminary results. Scribe-generated notes seem to be of equal or greater quality compared to physician-generated notes, though few studies have examined this issue. The impact of scribes on risk and safety has not been fully studied. Few studies of medical scribes have been conducted in Canada, and only one has been published in a peer-reviewed journal. Medical scribes are a promising solution to the growing challenge of physician documentation-related burden fueled by electronic health records and electronic medical records. Studies on the impact of scribes in countries other than the United States are needed. Administrative hurdles to the implementation of scribes in Canadian hospitals could be a barrier to pilot studies in Canada.

Keywords: Medical scribes; Scribes; Team documentation; Documentation-related burden; Physician burnout; Safety

Biographical notes: Dr. Lisa Shah is a PhD student in the School of Health Information Science at the University of Victoria, British Columbia, Canada. She received her Doctor of Medicine degree from the University of British Columbia and completed a residency in Family Medicine at the University of British Columbia. She also completed a Master of Science degree in the School of Health Information Science at the University of Victoria.

Dr. Elizabeth Borycki is a Professor in the School of Health Information Science at the University of Victoria, British Columbia, Canada. She is the Director of the Global Laboratory for Digital Health Innovation at the University of Victoria. Elizabeth conducts research at the intersection of safety science, human factors, and technology in the field of health informatics. She is a Clinician Scientist with the Michael Smith Foundation for Health Research, Vancouver, Canada.

Dr. Justin Shah is a Clinical Assistant Professor in the Department of Medicine at the University of British Columbia, and a practicing Gastroenterologist in Victoria, British Columbia, Canada.

Dr. Andre Kushniruk is Professor and Director of the School of Health Information Science at the University of Victoria, British Columbia, Canada. He has published widely in the area of health informatics and is known for his work in the usability of healthcare information systems. Dr. Kushniruk conducts research in a number of areas, and he focuses on developing new methods for the evaluation of information technology in healthcare. Dr. Kushniruk has been a key researcher on a number of national and international collaborative projects. His work includes evaluation of systems for use by healthcare providers, patients, and citizens.

1. Introduction

With the implementation of electronic health records (EHRs) and electronic medical records (EMRs) in the past few decades, healthcare has become more "data driven", with increased clerical workload for physicians (Bossen et al., 2019). Many physicians now spend more time on documentation and other "desktop medicine" than on direct patient care (Sinsky et al., 2016; Tai-Seale et al., 2017). The medical scribe industry developed in response to this new data-centric workload in healthcare, in an effort to off-load some of the clerical tasks from physicians. Medical scribes document the words of the practitioner who is assessing the patient, and do not have any patient care responsibilities. There are no formal training or background requirements for scribes (American College of Emergency Physicians, 2018). Medical scribes have been in existence since the 1970s, but their numbers did not increase dramatically until after the implementation of EHRs and EMRs (Bossen et al., 2019). Scribes were first employed to chart in paper medical records in emergency departments, due to the rapid pace of work faced by emergency physicians. As EHR and EMR implementations increased, so too did the number of medical scribes (Bossen et al., 2019). As medical scribes are not a regulated profession, it is difficult to quantify their current numbers in the healthcare workforce.

Medical scribes are described as "personnel specifically hired to chart patient-clinician encounters in real time, from the beginning of the encounter to its end" (Shultz

& Holmstrom, 2015, p. 372). As these authors clarify, "the identification of a person as a scribe is not dependent on their training per se, but the person's predefined role" (Shultz & Holmstrom, 2015, p. 372). Though there are no formal training or licensing requirement for medical scribes, they are often considered EHR experts by those who work with them (Ash et al., 2020; Hafer et al., 2018). Medical scribes chart patient-physician encounters in real time, and physicians must sign scribed notes to authenticate them (Shultz & Holmstrom, 2015). The goal of adding scribes to healthcare teams is to decrease the clerical work of physicians and allow them to focus on clinical work. The scope of duties for a medical scribe can vary, depending on the practice environment, as well as the wishes of the physician.

Appendices A, B, and C include the Joint Commission definition of a medical scribe, the American Academy of Emergency Medicine position statement on scribes, and the details of the organizations in the United States offering scribe certification exams. There are several different organizations in the United States which offer their own scribe certification exams, but these are not regulated by any accreditation body. Woodcock et al. (2017) noted that there are not any national, state, or local regulations governing scribe scope of practice in the United States (p. 383). This is also the case in Canada.

Accurate medical documentation is vital in communicating between health care providers. Adding an additional person into the documentation process has the potential to affect patient safety, particularly without any regulatory oversight of the medical scribe role. Concern about scribe role expansion or unintentional functional creep exists.

The adoption of health information systems in Canada has exploded over the past fifteen years, with EMR use among primary care physicians increasing from 24% in 2006 to 85% in 2017 (Canada Health Infoway, 2018). Widespread EHR/EMR implementation has increased documentation time, especially for primary care physicians (Zallman et al., 2018). Documentation-related burden, exacerbated by poor EHR usability, is known to decrease physician professional satisfaction (DiSanto & Prasad, 2017; C. Lowry et al., 2017). Quality of care may be decreasing due to physicians being burdened by excess administrative duties (Olson et al., 2019; Rao et al., 2017). Physician burnout has been described as a public health crisis, with primary care physicians experiencing the highest rates (Mishra et al., 2018; Olson et al., 2019).

A Canadian Medical Association (CMA) survey conducted in 2017 found that 30% of Canadian physicians reported burnout (Canadian Medical Association, 2018). Despite this statistic, medical scribes have not been widely implemented in Canada as they have in the United States. This review aims to determine what is currently known about medical scribe effects on patients and physicians, and what barriers might be preventing Canadian physicians from obtaining the documentation assistance of scribes.

2. Methods

Medical scribes are an emerging phenomenon in Canada and other countries outside of the United States, with few published research studies. The objectives of this scoping review are to assess the current state of research on the effects of scribes on patients, physicians, medical learners, medical record quality, risk, and safety. Scoping reviews are more appropriate than systematic reviews for topics with emerging evidence, such as medical scribes (Levac et al., 2010). As this is a scoping review, broad questions were defined:

1. What are the effects of medical scribes on physician burnout, physician well-being, and physician professional satisfaction?
2. What are the effects of medical scribes on patient satisfaction?
3. What are the effects of medical scribes on medical student and resident education?
4. What is known about the effects of medical scribes in Canada?
5. How does the quality of scribed notes compare to notes written by physicians?

The methodological framework for conducting a scoping review developed by Arksey and O'Malley was followed (Arskey & O'Malley, 2005; Levac et al., 2010; Younge et al., 2015). Peer-reviewed published studies and the grey literature were examined. Themes were identified to create a thematic analytic framework, and gaps in current knowledge sought. The methodological quality of individual studies was not assessed in depth, but sample sizes and methods were noted to identify current gaps in research (Pham et al., 2014).

2.1. Search strategy

Preliminary searches were done to pilot the search strategy using the following terms: "scribe*", "medical scribe*", and "physician scribe*". Studies were identified that referred to medical scribes simply as "scribes", or as "clinical scribes". Therefore, a determination was made that the term "scribe*" should be used on its own for the searches, to maintain breadth of coverage (Arskey & O'Malley, 2005). The databases PubMed, EMBASE and CINAHL were searched using the term "scribe*". Un updated search was done in February 2021 to include records published in 2020. Records published electronically in 2020 were included, even if the print publication date was in 2021. The results of those searches are summarized in Table 1.

Table 1
Number of records identified

Database	Number of records
PubMed	643
EMBASE	918
CINAHL	327
Total	1888

Note. Search query used: "scribe*"; Filters: English language, from Jan. 1, 2000 to Dec. 31, 2020

2.2. Study selection

The process for study selection was iterative and was refined as abstracts and articles were reviewed (Joseph et al., 2020; Levac et al., 2010). The database search results were imported into EndNote, combined into one group, and the EndNote de-duplication procedure was used. Authors L.S. and J.S. completed a rapid title screen, followed by an abstract review. Articles that seemed to meet the inclusion criteria based on the information in the abstract were read in full. Articles for which an abstract was not available were included in the final stage of full article review to determine if they met the inclusion criteria. See Table 2 for inclusion and exclusion criteria. Fig. 1 shows the Prisma diagram that was generated to demonstrate the process used for article selection (Crampton et al., 2016; Tricco et al., 2018).

Table 2
Inclusion and exclusion criteria

Inclusion Criteria	• Peer-reviewed articles regarding medical scribes and their effects on physician professional satisfaction or burnout • Peer-reviewed articles regarding medical scribes and their effects on patient satisfaction • Peer-reviewed articles regarding medical scribes and their effects on medical student or resident physician educational experience • Peer-reviewed articles regarding the quality of medical scribe-generated documentation • Grey literature from professional associations, dissertations, and conference abstracts, due to the lack of published Canadian studies on the topic of medical scribes
Exclusion Criteria	• Articles published in a non-English language • Opinion pieces and letters to the editor • Articles and dissertations without full text available (if attempts to locate these articles through inter-library loans and the relevant university's website were unsuccessful) • Articles focusing only on the financial impact of medical scribes • Articles focusing only on the effect of medical scribes on emergency department throughput metrics • Conference abstracts that went on to publication as full articles based on the same data – the article reporting the most complete data set was used, as per Pham et al. (2014)

2.3. Charting the data

Articles meeting the inclusion criteria were read and their contents summarized as per the Tables D.19, D.20, D.21, and D.22 in Appendix D. These tables were developed to systematically capture data from the included studies (Villumsen & Nøhr, 2017). Data on publication year, country, setting (hospital vs. outpatient), medical or surgical specialty, study methods, and results were summarized.

2.4. Collating, summarizing, and reporting the results

A thematic analysis approach was used to collate and summarize the data from the included studies (Crampton et al., 2016). All the articles eligible for inclusion were read and broad themes were identified. More themes were added as new topics emerged. Articles could be mapped to multiple themes, if applicable (Crampton et al., 2016). After themes were identified from all articles, they were analyzed, and sub-themes were developed and categorized (see Table 3).

Table 3
Themes and subthemes identified

Theme	Subthemes
Effects on patients	• Patient satisfaction
	• Willingness to discuss sensitive topics
Effects on physicians	• Physician professional satisfaction
	• Physician burnout
	• Physician efficiency
Interactional effects	• Physician-patient relationship
	• Scribe-physician team
	• Concern about number of people in the room
Organizational effects	• Different need for scribes in academic versus non-academic settings
	• Tasks and model of documentation for medical scribes need to be clearly defined
	• Quality of scribe-generated documentation
	• Safety and risks associated with medical scribe use
	• Cost
	• Training of scribes
	• Problem of rapid scribe turnover
Effects on medical education	• Medical students
	• Residents
Lack of validated measures	• Lack of validated surveys of patient and physician satisfaction
	• Lack of validated measures of burnout
	• Lack of validated measures of note quality

3. Results

Database searches of PubMed, EMBASE, and CINAHL retrieved 1888 results. Duplicates were removed using the EndNote de-duplication procedure and manual scanning, leaving 1399 unique records. Fig. 1 describes the process for article selection. Final article count included in the scoping review was 55 peer-reviewed studies and 40 grey literature articles. Table 4 lists studies by country of origin and type, excluding systematic reviews and studies that did not state the location.

Themes emerged regarding the effects of scribes on patients, physicians, and medical learners. Other themes involved the interaction between scribes and physicians, and the organizational impacts of scribes. Finally, the lack of validated measures for assessing the impact of scribes was a major theme.

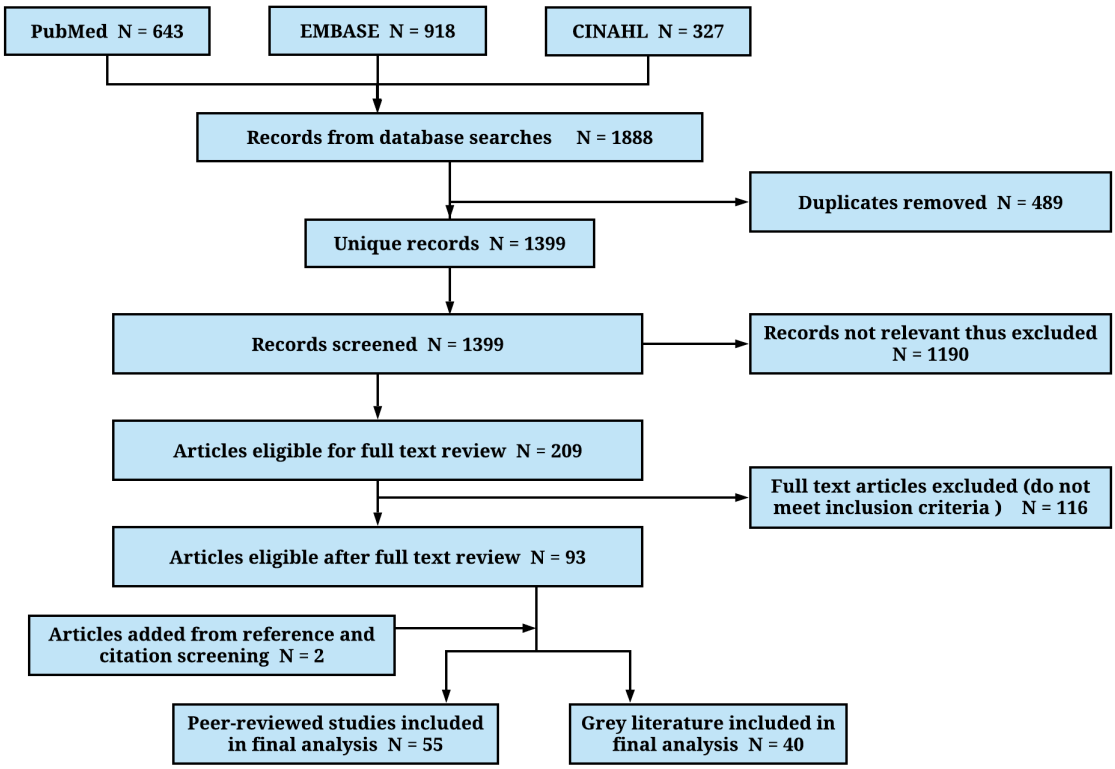


Fig. 1. PRISMA flow diagram

Table 4
Studies by country of origin and type (excluding systematic reviews and studies with unknown location)

	No. peer reviewed studies	No. conference abstracts	No. dissertations and thesis	No. grey literature articles
USA	45	23	3	8
Australia	4	0	0	0
Canada	1	3	0	0
England	0	1	0	0

3.1. Effects on patients

3.1.1. Patient satisfaction

Most of the studies reviewed found that patient satisfaction with the medical visit was high in the pre-scribe period and did not change very much post-scribe. Pre-scribe refers

to the period before scribe implementation, and post-scribe to the period after scribe implementation. Patient attitudes towards scribes tended to be neutral to positive. A recent systematic review found that 7 of 18 studies reported a favorable patient satisfaction with scribes, and no studies reported a negative patient satisfaction (Gottlieb et al., 2021). See Tables D.1 and D.2 in Appendix D for details of studies of scribes which included patient satisfaction surveys or qualitative interviews.

A large study of patient attitudes towards scribes found that among patients who had concerns regarding having a scribe present, some were simply unsure of who exactly the scribe was (Addesso et al., 2019). This study concluded that healthcare providers may need education on how to introduce scribes to patients. Martel et al. (2018) found a slight decrease in patient satisfaction, from 100% to > 90%. Taylor et al. (2019) also reported a slight decrease in patient experience when a scribe was present, however "overall patient experience and satisfaction were not negatively impacted when using scribes" (p. 4).

3.1.2. Willingness of patient to discuss sensitive topics with a scribe present

A concern that has repeatedly been raised in the literature is that patients may not feel comfortable discussing sensitive topics with their physician if a scribe is present (Taylor et al, 2019; Wangenheim, 2018). Issues such as sexual function, mental health, domestic violence, and substance abuse are topics that some patients may rather discuss with their physician alone. The recurrent theme of studies which examined this topic was that most patients were comfortable having a scribe present during their medical visit, even during the discussion of sensitive issues. Dunlop et al. (2018) recommended that physicians be trained to subtly ask the scribe to leave if they sense that the scribe's presence is affecting a patient's comfort level or disclosure of sensitive information. See Table D.3 in Appendix D for a summary of studies that examined this topic.

3.2. Effects on physicians

3.2.1. Physician professional satisfaction

Physicians were overwhelmingly positive about the impact of working with a medical scribe. Quotes frequently mentioned the huge improvement in workload and work hours, along with increased joy of practice, that physicians experienced when working with the assistance of a scribe. Scribe assistance beyond just documentation was valuable to physicians, as they were also able to help with paperwork and forms (Gao et al., 2020; Sattler et al., 2018). A recent systematic review found that 14 of 16 studies reported favorable provider satisfaction with scribes (Gottlieb et al., 2021).

Occasionally physicians provided negative feedback about working with a scribe. Inexperienced scribes may be less effective, and some physicians are frustrated by overlap in areas of the record documented by scribes (Hudson et al., 2020; Martel et al., 2018). Out of approximately 100 physicians in the study by Martel et al. (2018), three later requested not to work with scribes because they preferred to maintain their personal documentation style. See Tables D.4 and D.5 in Appendix D for details of the effects of scribes on physician satisfaction.

3.2.2. Physician burnout

Very few studies directly measured the impact of scribes on physician burnout. Morawski et al. (2017) found that physicians working with scribes showed improvement on all Maslach Burnout Inventory (MBI) sub scores. This was the only study that used the MBI to measure the effects of scribes on physician burnout, though it was categorized as an opinion paper and thus was classified as grey literature in this review (Morawski et al., 2017).

Although they did not directly measure physician burnout, many studies reported that physicians had decreased stress levels when working with a scribe. Physician time spent documenting in the EHR after hours has been shown to be associated with physician burnout (Gardner et al., 2019; Tran et al., 2019). Olson et al. (2019) found that insufficient documentation time increased the odds ratio of physician burnout to 5.63. Approximately 70% of physicians surveyed in Rhode Island reported health information technology-related stress and insufficient time for documentation, and this predicted burnout symptoms (Gardner et al., 2019). Therefore, studies which assessed the effects of scribes on physician documentation-related burden and EHR use after hours may be indicative of the effects of scribes on physician burnout. Studies consistently found that scribes decreased documentation-related burden for physicians during work hours, and decreased physician after-hours work in the EHR. Therefore, it may be inferred that scribes can provide a systems-level approach to decreasing physician burnout, though this issue requires further study (Gao et al., 2020). See Tables D.6 and D.7 in Appendix D for details on this topic.

3.2.3. Physician efficiency

Dramatic reductions in documentation time, both during and after clinic hours, were a recurrent theme. See Tables D.8 and D.9 in Appendix D for details of the effects of scribes on physician efficiency. Some pilot quality improvement studies required that physicians be willing to add extra patients to their clinic sessions in order to work with a scribe, due to management mandated return on investment guidelines (Earls et al., 2017). Other programs that did not have this requirement reported that physicians offered to see extra patients to cover the cost and continue working with a scribe. Morawski et al. (2017) noted that physicians were more likely to add on urgent patients to their schedules on short notice when working with a scribe.

3.3. Interactional effects

3.3.1. Physician-patient relationship

Physician distraction by the EHR/EMR has been assumed to negatively affect the amount of face-to-face time during medical encounters. Several studies identified in this scoping review included observation of physicians by research assistants. The amount of time that physicians spent staring at the computer decreased when they were working with a scribe, while the amount of time spent facing the patient increased. Physicians felt that working with a scribe improved the quality of their interactions with patients. Face-to-face interaction between physicians and patients increased and medical visits were more patient-centered when a scribe was present. See Tables D.10 and D.11 in Appendix D for details of the effects of scribes on the physician-patient relationship.

3.3.2. Scribe-physician team

Interpersonal fit within the scribe-physician team is important, and the working relationship can take time to develop (Danila et al., 2018; Yan et al., 2016). To foster a positive scribe-physician interaction, scribes need to communicate their needs and be able to handle constructive feedback, while physicians need to verbalize what findings they want in the chart note (Corby et al., 2019). Some studies reported that physicians were repeatedly paired with the same scribe, when possible, to facilitate the development of this interprofessional connection. Numerous studies noted the negative effect of rapid scribe turnover on the development and maintenance of this team approach to documentation. See Table D.12 in Appendix D for information on studies which examined the concept of a scribe-physician team.

3.3.3. Concern about the number of people in the room

Several studies raised the concern of too many people in the room if a scribe is present (Keefe et al., 2020; Pozdnyakova et al., 2018b). Some medical offices are very small, and thus may not be large enough to hold the patient, family member(s), translators, medical learners, the scribe, and the physician. Ash et al. (2020) found that many exam rooms are too small to accommodate scribes well. Academic medical centres where medical trainees are common reported that the high level of patient acceptance of scribes at their centres could be due to patients being accustomed to having additional people present during their medical visits (Koshy et al., 2010; C. Lowry et al., 2017; Rohlfing et al., 2019). Zallman et al. (2018) found that the proportion of patients who felt very comfortable with the number of people in the room decreased from 93% to 66% when a scribe was present. DeWitt and Harrison (2018) raised the concern that the presence of a scribe may lead to the exclusion of medical learners if there is not enough space in exam rooms for them.

3.4. Organizational effects

3.4.1. Different need for scribes in academic versus non-academic settings

The difference between the documentation-related burden faced by academic versus non-academic physicians was raised by numerous authors. At academic hospitals affiliated with medical schools, attending physicians often have the assistance of medical students and resident physicians when completing documentation. Several studies noted that scribes are even more valuable in community-based emergency departments, as community hospitals do not have residents and medical students to help attending physicians with documentation (Bastani et al., 2014; Shuaib et al., 2019).

3.4.2. Tasks and model of documentation for scribes need to be clearly defined

As scribes are not a regulated profession and their tasks can vary, the model of documentation assistance provided by scribes needs to be clearly articulated. The Joint Commission recognizes the evolving roles that scribes may take on (The Joint Commission, 2021a). A signed agreement between the physician and the scribe outlining responsibilities and expectations is recommended. Table D.13 in Appendix D outlines the details of possible scribe roles and the need for clarity.

3.4.3. Quality of scribe-generated documentation

Only a few peer-reviewed studies have directly examined the quality of scribed notes. These studies found that scribed notes are of equal or greater quality compared to physician-generated notes. There is widespread agreement that future studies of scribed note accuracy and completeness are needed (Yan et al., 2016). A recent qualitative study that focused on safe use of the EHR by scribes found that scribes, physicians, and managers all felt that scribe documentation was more complete and more accurate than physician documentation, and that standard documentation templates help ensure this high quality (Ash et al., 2020). See Tables D.14 and D.15 in Appendix D for more information on the effect of scribes on documentation quality.

3.4.4. Safety and risks associated with medical scribes

Some concerns about the risks of scribes exist. Campbell et al. (2012) cautioned that documentation errors can occur due to inexperienced scribes who lack adequate knowledge of medical terminology. There is a risk that physicians may not thoroughly review scribed notes for accuracy before note authentication. A study which included numerous specialties and primary care found that once physicians are comfortable with their scribe, they may become complacent and not adequately review scribed notes before signing off on them (Corby et al., 2019). There is not currently a standardized method for evaluating scribe performance and ensuring that their notes are of high quality.

Physicians who rely on scribes may become overly dependent on them, and not be able to navigate an EHR or EMR system when a scribe is not available (Campbell et al., 2012; Corby et al., 2019). Physicians may miss computer prompts and clinical decision support generated by the EHR if a scribe does not alert them to these. Campbell et al. (2012) recommended that physicians direct scribes on the correct response to any alerts that arise during documentation in the EHR/EMR. Some physicians worry that working with a scribe could have a negative cognitive impact, as the act of writing down a medical note can help them to process the medical encounter and remember details better (Corby et al., 2019). A lack of clear boundaries around scribe duties could lead providers to ask scribes to complete tasks beyond their scope, and the power dynamic can exacerbate this risk (Corby et al., 2019). A multicentre randomised trial that encouraged reporting of safety incidents involving scribes did not find evidence of patient harm (Walker et al., 2019).

It is important to avoid inappropriate role expansion of scribes to avoid legal liability (Ash et al., 2020). Conversely, scribes can provide legal protection for physicians by acting as witnesses and/or helping physicians to obtain security assistance in the rare instance of a violent patient (Ash et al., 2020).

3.4.5. Cost

The biggest barrier to implementation of scribes in private practice physician offices may be the cost. This scoping review did not include articles focused only on the economic issues related to scribes, however many of the studies which met inclusion criteria mentioned cost. A recently published study from the United States stated that total costs for scribes are around $25 per hour (Miksanek et al., 2021). The only Canadian peer-reviewed published study stated that scribes were paid $27/hour (Graves et al., 2018).

Table D.16 in Appendix D details scribe salaries noted by the articles in this review. The cost required to purchase computers for scribes also must be factored in.

Although beyond the scope of this review, some studies mentioned that the increased efficiency of physicians when working with scribes may partially or completely cover their cost (Golob et al., 2018; Graves et al., 2018; Martel et al., 2018).

3.4.6. Training scribes in-house vs. scribes contracted from a scribe company

Many of the studies described hiring scribes from professional scribe companies. Comments were made that the cost was higher with the scribe company employees, but that training support was available. Other authors stated that they preferred to train their own scribes (Martel et al., 2018). These tended to be hospital-based programs with more financial resources. One study used volunteer scribes, which the authors described as a mentoring environment for future medical professionals (C. Lowry et al., 2017). They recommended recruiting university students during semesters and training them during academic breaks.

3.4.7. Problem of rapid scribe turnover

Many of the studies included in this scoping review mentioned the problem of rapid scribe turnover (C. Lowry et al., 2017; Yan et al., 2016). Scribes are most often recruited from local universities, and tend to be students interested in healthcare careers, or already enrolled in medical or nursing programs (Martel et al., 2018; J.E. Lowry, 2017). Because they tend to move on to other careers, most only work as scribes for approximately one year (Martel et al., 2018; Miller et al., 2016; Danak et al., 2019). Ash et al. (2020) found that it takes around six months for scribes to become skilled at their jobs. Due to the labour-intensive nature of scribe training, and the importance of developing a physician-scribe working relationship, rapid scribe turnover is a major problem. The importance of repeated pairing of the same physician and scribe to allow team building and scribe learning of physician documentation preferences was emphasized by several authors (Danila et al., 2018; Morawski et al., 2017). The formation of sustainable partnerships cannot take place if scribe turnover is too rapid (Yan et al., 2016). One study mentioned the possibility of medical office assistants taking on the role of scribes to help reduce turnover, though the authors acknowledged that this cross-over role type would be complicated and require further investigation (Danak et al., 2019).

3.5. Effects of scribes on medical students and resident physicians

Scribe presence as part of the healthcare team seems to have a positive effect on medical education. Attending physicians and resident physicians working with scribes reported more time for teaching and patient care. Medical students noted these improvements to their educational experience as well. See Tables D.17 and D.18 in Appendix D for more details of the effects of scribes on medical learners.

A subtheme emerged around the common practice of university students in the United States working as scribes, partly to improve their resumes before applying to medical school (DiSanto & Prasad, 2017; Martel et al., 2018). Some authors have expressed concern that prior experience working as a medical scribe may become an unofficial pre-requisite for applying to medical school (DeWitt & Harrison, 2018). This may create inequity for medical school applicants who do not have the opportunity to work as scribes. Stanford University School of Medicine launched a medical scribe fellowship program in 2015. This program trains postbaccalaureate premedical students in scribing while also providing them with scholarly mentorship, with the goal of helping

students increase their chance of admission to health professional schools (Lin et al., 2020).

A recent phenomenon involves medical students being trained to work as scribes during their time in medical school. A Canadian conference abstract reported that medical students trained as scribes felt that scribing provided them with unique benefits and should be added to the medical school curriculum (Abelev et al., 2020). In the United States, medical students also felt that being trained as scribes improved their education (Delage et al., 2020).

3.6. Lack of standardized/validated measures for assessing satisfaction with scribes

A recurrent issue that was raised as a limitation in studies of scribes was the lack of validated survey instruments to measure the impact of scribes on physician and patient satisfaction (Gottlieb et al., 2021; Koshy et al., 2010; Ou et al., 2017; Platt & Altman, 2019; Taylor et al., 2019; Zallman et al., 2018). This issue prevented meta-analysis by Heaton et al. (2016). Shultz and Holmstrom (2015) conducted a systematic review of scribes and concluded that the lack of validated survey instruments was a major weakness of the identified studies. The lack of validated measurement tools of scribe effects was also noted in the recent systematic review by Gottlieb et al. (2021).

Many of the studies identified in this scoping review that assessed patient and physician satisfaction developed their own survey instruments (see Table E.1 in Appendix E). Most of these used Likert-type scales, while some studies used Press Ganey surveys to measure patient satisfaction.

4. Discussion

In industries where safety is critical, such as the airline industry, the cognitive workloads of employees are carefully monitored (Sinsky & Privitera, 2018). Physicians have not been afforded such consideration. The physician workspace "now consists of a cacophony of warning alerts, pop-up messages, mandatory tick boxes, a Sisyphean inbox, and maddening documentation" (Sinsky & Privitera, 2018, p. 741). Industrial engineers can shadow physicians to determine the tasks they are currently completing that do not require medical expertise (Birznieks & Zane, 2017). Some of these tasks can be handed over to scribes. Scribes can save physicians "cognitive time", by relieving them of documentation and administrative burdens (Gao et al., 2020).

Safety is paramount in healthcare, and medical scribes have the potential to either improve or adversely affect the quality of documentation in the EMR/EHR. Few studies have examined the impact of scribes on safety. A recent qualitative study of scribes conducted using a sociotechnical framework found that healthcare providers, scribes, and managers all considered scribes to be EHR super users (Ash et al., 2020). Medical trainees may consider scribes to be a resource for EHR help (Hafer et al., 2018). Scribes are generally able to learn the documentation style of healthcare providers, and EHR template customization can help to ensure that providers are comfortable with the documentation completeness of scribed chart notes (Ash et al., 2020). Although outside of the scope of this literature review given its publication date, the Joint Commission recently reviewed the literature and updated its statement on medical scribes (The Joint Commission, 2021a). The Joint Commission identified potential quality and safety issues related to medical scribes, which they also refer to as documentation assistants. These

included unclear roles and responsibilities, scribes using practitioner logins rather than independently logging in to the EMR, failure of practitioners to verify scribed notes, and unqualified staff performing documentation assistance (The Joint Commission, 2021a). The Joint Commission provides guidelines to avoid these problems and increase safety, including training scribes in medical terminology, EMR navigation, and proper login procedures, as well as more advanced EMR functionalities, when scribes have a broader scope of tasks (The Joint Commission, 2021a). Healthcare data quality assurance policies should be put in place to ensure the continuous evaluation of data quality in health information systems, and when scribes are involved in documentation their note quality should be included in these policies (Borycki, 2015).

The potential for scribe role expansion under different scribing models can be a potential source of risk, if scribes are asked to take on tasks they are not trained for. Conversely, scribes can help to ensure the safety of both physicians and patients, by helping physicians remember what a patient said or helping to get assistance in a rare adversarial interaction (Ash et al., 2020).

While it is clear that scribes benefit time-stressed physicians, ethical concerns exist. Woodcock et al. (2017) and Wangenheim (2018) raised concerns about the impact of scribes on how patients interact with physicians. Woodcock et al. (2017) stated that "the scribe becomes an actor in the patient encounter and may affect how the patient interacts with the provider" (p. 383). Wangenheim (2018) had the opinion that "scribes improve physicians' difficulties with EHRs, but at the expense of patients' confidentiality" (p. 242). Wangenheim (2018) stated that more studies are needed on the issue of patients' comfort with scribe presence. The studies identified during this scoping review reported that most patients were comfortable having a scribe present during the discussion of sensitive issues. Every effort must be made to explain the purpose of the scribe to patients and to ask for their permission that the scribe be present during the visit. Physicians can ask patients if they feel comfortable with scribe presence when discussing sensitive topics, or if they would prefer if the scribe left the room. Cases often arise where physicians or patients request that a third person be present. Medical students, residents, translators, and family members are often present during medical encounters. A systematic review found that the rate of friend or family member companions attending outpatient medical consultations with older patients is 36-57% (Troy et al., 2019, p. 746). The addition of a medical scribe is thus not necessarily a major change in terms of the presence of an additional person during the medical encounter. Patients already interact with many allied medical professionals during their medical encounters.

Administrative barriers could slow the implementation of scribes in Canadian hospitals. There is only one published peer-reviewed study of scribes in Canada, thus the literature has not yet addressed the issue of how scribes might face administrative barriers in Canada. Medical scribes do not currently require any formal qualifications. Thus, introducing this new role into a hospital could be seen as taking away existing jobs from health professionals or even custodial staff, since any hospital employee could theoretically fill the scribe role. Paradoxically, current hospital employees may not want to work as scribes for a variety of reasons. Transcription staff may not want to switch roles from a job that can be done remotely, to an in-person job that can be physically demanding (Tegen & O'Connell, 2012). For scribes who are hired to round with physicians on hospital wards, "the rounding process is intense. Scribes stand for the entire process, which averages four to five hours in length. There are no breaks." (Tegen & O'Connell, 2012, p. 35).

In Canada it is likely that some type of government assistance would be required to make the cost of scribes feasible for primary care providers. Team-based medical care initiatives are increasing in British Columbia. At these clinics, government funding helps to cover the cost of healthcare professionals to assist family physicians in caring for their patients (Harnett & Kines, 2019). Such a model would lend itself to the addition of scribes to the healthcare team. If government funded multi-disciplinary health clinics included scribes to assist physicians with documentation, it could be a valuable incentive in attracting physicians to under-served rural areas. Scribes have been shown to be a valuable addition to team-based primary care clinics, increasing the benefit from complementary professional roles and a patient-centered approach to care (Sinsky, 2014; Van Tiem et al., 2019).

It is possible that scribes may be a temporary strategy to help physicians cope with EHRs that have poor human factors ratings. Synchronous or asynchronous virtual scribes are an alternative to in-person scribes, as they remove the extra person from the exam room (Bates & Landman, 2018; Benko et al., 2020). However, virtual scribes introduce the risk of remote data transmission because audio recordings of the medical visit are transmitted electronically to remote virtual scribes. The COVID-19 pandemic has increased the uptake of remote scribing, with many in-person scribes having to transition to remote scribing (Gold et al., 2020). Speech recognition technology is another alternative to scribes. It generally necessitates the physician dictating the note after the medical encounter has ended, rather than in real-time as when working with a scribe. Coiera et al. (2018) described a new option of digital scribes. These are documentation support systems that use speech recognition, natural language processing and artificial intelligence to automate documentation (Coiera et al., 2018). These authors acknowledged that digital scribes are still in their infancy and may introduce new patient safety risks. Quiroz et al. (2020) determined that less than 20% of what is said during a general practice patient consultation is required for a summary of the consultation, and that machine learning algorithms to guide the development of digital scribes will need to identify this 20%.

4.1. Limitations

Interpretation of the included articles could be subject to reviewer bias (Pham et al., 2014). The search term "scribe*" was used to maintain breadth of coverage, but it is possible that other terms exist to describe scribes which may have been missed in this search. This review was limited to articles published in English, which may have led to the exclusion of articles from non-English speaking countries. No peer-reviewed articles published in English were identified originating from any countries other than the United States, Australia, and Canada.

The majority of studies identified in this scoping review were from the United States. Clinical notes in the United States were found to be nearly four times longer on average than clinical notes in other countries (Downing et al., 2018). It is possible that the effects of scribes found in the United States may not be generalizable to other countries where clinical notes are briefer.

4.2. Need for future study

Validated survey instruments are needed to standardize the assessment of scribe impact upon physicians and patients. Standardized methods of assessing physician burnout and the possible impact of scribes on this problem are also required. Studies are needed that

address the issue of gender differences and language differences among the three parties of patient, scribe, and physician, and the impact of these differences on patient comfort with the presence of a scribe. The effect of scribe presence during emotionally charged patient disclosure on such sensitive topics as sexual health, mental health, and domestic violence has not been adequately studied (Schiff & Zucker, 2016). The comparison of patient discomfort due to the presence of a scribe versus the physician staring at a computer during the medical visit warrants investigation (Platt & Altman, 2019).

Different types of scribe-provider relationships exist but have not been adequately studied. Documented scribe management styles include pooled, dedicated one-to-one scribe to physician, or hybrid with one scribe working for several providers (Woodcock et al., 2017, p. 383). Additional studies are needed on scribed note quality and accuracy, preferably with blinded observers using a validated instrument (Gidwani et al., 2017; Yan et al., 2016). Another issue that warrants further study is the additional responsibilities that scribes can take on. In an advanced team-based care strategy, medical office assistants act as scribes and also have additional duties (Basu et al., 2018). Scribe role expansion creates the possibility of new safety risks, and requires future study (Ash et al., 2020). A multicentre randomised trial concluded that scribes prevented medical errors, but self-reporting likely led to an underestimate of harms (Walker et al., 2019). No studies have objectively quantified scribe-related safety issues.

5. Conclusion

As health care documentation has digitized, the documentation workload of many physicians has become unmanageable and contributes to burnout. Possible solutions to this documentation-related burden include the use of scribes, EHR/EMR optimization to improve usability, and clinician education on improving EHR/EMR workflow (Gesner et al., 2019, p. 1196). Natural language processing and artificial intelligence are not yet able to relieve physician documentation-related burden, as digital scribes are still in their infancy (Coiera et al., 2018; Gesner et al., 2019). Scribes are viewed as a safe addition to the healthcare team, with best practices implementation providing an opportunity to enhance patient safety (Ash et al., 2020).

While the medical community waits for digital scribes to become a reality and for EHR/EMR vendors to optimize usability, scribes remain a possible salvation for physicians pushed to the brink by documentation demands. EHR redesign is difficult and time consuming, while scribes are potentially a proximate solution. The ability of a physician to provide undivided attention to the patient is a benefit of scribes that would remain even with excellent EHR usability (Martel et al., 2018). With the current staggering EHR/EMR documentation-related burden faced by physicians, scribes are an option that can be considered in Canada. There is not currently any evidence in the literature, other than one pilot proof-of concept study, on whether scribes will fit within the structure of the Canadian healthcare system (Graves et al., 2018). The implementation of scribes in Canadian hospitals may face administrative hurdles, whereas physicians have more autonomy to begin working with scribes in their private offices.

Author Statement

The authors declare that there is no conflict of interest.

Acknowledgements

The authors would like to thank recently retired UVic librarian Rebecca Raworth for her help in refining the database search strategy, as well as recently retired UVic librarian Carol Gordon for her help with using Covidence for the article reviews. Dr. Lisa Shah is currently a student in the Visual and Automated Disease Analytics Graduate Training (VADA) Program, which is supported by the Natural Sciences and Engineering Research Council of Canada (NSERC). Editing of this paper was done while Dr. Lisa Shah received funding from the VADA Program.

ORCID

Lisa Shah https://orcid.org/0000-0002-7377-8433

Elizabeth Borycki https://orcid.org/0000-0003-0928-8867

Justin Shah https://orcid.org/0000-0002-8195-816X

Andre Kushniruk https://orcid.org/0000-0002-2557-9288

References

Abelev, I., Lewis, D., Fraser, J., & Atkinson, P. (2020). P142: Perspectives of medical students and undergraduate students on their experience as medical scribes in the saint john regional hospital emergency department. *Canadian Journal of Emergency Medicine, 22*(S1), S115–S116.

Addesso, L. C., Nimmer, M., Visotcky, A., Fraser, R., & Brousseau, D. C. (2019). Impact of medical scribes on provider efficiency in the pediatric emergency department. *Academic Emergency Medicine, 26*(2), 174–182. doi: 10.1111/acem.13544

Allen, B., Banapoor, B., Weeks, E. C., & Payton, T. (2014). An assessment of emergency department throughput and provider satisfaction after the implementation of a scribe program. *Advances in Emergency Medicine, 2014*: 517319.

American Academy of Emergency Medicine. (2014). *Position statement on medical scribes.* Retrieved from https://www.aaem.org/resources/statements/position/medical-scribes

American College of Emergency Physicians. (2018). *Scribe FAQ.* Retrieved from https://www.acep.org/administration/reimbursement/reimbursement-faqs/scribe-faq/

American College of Medical Scribe Specialists (ACMSS). (2021). *ACMSS MSCAT certification examination program.* Retrieved from https://acmss.org/store/acmss-volume-packages/

American Healthcare Documentation Professionals Group (AHDPG). (2020). *The MSCE credentialing exam*. Retrieved from https://ahdpg.com/scribe-certification/

Anderson, R. E., & Tschirhart, E. (2017). Understanding the impact of medical scribes on primary care practice. *Journal of General Internal Medicine, 32*(Suppl), S367–S367.

Arskey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8*(1), 19–32. doi: 10.1080/1364557032000119616

Ash, J. S., Corby, S., Mohan, V., Solberg, N., Becton, J., Bergstrom, R., … Gold, J. A. (2020). Safe use of the EHR by medical scribes: A qualitative study. *Journal of the American Medical Informatics Association, 28*(2), 294–302.

Bank, A. J., & Gage, R. M. (2015). Annual impact of scribes on physician productivity

and revenue in a cardiology clinic. *ClinicoEconomics and Outcomes Research, 7*, 489–495.

Bank, A. J., Obetz, C., Konrardy, A., Khan, A., Pillai, K. M., McKinley, B. J., … Kenney, W. O. (2013). Impact of scribes on patient interaction, productivity, and revenue in a cardiology clinic: A prospective study. *ClinicoEconomics and Outcomes Research, 5*, 399–406. doi: 10.2147/ceor.S49010

Bastani, A., Shaqiri, B., Palomba, K., Bananno, D., & Anderson, W. (2014). An ED scribe program is able to improve throughput time and patient satisfaction. *The American Journal of Emergency Medicine, 32*(5), 399–402. doi: 10.1016/j.ajem.2013.03.040

Basu, S., Phillips, R. S., Bitton, A., Song, Z., & Landon, B. E. (2018). Finance and time use implications of team documentation for primary care: A microsimulation. *The Annals of Family Medicine, 16*(4), 308–313. doi: 10.1370/afm.2247

Bates, D. W., & Landman, A. B. (2018). Use of medical scribes to reduce documentation burden: Are they where we need to go with clinical documentation? *JAMA Internal Medicine, 178*(11), 1472–1473. doi: 10.1001/jamainternmed.2018.3945

Benko, S., Idarraga, A. J., Bohl, D. D., & Hamid, K. S. (2020). Virtual scribe services decrease documentation burden without affecting patient satisfaction: A randomized controlled trial. *Foot & Ankle Orthopaedics, 4*(4). doi: 10.1177/2473011419S00105

Birznieks, D., & Zane, R. (2017). Process improvement tools, commitment to change lead to serious turnaround. *ED Management, 29*(5), 54–57.

Borycki, E. M. (2015). Towards a framework for teaching about information technology risk in health care: Simulating threats to health data and patient safety. *Knowledge Management & E-Learning, 7*(3), 480–488.

Bossen, C., Chen, Y., & Pine, K. H. (2019). The emergence of new data work occupations in healthcare: The case of medical scribes. *International Journal of Medical Informatics, 123*, 76–83. doi: 10.1016/j.ijmedinf.2019.01.001

Brown, L., Benage, M., Tran, A., & Chapman, D. (2014). 121 impact of scribes upon emergency physician self-assessed authenticity. *Annals of Emergency Medicine, 64*(4 Suppl.), S44.

Bryce, S., Cheema, K., Warrick, B., Mortiz, G., & Lewis, M. (2019). Truro trauma scribes: Students as scribes to improve trauma documentation and educational experience. *Trauma, 21*(3), 229.

Business Wire. (2011, June 13). *The American college of clinical information managers (ACCIM) to set certification criteria and advocacy for medical scribes*. Retrieved from https://www.businesswire.com/news/home/20110613005085/en/American-College-Clinical-Information-Managers-ACCIM-Set

Cabilan, C. J., & Eley, R. M. (2015). Review article: Potential of medical scribes to allay the burden of documentation and enhance efficiency in Australian emergency departments. *Emergency Medicine Australasia, 27*(6), 507–511. doi: 10.1111/1742-6723.12460

Campbell, L. L., Case, D., Crocker, J. E., Foster, M., Johnson, M., Lee, C. A., … Warner, D. (2012). Using medical scribes in a physician practice. *Journal of AHIMA, 83*(11), 64–69.

Canada Health Infoway. (2018). *Connected health information in Canada: A benefits evaluation study*. Retrieved from https://www.infoway-inforoute.ca/en/component/edocman/3510-connected-health-information-in-canada-a-benefits-evaluation-study-document/view-document?Itemid=101

Canadian Medical Association. (2018). *CMA national physician health survey - A national snapshot*. Retrieved from https://www.cma.ca/sites/default/files/2018-11/nph-survey-e.pdf

Cancian, M., Pareek, G., Schiff, S., & Thavaseelan, S. (2017). MP76-13 scribes in

ambulatory urologic practice: Financial analysis and practice management considerations. *The Journal of Urology, 197*(4S): e1018.

Chen, P. W., Dowling, S., Abernethy, R., & Innes, G. (2012). Assessment of scribes in Calgary emergency departments. *Canadian Journal of Emergency Medicine, 14*(Suppl. 1), S29.

Cho, J., Sanchez, K., Ganor, O., Afshar, S., Ruditsky, A., Bierman, A., & Taghinia, A. H. (2019). Utilizing a physician scribe in a pediatric plastic surgical practice: A time-driven activity-based costing study. *PRS Global Open, 7*(10): e2460. doi: 10.1097/gox.0000000000002460

Cleland, D. W. (2017). *Effect of medical scribe use on medical provider productivity and job satisfaction in a walk-in urgent care medical clinic*. Doctoral dissertation, Brandman University, USA.

Coiera, E., Kocaballi, B., Halamka, J., & Laranjo, L. (2018). The digital scribe. *NPJ Digital Medicine, 1*(1), 1–5.

Corby, S., Gold, J. A., Mohan, V., Solberg, N., Becton, J., Bergstrom, R., … Ash, J. S. (2019). A sociotechnical multiple perspectives approach to the use of medical scribes: A Deeper dive into the scribe-provider interaction. In *Proceedings of the AMIA Annual Symposium* (pp. 333–342).

Cowan, T. L., Dunlop, W. A., Ben-Meir, M., Staples, M., Treadwell, A., Gardner-Brunton, E., & Walker, K. J. (2018). 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*(1), 12–17. doi: 10.1136/emermed-2017-206637

Crampton, N. H., Reis, S., & Shachak, A. (2016). Computers in the clinical encounter: A scoping review and thematic analysis. *Journal of the American Medical Informatics Association (JAMIA), 23*(3), 654–665. doi: 10.1093/jamia/ocv178

Danak, S. U., Guetterman, T. C., Plegue, M. A., Holmstrom, H. L., Kadri, R., Duthler, A., … Buis, L. R. (2019). Influence of scribes on patient-physician communication in primary care encounters: Mixed methods study. *JMIR Medical Informatics, 7*(3): e14797. doi: 10.2196/14797

Danila, M. I., Melnick, J. A., Curtis, J. R., Menachemi, N., & Saag, K. G. (2018). Use of scribes for documentation assistance in rheumatology and endocrinology clinics: Impact on clinic workflow and patient and physician satisfaction. *Journal of Clinical Rheumatology, 24*(3), 116–121. doi: 10.1097/rhu.0000000000000620

Delage, B. S., Sherman, K., Halaas, G., & Johnson, E. L. (2020). Getting the predoc back into documentation: Students as scribes during their clerkship. *Family Medicine, 52*(4), 291–294. doi: 10.22454/FamMed.2020.450186

DeWitt, D., & Harrison, L. E. (2018). The potential impact of scribes on medical school applicants and medical students with the new clinical documentation guidelines. *Journal of General Internal Medicine, 33*(11), 2002–2004.

Dick, A. B., Olszynski, P. & Behl, V. (2018). Role of scribes in emergency care in the Saskatoon health region. *Canadian Journal of Emergency Medicine, 20*(Suppl. 1), S67.

DiSanto, R., & Venkat Prasad, M. D. (2017). Scribe utilization in the primary care environment. *The Journal of Medical Practice Management, 33*(1), 66–70.

Downing, N. L., Bates, D. W., Longhurst, C. A. (2018). Physician burnout in the electronic health record era: Are we ignoring the real cause? *Annals of Internal Medicine, 169*(1), 50–51. doi: 10.7326/m18-0139

Dunlop, W., Hegarty, L., Staples, M., Levinson, M., Ben-Meir, M., & Walker, K. (2018). Medical scribes have no impact on the patient experience of an emergency department. *Emergency Medicine Australasia, 30*(1), 61–66.

Dusek, H. L., Goldstein, I., Hribar, M., & Chiang, M. F. (2019). Electronic health records in ophthalmology: Impact of scribes on office visit length, documentation time, and note length. *Investigative Ophthalmology & Visual Science, 60*: 5503.

Earls, S. T., Savageau, J. A., Begley, S., Saver, B. G., Sullivan, K., & Chuman, A. (2017). Can scribes boost FPs' efficiency and job satisfaction? *Journal of Family Practice, 66*(4), 206–214.

Ewelukwa, O., Perez, R., Carter, L. E., Fernandez, A., & Glover, S. (2018). Incorporation of scribes into the inflammatory bowel disease clinic improves quality of care and physician productivity. *Inflammatory Bowel Diseases, 24*(3), 552–557.

Feld, L. D., Laiteerapong, N., Volerman, A., del Castillo, F. F., & Lee, W. W. (2017). Primary care physicians' attitudes on the impact of medical scribes on patient-doctor relationship, physician satisfaction and patient experience. *Journal of General Internal Medicine, 32*(Suppl.), S290–S290.

Gao, R. W., Dugala, A., Maxwell, J., Falconer, P., Birkeland, A. C., Divi, V., & Rosenthal, E. L. (2020). Effect of medical scribes on outpatient oncology visits at a multidisciplinary cancer center. *JCO Oncology Practice, 16*(2), e139–e147. doi: 10.1200/jop.19.00307

Gardner, R. L., Cooper, E., Haskell, J., Harris, D. A., Poplau, S., Kroth, P. J., & Linzer, M. (2019). Physician stress and burnout: The impact of health information technology. *Journal of the American Medical Informatics Association (JAMIA), 26*(2), 106–114. doi: 10.1093/jamia/ocy145

Gesner, E., Gazarian, P., & Dykes, P. (2019). The burden and burnout in documenting patient care: An integrative literature review. *Studies in Health Technology & Informatics, 263*, 1194–1198. doi: 10.3233/SHTI190415

Gidwani, R., Nguyen, C., Kofoed, A., Carragee, C., Rydel, T., Nelligan, I., … Lin, S. (2017). Impact of scribes on physician satisfaction, patient satisfaction, and charting efficiency: A randomized controlled trial. *The Annals of Family Medicine, 15*(5), 427–433. doi: 10.1370/afm.2122

Glynn, A. (2018). *Assessing the impact of scribe use on a pediatric urgent care department one year postimplementation.* Master's thesis, University of Washington, Seattle, USA.

Gold, J. A., Becton, J., Ash, J. S., Corby, S., & Mohan, V. (2020). Do you know what your scribe did last spring? The impact of COVID-19 on medical scribe workflow. *Applied clinical Informatics, 11*(5), 807–811. doi: 10.1055/s-0040-1721396

Golob, J. F., Jr., Como, J. J., & Claridge, J. A. (2018). Trauma surgeons save lives-Scribes save trauma surgeons! *The American Surgeon, 84*(1), 144–148.

Gottlieb, M., Palter, J., Westrick, J., & Peksa, G. D. (2021). Effect of medical scribes on throughput, revenue, and patient and provider satisfaction: A systematic review and meta-analysis. *Annals of Emergency Medicine, 77*(2), 180–189. doi: 10.1016/j.annemergmed.2020.07.031

Graves, P. S., Graves, S. R., Minhas, T., Lewinson, R. E., Vallerand, I. A., & Lewinson, R. T. (2018). Effects of medical scribes on physician productivity in a Canadian emergency department: A pilot study. *CMAJ Open, 6*(3), E360–e364. doi: 10.9778/cmajo.20180031

Hafer, J., Wu, X., & Lin, S. (2018). Impact of scribes on medical student education: A mixed-methods pilot study. *Family Medicine, 50*(4), 283–286. doi: 10.22454/FamMed.2018.933777

Harnett, C. E., & Kines, L. (2019, July 7). *Doctors, staff team up for better care*. Times Colonist. Retrieved from https://www.timescolonist.com/local-news/doctors-staff-team-up-for-better-care-4674136

Heaton, H. A., Castaneda-Guarderas, A., Trotter, E. R., Erwin, P. J., & Bellolio, M. F. (2016). Effect of scribes on patient throughput, revenue, and patient and provider

satisfaction: A systematic review and meta-analysis. *The American Journal of Emergency Medicine, 34*(10), 2018–2028.

Heaton, H. A., Nestler, D. M., Barry, W. J., Helmers, R. A., Sir, M. Y., Goyal, D. G., … Sadosty, A. T. (2019). A time-driven activity-based costing analysis of emergency department scribes. *Mayo Clinic Proceedings: Innovations, Quality & Outcomes, 3*(1), 30–34. doi: 10.1016/j.mayocpiqo.2018.11.004

Heaton, H. A., Wang, R., Farrell, K. J., Ruelas, O. S., Goyal, D. G., Lohse, C. M., … Nestler, D. M. (2018). Time motion analysis: Impact of scribes on provider time management. *The Journal of Emergency Medicine, 55*(1), 135–140.

Heckman, J., Mukamal, K. J., Christensen, A., & Reynolds, E. E. (2020). Medical scribes, provider and patient experience, and patient throughput: A trial in an academic general internal medicine practice. *Journal of General Internal Medicine, 35*(3), 770–774.

Hess, J. J., Wallenstein, J., Ackerman, J. D., Akhter, M., Ander, D., Keadey, M. T., & Capes, J. P. (2015). Scribe impacts on provider experience, operations, and teaching in an academic emergency medicine practice. *Western Journal of Emergency Medicine, 16*(5), 602–610. doi: 10.5811/westjem.2015.6.25432

Hribar, M., Dusek, H. L., Goldstein, I. H., Rule, A., & Chiang, M. F. (2020). Documentation composition and efficiency during scribed and non-scribed ophthalmology visits. *Investigative Ophthalmology & Visual Science, 61*(7): 1587.

Hudson, S. M., Roberts, S., Jacobs, R., Khalili, H., & Patel Gera, M. (2020). *Integration of medical scribes in a general pediatric outpatient clinic: Pilot results studying provider satisfaction.* Perspectives in Health Information Management. Retrieved from https://perspectives.ahima.org/integration-of-medical-scribes-in-a-general-pediatric-outpatient-clinic-pilot-results-studying-provider-satisfaction/

Imdieke, B. H., & Martel, M. L. (2017). Integration of medical scribes in the primary care setting: Improving satisfaction. *The Journal of Ambulatory Care Management, 40*(1), 17–25. doi: 10.1097/jac.0000000000000168

Iqbal, U., Scalise, J., Anwar, H., Scribani, M., Thibodeau, R., & Quadri, A. (2017). Can use of medical scribes bring efficiency in a busy GI lab? 1115. *The American Journal of Gastroenterology, 112*, S611.

Jones, D. D., Thompson, M. S., Colletti, J. E., & Heaton, H. A. (2018). Impact of scribe utilization on resident education and fatigue mitigation. *The American Journal of Emergency Medicine, 36*(10), 1905–1906. doi: 10.1016/j.ajem.2018.02.028

Joseph, A. L., Kushniruk, A. W., Borycki, E. M. (2020). Patient journey mapping: Current practices, challenges and future opportunities in healthcare. *Knowledge Management & E-Learning, 12*(4), 387–404.

Keefe, K. R., Levi, J. R., & Brook, C. D. (2020). The impact of medical scribes on patient satisfaction in an academic otolaryngology clinic. *Annals of Otology, Rhinology & Laryngology, 129*(3), 238–244. doi: 10.1177/0003489419884337

Koshy, S., Feustel, P. J., Hong, M., & Kogan, B. A. (2010). Scribes in an ambulatory urology practice: Patient and physician satisfaction. *The Journal of urology, 184*(1), 258–262. doi: 10.1016/j.juro.2010.03.040

Lancey, R. W. (2019). Impact of medical scribes on physician-patient interactions during outpatient visits. *Journal of General Internal Medicine, 34*(2 Suppl.), S729–S730.

Leeman, S., & Schaal, S. (2019). Analysis of a scribe's impact in an academic ophthalmology clinic. *Investigative Ophthalmology & Visual Science, 60*(9), 5508.

Lerner, R. E., Shapiro, A. C., Richter, S., Craft, C., Menge, M. R., Zylla, D. M., … Holasek, L. (2016). Medical scribes in a community oncology clinic. *Journal of Clinical Oncology. 34*(Suppl. 15), 6585.

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: Advancing the

methodology. *Implementation science, 5*: 69. doi: 10.1186/1748-5908-5-69
Lin, S., Duong, A., Nguyen, C., & Teng, V. (2020). Five years' experience with a medical scribe fellowship: Shaping future health professions students while addressing provider burnout. *Academic Medicine, 96*(5), 671–679.
Lorigiano, T. J. V., McGuire, M. J., Snyder, J. V., Liang, B. V., Rebbert, N. V., Chin, P., & Berkenblit, G. (2020). In-scribing change in an academic resident clinic. *Journal of General Internal Medicine, 35*(Suppl. 1), S665–S666.
Lowry, C., Orr, K., Embry, B., Nguyen, M., Petersen, A., James, C., … Ratanawongsa, N. (2017). Primary care scribes: Writing a new story for safety net clinics. *BMJ Open Quality, 6*(2): e000124. doi: 10.1136/bmjoq-2017-000124
Lowry, J. E. (2017). *Medical students' perspectives on their experiences as medical scribes*. Doctoral Dissertation, Michigan State University, Michigan, USA.
MacPhail, M. E., Main, S. A., Tippins, W. W., Sullivan, A. W., & Rex, D. K. (2018). Impact of scribing history and physical notes and procedure reports on endoscopist efficiency during routine procedures: A proof-of-concept study. *Clinical and Translational Gastroenterology, 9*(8): 174. doi: 10.1038/s41424-018-0042-3
Martel, M. L., Imdieke, B. H., Holm, K. M., Poplau, S., Heegaard, W. G., Pryor, J. L., & Linzer, M. (2018). Developing a medical scribe program at an academic hospital: The Hennepin County Medical Center experience. *The Joint Commission Journal on Quality and Patient Safety, 44*(5), 238–249. doi: 10.1016/j.jcjq.2018.01.001
McCormick, B. J., Deal, A., Borawski, K. M., Raynor, M. C., Viprakasit, D., Wallen, E. M., … Pruthi, R. S. (2018). Implementation of medical scribes in an academic urology practice: An analysis of productivity, revenue, and satisfaction. *World Journal of Urology, 36*(10), 1691–1697. doi: 10.1007/s00345-018-2293-8
McGuire, M. J., Lee, D., Deckert, J., Bastani, H., & Kravet, S. J. (2018). Early impact of scribes on provider efficiency in an EHR. *Journal of General Internal Medicine, 33*(2 Suppl. 1), S776–S777.
Medical Scribe Training Systems. (2020). *Master the medical note with medical scribe training systems*. Retrieved from https://www.medicalscribetraining.net
Medical Scribes Training Institute. (2021a). *Medical scribe certification*. Retrieved from https://medicalscribes.org/medical-scribe-certification/
Medical Scribes Training Institute. (2021b). *Medical scribe programs: Colleges and hospitals*. Retrieved from https://medicalscribes.org/medical-scribe-programs/
Miksanek, T. J., Skandari, M. R., Ham, S. A., Lee, W. W., Press, V. G., Brown, M. T., & Laiteerapong, N. (2021). The productivity requirements of implementing a medical scribe program. *Annals of Internal Medicine, 174*(1), 1–7. doi: 10.7326/m20-0428
Miller, N., Howley, I., & McGuire, M. (2016). Five lessons for working with a scribe. *Family Practice Management, 23*(4), 23–27.
Mishra, P., Kiang, J. C., & Grant, R. W. (2018). Association of medical scribes in primary care with physician workflow and patient experience. *JAMA Internal Medicine, 178*(11), 1467–1472. doi: 10.1001/jamainternmed.2018.3956
Misra-Hebert, A. D., Amah, L., Rabovsky, A., Morrison, S., Cantave, M., Hu, B., Sinsky, C. A., & Rothberg, M. B. (2016). Medical scribes: How do their notes stack up? *The Journal of Family Practice, 65*(3), 155–159.
Misra-Hebert, A. D., Fox, J., Kou, L., Schramm, S., & Rothberg, M. B. (2017). Caregiver burnout in a scribe model and physician financial pressures in outpatient primary care practices. *Journal of General Internal Medicine, 32*(2 Suppl. 1), S134.
Mojeski, J. A., Singh, J., McCabe, J., Colegio, O. R., Rothman, I., & Paragh, G. (2020). An institutional scribe program increases productivity in a dermatology clinic. *Health Policy and Technology, 9*(2), 174–176.
Morawski, K., Childs-Roshak, J., & Weitberg, A. (2017). Scribes: Re-writing the story on patient and provider experience. *Healthcare (Amsterdam), 5*(3), 95–97.

Nambudiri, V. E., Watson, A. J., Buzney, E. A., Kupper, T. S., Rubenstein, M. H., & Yang, F. C. (2018a). Medical scribes in an academic dermatology practice. *JAMA Dermatology, 154*(1), 101–103. doi: 10.1001/jamadermatol.2017.3658

Nambudiri, V. E., Watson, A. J., Rubenstein, M. H., Kupper, T. S., & Yang, F. C. (2018b). Association of patient satisfaction with medical scribe use in an academic dermatology practice. *JAMA Dermatology, 154*(4), 480–482.

Olson, K., Sinsky, C., Rinne, S. T., Long, T., Vender, R., Mukherjee, S., … Linzer, M. (2019). Cross-sectional survey of workplace stressors associated with physician burnout measured by the Mini-Z and the Maslach Burnout Inventory. *Stress Health, 35*(2), 157–175. doi: 10.1002/smi.2849

Ondrey, F. G., & Schutte, D. (2018). Initial analysis of personal use of a medical scribe. *Otolaryngology - Head and Neck Surgery, 159*(1 Suppl. 1), 184–185.

Ou, E., Mulcare, M., Clark, S., & Sharma, R. (2017). Implementation of scribes in an academic emergency department: The resident perspective. *Journal of Graduate Medical Education, 9*(4), 518–522. doi: 10.4300/jgme-d-16-00807.1

Perozich, A., Young, P., Huang, A., Chin, P., Verrier, D., & McGuire, M. J. (2017). An academic community scribe program-partnering for a triple win. *Journal of General Internal Medicine, 32*(2 Suppl. 1), S735.

Pham, M. T., Rajic, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & McEwen, S. A. (2014). A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Research Synthesis Methods, 5*(4), 371–385. doi: 10.1002/jrsm.1123

Platt, J., & Altman, W. (2019). Can medical scribes improve quality measure documentation? *The Journal of Family Practice, 68*(5), E1–E7.

Pozdnyakova, A., Del Castillo, F. F., Volerman, A., Feld, L. D., Wan, W., Burnet, D. L., … Lee, W. W. (2018a). Impact of medical scribes on quality of electronic health record documentation in academic primary care. *Journal of General Internal Medicine, 33*(2 Suppl. 1), S226–S227.

Pozdnyakova, A., Laiteerapong, N., Ham, S., & Lee, W. W. (2019). Impact of medical scribes on clinical productivity in academic primary care. *Journal of General Internal Medicine, 34*(2 Suppl.), S253.

Pozdnyakova, A., Laiteerapong, N., Volerman, A., Feld, L. D., Wan, W., Burnet, D. L., & Lee, W. W. (2018b). Impact of medical scribes on physician and patient satisfaction in primary care. *Journal of General Internal Medicine, 33*(7), 1109–1115.

Quiroz, J. C., Laranjo, L., Kocaballi, A. B., Briatore, A., Berkovsky, S., Rezazadegan, D., & Coiera, E. (2020). Identifying relevant information in medical conversations to summarize a clinician-patient encounter. *Health Informatics Journal, 26*(4), 2906–2914. doi: 10.1177/1460458220951719

Ramirez, R. (2016). TF2 development and deployment of a scribe curriculum in a busy level 1 trauma center emergency medicine residency program. *Annals of Emergency Medicine, 68*(4 Suppl. 1), S151. doi: 10.1016/j.annemergmed.2016.08.413

Rao, S. K., Kimball, A. B., Lehrhoff, S. R., Hidrue, M. K., Colton, D. G., Ferris, T. G., & Torchiana, D. F. (2017). The impact of administrative burden on academic physicians: Results of a hospital-wide physician survey. *Academic Medicine, 92*(2), 237–243.

Rohlfing, M. L., Keefe, K. R., Komshian, S. R., Valentine, A. D., Noordzij, J. P., Levi, J. R., & Brook, C. D. (2019). Clinical scribes and their association with patient experience in the otolaryngology clinic. *Laryngoscope, 130*(4), E134–E139.

Sattler, A., Rydel, T., Nguyen, C., & Lin, S. (2018). One year of family physicians' observations on working with medical scribes. *Journal of the American Board of Family Medicine, 31*(1), 49–56. doi: 10.3122/jabfm.2018.01.170314

Schiff, G. D., & Zucker, L. (2016). Medical scribes: Salvation for primary care or workaround for poor EMR usability? *Journal of General Internal Medicine, 31*(9),

979–981. doi: 10.1007/s11606-016-3788-x
ScribeAmerica. (2021). *Who we are.* Retrieved from https://www.scribeamerica.com/who-we-are/
Seng, S. S., Chang, J. H., Malek, K., Senthil, M., & Lum, S. S. (2019). Quantifying the contribution of medical scribes in an outpatient academic surgical oncology setting. *Journal of the American College of Surgeons, 229*(4 Suppl. 1), S160–S161.
Shuaib, W., Hilmi, J., Caballero, J., Rashid, I., Stanazai, H., Tawfeek, K., … Gaeta, T. J. (2019). Impact of a scribe program on patient throughput, physician productivity, and patient satisfaction in a community-based emergency department. *Health Informatics Journal, 25*(1), 216–224. doi: 10.1177/1460458217704255
Shultz, C. G., & Holmstrom, H. L. (2015). The use of medical scribes in health care settings: A systematic review and future directions. *The Journal of the American Board of Family Medicine, 28*(3), 371–381. doi: 10.3122/jabfm.2015.03.140224
Sinsky, C. A. (2014). *Team documentation: Improve efficiency, workflow, and patient care.* AMA STEPS Forward - Team-Based Learning. Retrieved from https://edhub.ama-assn.org/steps-forward/module/2702598
Sinsky, C. A., Colligan, L., Li, L., Prgomet, M., Reynolds, S., Goeders, L., … Blike, G. (2016). Allocation of physician time in ambulatory practice: A time and motion study in 4 specialties. *Annals of Internal Medicine, 165*(11), 753–760.
Sinsky, C. A., & Privitera, M. R. (2018). Creating a "manageable cockpit" for clinicians: A shared responsibility. *JAMA Internal Medicine, 178*(6), 741–742.
Tai-Seale, M., Olson, C. W., Li, J., Chan, A. S., Morikawa, C., Durbin, M., … Luft, H. S. (2017). Electronic health record logs indicate that physicians split time evenly between seeing patients and desktop medicine. *Health Affairs, 36*(4), 655–662.
Tanaka, M., Marshall, J., Verdick, C., Frederick, R. C., Hevesy, G. Z., Wang, H., & Hafner, J. W. (2012). Emergency medicine resident physician attitudes about the introduction of a scribe program at an academic EM training site. *Academic Emergency Medicine, 19*(Suppl. 1), S30.
Taylor, K. A., McQuilkin, D., & Hughes, R. G. (2019). Medical scribe impact on patient and provider experience. *Military Medicine, 184*(9/10), 388–393.
Tegen, A., & O'Connell, J. (2012). Rounding with scribes: Employing scribes in a pediatric inpatient setting. *Journal of AHIMA, 83*(quiz 39), 34–38.
The Joint Commission. (2021a). *Documentation assistance provided by scribes.* Retrieved from https://www.jointcommission.org/standards/standard-faqs/ambulatory/record-of-care-treatment-and-services-rc/000002210/
The Joint Commission. (2021b). *What is the joint commission?* Retrieved from https://www.jointcommission.org/about-us/facts-about-the-joint-commission/joint-commission-faqs/
Thompson, M., Colletti, J., & Heaton, H. A. (2016). 35 observational survey of the impact of scribe utilization on resident education and fatigue mitigation. *Annals of Emergency Medicine, 68*(4 Suppl. 1), S15–S16.
Tran, B., Lenhart, A., Ross, R., & Dorr, D. A. (2019). Burnout and EHR use among academic primary care physicians with varied clinical workloads. In *Proceedings of the AMIA Joint Summits on Translational Science* (pp. 136–144).
Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine, 169*(7), 467–473. doi: 10.7326/M18-0850
Troy, E., Doltani, D., & Harmon, D. (2019). The role of a companion attending consultations with the patient. A systematic review. *Irish Journal of Medical Science, 188*(3), 743–750. doi: 10.1007/s11845-018-1920-0
Van Tiem, J. M., Stewart Steffensmeier, K. R., Wakefield, B. J., Stewart, G. L., Zemblidge, N. A., Steffen, M. J. A., & Moeckli, J. (2019). Taking note: A qualitative

study of implementing a scribing practice in team-based primary care clinics. *BMC Health Services Research, 19*(1), 574. doi: 10.1186/s12913-019-4355-z

Villumsen, S., & Nøhr, C. (2017). National monitoring and evaluation of health IT: Protocol for a scoping review. *Studies in Health Technology and Informatics, 234*, 352–357. doi: 10.3233/978-1-61499-742-9-352

Walker, K., Ben-Meir, M., Dunlop, W., Rosler, R., West, A., O'Connor, G., … Staples, M. (2019). Impact of scribes on emergency medicine doctors' productivity and patient throughput: Multicentre randomised trial. *BMJ, 364*: l121. doi: 10.1136/bmj.l121

Walker, K. J., Wang, A., Dunlop, W., Rodda, H., Ben-Meir, M., & Staples, M. (2017). The 9-item physician documentation quality instrument (PDQI-9) score is not useful in evaluating EMR (scribe) note quality in emergency medicine. *Applied Clinical Informatics, 8*(3), 981–993. doi: 10.4338/aci2017050080

Wangenheim, P. M. (2018). Scribes, electronic health records, and the expectation of confidentiality. *The Journal of Clinical Ethics, 29*(3), 240–243.

Wegg, B., Deibel, M., & Kiernan, C. (2014). 162 Advancing resident training with the use of scribes. *Annals of Emergency Medicine, 64*(4 Suppl. 1), S59.

Williams, K., Mitra, A., Anderson, W., & Bastani, A. (2016). 50 Who is the other person in the room: Patient attitudes towards emergency department medical scribes. *Annals of Emergency Medicine, 68*(4 Suppl. 1), S22.

Woodcock, D. V., Pranaat, R., McGrath, K., & Ash, J. S. (2017). The evolving role of medical scribe: Variation and implications for organizational effectiveness and safety. *Studies in Health Technology and Informatics, 234*, 382–388.

Wright, A., Strickland, S., Grove, C., & Wright, S. (2019). 1311: Implementation of a scribe program in a neuroscience ICU: Effects and results. *Critical Care Medicine, 47*(1), 632.

Yan, C., Rose, S., Rothberg, M., Mercer, M. B., Goodman, K., & Misra-Hebert, A. D. (2018). Patient perspectives on clinical scribes in primary care. *Journal of General Internal Medicine, 33*(11), 1859–1861.

Yan, C., Rose, S., Rothberg, M., Mercer, M., Goodman, K., Misra-Hebert, A., … Misra-Hebert, A. D. (2016). Physician, scribe, and patient perspectives on clinical scribes in primary care. *Journal of General Internal Medicine, 31*(9), 990–995.

Younge, V. L., Borycki, E. M., & Kushniruk, A. W. (2015). On-the-job training of health professionals for electronic health record and electronic medical record use: A scoping review. *Knowledge Management & E-Learning, 7*(3), 436–469.

Zallman, L., Finnegan, K., Roll, D., Todaro, M., Oneiz, R., & Sayah, A. (2018). Impact of medical scribes in primary care on productivity, face-to-face time, and patient comfort. *The Journal of the American Board of Family Medicine, 31*(4), 612–619.

Zhong, C. S., Mostaghimi, A., & Nambudiri, V. E. (2019). Impact of medical scribes on dermatology trainee and attending experience. *Dermatology Online Journal, 25*(10): 4.

Appendix A

Joint Commission definition of a medical scribe

The Joint Commission is an independent, not-for-profit organization that "accredits and certifies more than 22,000 health care organizations and programs in the United States" (The Joint Commission, 2021b).

As per the Joint Commission (retrieved Feb. 21, 2021):

> The Joint Commission has previously defined scribes as unlicensed personnel and prohibited them from entering orders. However, due to the emergence of models including both licensed and unlicensed personnel of varying levels of skill and clinical knowledge, that previous definition is no longer valid or appropriate. There are individuals with the official title of "scribe" for whom documentation assistance is their only role, and there are individuals who perform dual roles that include clinical responsibilities as well as documentation assistance (The Joint Commission, 2021a).

Appendix B

Position statement of the American Academy of Emergency Medicine on medical scribes

American Academy of Emergency Medicine Position Statement on Medical Scribes (American Academy of Emergency Medicine, 2014):

> Medical scribes should be considered ancillary staff members employed to assist the emergency physician with data entry and documentation requirements. Their function should be to free the emergency physician to focus on clinical duties. All information entered or generated in a health care record by a medical scribe should be reviewed for accuracy by the treating emergency medicine physician. The documentation generated by a medical scribe is by necessity an accurate reflection of the encounter between the emergency medicine physician and the patient. Medical scribes should be prohibited from taking liberties with documenting from their own perspective. The medical scribe duties should not include independent interaction with a patient, order entry or selection of discharge plans or documents.

Appendix C

Organizations in the USA offering medical scribe certification exams

The American College of Clinical Information Managers was formed in 2011 (ACCIM) (Campbell et al., 2012, p. 67). As noted by Bossen et al. (2019)

> The formation of the ACCIM association was the initiative of the scribe company, ScribeAmerica, which three years later in 2014 emphasized the arms-length

> relations between the company and the association, ACCIM, by transforming ACCIM to the American College of Medical Scribe Specialists (ACMSS) (p. 78).

Dr. Michael Murphy was listed as the President of the ACCIM in the press release for its formation in 2011 (Business Wire, 2011, June 13). He was also the CEO of ScribeAmerica, establishing it in 2003 (ScribeAmerica, 2021). ScribeAmerica reports that it has over 25,000 employees in 50 states (ScribeAmerica, 2021). The number of scribes is increasing along with the adoption rate of EMRs (DiSanto & Prasad, 2017).

The American College of Medical Scribe Specialists (ACMSS) provides licensing for Certified Medical Scribe Specialists (CMSS). The ACMSS offers a Medical Scribe Certification and Aptitude Test (MSCAT) to become a CMSS. Individuals must complete the CMSS educational program or be certified healthcare personnel to be eligible to take the 2-hour MSCAT examination (American College of Medical Scribe Specialists (ACMSS), 2021).

Medical scribes are endorsed by the American Healthcare Documentation Professionals Group (AHDPG). The AHDPG offers Certified Medical Scribe Professional (CMSP) credentialing through the Medical Scribe Certification Exam (MSCE) (American Healthcare Documentation Professionals Group (AHDPG), 2020). Other companies in the United States also offer their own medical scribe certification courses and certificates (Medical Scribe Training Systems, 2020; Medical Scribes Training Institute, 2021a). Many colleges and some hospitals in the United States also offer medical scribe training programs (Medical Scribes Training Institute, 2021b).

Appendix D

Data charting

Table D.1
Effects of scribes on patient satisfaction – Peer-reviewed studies

Table D.1	
Patients feeling comfortable with a scribe being present	• 96% in rheumatology & endocrinology (Danila et al., 2018) • 82% in family medicine (Earls et al., 2017) • 97% in urology (McCormick et al., 2018) • 96% in family medicine (Platt & Altman, 2019) • 98% in primary care (Yan et al. 2018) • 69% in primary care (Zallman et al., 2018)
Patient satisfaction high and remained unchanged by the presence of a scribe	• In pediatric emergency medicine (Addesso et al., 2019) • In cardiology (Bank et al., 2013) • In family medicine (Danak et al., 2019) • In rheumatology & endocrinology (Danila et al., 2018) • In emergency medicine (Dunlop et al., 2018) • In family medicine (Gidwani et al., 2017) • In internal medicine, despite medical appointments being shortened by 25% when scribes were present (Heckman et al., 2020) • In otolaryngology (Keefe et al., 2020)

	• In primary care (C. Lowry et al., 2017) • In urology (McCormick et al., 2018) • In otolaryngology (Rohlfing et al., 2019) • In emergency medicine (Shuaib et al., 2019)
Patient attitudes towards scribes neutral to positive	• In cardiology (Bank et al., 2013) • In primary care (Mishra et al., 2018) • In family medicine (Platt & Altman, 2019) • In internal medicine (Pozdnyakova et al., 2018b) • In otolaryngology (Rohlfing et al., 2019) • In emergency medicine (Shuaib et al., 2019) • In primary care (Yan et al, 2018)
Patients more satisfied with medical office visit when a scribe was present	• 43% of patients in emergency medicine (Addesso et al., 2019) • Patient satisfaction with the emergency physician increased from 72% pre-scribe to 87% post-scribe (Bastani et al., 2014) • Patient satisfaction scores increased from 6.8/10 pre-scribe to 9.2/10 post-scribe in gastroenterology (Ewelukwa et al., 2018) • 61% of patients in primary care (Mishra et al., 2018) • 61% of patients in family medicine (Platt & Altman, 2019) • 77% of patients in otolaryngology (Rohlfing et al., 2019) • 31% in primary care (Yan et al., 2018)
Impact of gender on patients feeling comfortable with a scribe being present	• 93% of patients reported that scribe gender did not have any effect on their satisfaction with the medical visit (Koshy et al., 2010) • 39% of female patients seeing a female dermatologist preferred a female scribe (Nambudiri et al., 2018a) • Male patients were more likely than female patients to report that they disliked having a scribe present; the only scribe in this study was female (Pozdnyakova et al., 2018b) • 68% of patients were comfortable with a scribe of a different gender being present (Yan et al., 2018)

Table D.2
Effects of scribes on patient satisfaction – Grey literature

Table D.2	
Primary care	• All dimensions of patient experience were improved post-scribe (Morawski et al., 2017) • No change in patient satisfaction (Perozich et al., 2017)
Emergency medicine	• A thesis study found that patient satisfaction in a pediatric urgent care setting increased slightly post-scribe (Glynn, 2018) • Patient attitudes towards scribes were "generally positive" (average attitude score of 3.7 out of 5) (Williams et al., 2016)
Speciality clinics	• In a community cancer center, 90% of patients were comfortable with a scribe present & patient satisfaction remained high (Lerner et al., 2016) • Among various specialities, patient satisfaction unchanged post-scribe (Miller et al., 2016) • Patient satisfaction increased in dermatology (Nambudiri et al.,

	2018b) • Patient (parent) satisfaction increased post-scribe in a pediatric inpatient setting (Tegen & O'Connell, 2012)

Table D.3
Willingness of patient to discuss sensitive topics with a scribe present

Table D.3	
Studies of urologic and sexual history taking	• Patients were comfortable discussing urological & sexual function with a scribe present at a urology practice (Koshy et la., 2010) • 57% of male patients & 79% of female patients were at least "somewhat comfortable" discussing sexual health with a scribe present; all scribes in this study were female (Yan et al., 2018)
Emergency department study	• Patients' disclosure of medical information in the ER unlikely to be affected by presence of scribes (Dunlop et al., 2018)
Family medicine studies	• Some physicians ask the scribe to leave the room during sensitive exams (Danak et al., 2019) • Patients reported a high level of comfort with scribes & scribe presence did not affect what they told their physicians (Earls et al, 2017) • Less than 10% of patients declined to have a scribe present (Earls et al., 2017) • Primary care physicians expressed concerns that a scribe's presence "may hinder the full transparency of a patient's concerns" and thus told patients that the scribe could step out of the room if the patient wanted to discuss something privately; this occurred less than 5 times during this study (Taylor et al., 2019, p.3)

Table D.4
Effects of scribes on physician professional satisfaction – Peer-reviewed studies

Table D.4	
Increased workplace satisfaction and quality of life post-scribe	• 88% of providers in emergency medicine (Addesso et al., 2019) • 90% of providers in emergency medicine (Allen et al., 2014) • Physicians described lower stress, less exhaustion in emergency medicine (Cowan et al., 2018) • Family physician morale increased post-scribe despite 29% increased patient volume as mandated by return-on-investment requirement set by management (Earls et al., 2017) • 100% of oncologists agreed that working with a scribe improved their quality of life (Gao et al., 2020) • Physicians in family medicine who worked with a scribe had 10.8 adjusted odds of having high satisfaction with their workday (Gidwani et al., 2017) • Internal medicine physicians in the USA did not feel more rushed despite visit lengths being shortened by 25% when they had the assistance of a scribe (Heckman et al., 2020) • Significant improvements in clinician satisfaction (Martel et al.,

	2018) • Increased work satisfaction overall in urology (McCormick et al., 2018) • 94% of primary care physicians (Mishra et al., 2018) • 33% of internists were satisfied with clinic workflow pre-scribe, 100% were satisfied post-scribe (Pozdnyakova et al, 2018b) • 100% of family physicians reported increased joy of practice (Sattler et al., 2018)
Satisfaction with work hours	• In primary care setting study estimated that scribes saved physicians approximately 60 minutes per day (DiSanto & Prasad, 2017) • Trauma surgeons were able to leave work on time post-scribe and reported increased satisfaction (Golob et al., 2018) • Urologists were more satisfied with office hours when working with a scribe: 19% pre-scribe vs. 69% post-scribe (Koshy et al., 2010) • Emergency physician satisfaction increased from 66% pre-scribe to 81% post-scribe (Shuaib et al., 2019)
Decreased documentation burden post-scribe	• Cardiologists estimated that working with a scribe saved them 2.5 hours/day (Bank & Gage, 2015) • Reported by emergency medicine physicians (Cowan et al., 2018) • Oncologists spent significantly less time documenting at the end of clinic & at home when working with a scribe (Gao et al., 2020) • Family physicians reported 86 times the adjusted odds ratio of high satisfaction with the amount of time spent charting post-scribe (Gidwani et al., 2017) • Documentation time decreased by 33% on average in emergency medicine (Heaton et al., 2019) • 36% relative reduction in time spent charting in emergency medicine (Hess et al., 2015) • Physician documentation time in primary care decreased by > 50% (Imdieke & Martel, 2017) • 75% of providers rated documentation time at the office as poor pre-scribe, and only 24% rated it as poor post-scribe (Martel et al., 2018) • All physicians reported this in a urology practice (McCormick et al., 2018) • Reported by dermatologists (Nambudiri et al., 2018a) • 83% of internists were dissatisfied with time for documentation pre-scribe, 0% were dissatisfied post-scribe (Pozdnyakova et al., 2018b)

Table D.5
Effects of scribes on physician professional satisfaction – Grey literature

Table D.5	
Primary care	• 67% of physicians felt greater professional competence when working with a scribe (Anderson & Tschirhart, 2017) • Pediatricians reported increased satisfaction post-scribe (Glynn, 2018) • Physicians reported increased "joy of practice" (Perozich et al., 2017)
Emergency medicine	• Physicians in Calgary reported increased job satisfaction and decreased time spent on clerical tasks when they had the assistance of a scribe (Chen et al, 2012) • Physician satisfaction in urgent care increased post-scribe (Cleland, 2017) • Physicians in Saskatoon noted a 33% mean decrease in mental fatigue, a 23% mean decrease in physical fatigue, and a 10% mean increase in work enjoyment (Dick et al., 2018) • Physician well-being improved post-scribe (Ramirez, 2016)
Specialty clinics	• Urologists reported an average decrease of 5.9 hours in after-hours EHR documentation when working with a scribe, which contributed to an improvement in quality of life (Cancian et al, 2017) • Ophthalmologists had average satisfaction increase of 14.28% from baseline when a scribe was present (Leeman & Schaal, 2019) • Oncologists reported increased satisfaction with work hours, amount of time spent with patients, and work-life balance post-scribe (Lerner et al., 2016) • Physicians in various specialities reported increased satisfaction post-scribe, regardless of their degree of EHR-savviness (Miller et al., 2016) • Dermatologists reported decreased documentation burden and increased job satisfaction post-scribe (Nambudiri et al., 2018a)

Table D.6
Effects of scribes on physician burnout – Peer-reviewed studies

Table D.6	
Decrease in physician burnout post-scribe	• Physician burnout not measured objectively but subjectively surgeon burnout was decreased (Golob et al, 2018) • Physicians in an orthopedic clinic reported considerable drop in burnout (Martel et al., 2018)
Physicians feeling their skills were more effectively utilized post-scribe	• 82% of pediatric emergency medicine physicians felt this way & authors of this study noted that increased feelings of effectiveness lower the risk of burnout (Addesso et al., 2019)
Decreased physician stress levels at work post-scribe	• 80% of emergency medicine providers noted decreased work stress (Allen et al., 2014) • Emergency medicine physicians reported decreased stress and exhaustion (Cowan et al., 2018) • Oncologists reported savings of "cognitive time" when scribes

	relieved them from the mental load of documentation & administrative work (Gao et al., 2020) • Family medicine physicians reported decreased stress levels (Platt & Altman, 2019) • 83% of internal medicine physicians reported decreased stress at work & at home post-scribe (Pozdnyakova et al., 2018b)
Time spent charting at home, after hours, post-scribe, which may be viewed as a potential marker of physician burnout	• Time spent working at home decreased by 38% in a family medicine study (Earls et al., 2017) • Decreased as reported by oncologist survey (Gao et al., 2020) • Fewer progress notes were written in late evening post-scribe (Golob et al., 2018) • Decreased post-shift documentation by approximately 50% in emergency medicine (Heaton et al., 2018) • Decreased post-shift documentation from 67 minutes to 16 minutes in emergency medicine (Heaton et al., 2019) • Decreased from 30 minutes to 14 minutes after clinic sessions in primary care clinics (C. Lowry et al., 2017) • Decrease in excessive time spent on the EHR at home from 64% pre-scribe to 32% post-scribe (Martel et al., 2018) • In primary care, after-hours EHR work > 1 hour on weekdays decreased from 69% of physicians pre-scribe to 17% post-scribe (Mishra et al., 2018) • All urologists in this study reported decrease in after-work & weekend hours spent on EHR documentation (McCormick et al., 2018) • Primary care physicians reported decreased after work charting in the EHR from 20-26 hours weekly pre-scribe to less than 10 hours post-scribe (Taylor et al., 2019)
Work-life balance	• 90% of emergency medicine providers reported increased quality of life post-scribe & 70% reported decreased stress at home post-scribe (Allen et al., 2014) • Scribes provided intangible benefits to physicians in terms of work-life balance (Martel et al., 2018) • Family physicians expressed “great satisfaction with having more time to spend with their families” (Sattler et al., 2018, p.54) • Primary care physicians reported improved work-life balance post-scribe (Taylor et al., 2019)

Table D.7
Effects of scribes on physician burnout – Grey literature

Table D.7	
Primary care	• 93% of physicians reported decreased emotional exhaustion when working with a scribe (Anderson & Tschirhart, 2017) • Misra-Hebert et al. (2017) assessed physician burnout levels with a survey that included the Maslach Burnout Inventory (MBI). These authors did not find significant differences in MBI scores between physicians working with or without a scribe, but only 12% of the physicians in this study worked with a scribe
Emergency medicine	• A study at an academic emergency department measured a "self-assessed authenticity score" which included a burnout subscale (Brown et al., 2014) • Brown et al. (2014) found that working with scribes mitigated factors thought to lead to physician burnout, and increased physician self-assessed authenticity
Specialty clinics	• Dermatologists reported decreased burnout factors post-scribe (Nambudiri et al., 2018a)

Table D.8
Effects of scribes on physician efficiency – Peer-reviewed studies

Table D.8	
Medical visit duration when working with a scribe	• Visit duration in cardiology (including documentation) was 37% shorter post-scribe (Bank et al., 2013) • Door-to-doc time in emergency department decreased from 74 minutes pre-scribe to 61 minutes post-scribe (Bastani et al., 2014) • Duration of visits was an average of 1.58 min. shorter when a scribe was present in a pediatric plastic surgery clinic (Cho et al., 2019) • Decreased from average of 31 minutes to 18 minutes in a gastroenterology clinic (Ewelukwa et al., 2018) • Oncology visit durations decreased by 11-14% (Gao et al., 2020) • Decreased by 31% in an emergency department as measured by time-motion analysis (Shuaib et al., 2019)
Physician time saved per day due to working with a scribe	• Physicians working with scribes estimated that scribes saved them 2.5 hours/day due to decreased documentation burden, despite seeing approx. 10% more patients per day (Bank & Gage, 2015) • 13% decrease in time spent in the clinic, despite 29% increase in appointments in a primary care study (Earls et al., 2017) • 61 minutes in emergency medicine (Heaton et al., 2019) • 36% relative reduction in time spent charting in emergency medicine (Hess et al., 2015) • 70% of physicians were more efficient post-scribe in primary care clinics (C. Lowry et al., 2017) • Scribing saved a gastroenterologist 41 min. over a 6.5 h

	endoscopy session in a proof-of-concept study, enough time to schedule an additional procedure or complete other tasks (MacPhail et al., 2018) • 1.5 hours per day for family physicians (Platt & Altman, 2019)
Physicians seeing more patients per day	• Cardiologists with scribes saw 9.6% more patients per hour (Bank & Gage, 2015) • Patient appointments per clinical session increased by 29% in a primary care study (Earls et al., 2017) • Emergency physicians with scribes saw 12.9% more patients per hour per physician (Graves et al., 2018) • Internists working with a scribe had increased efficiency without negative effects on physicians or patients (Heckman et al., 2020) • Urologists working with a scribe saw 25% more patients per day (McCormick et al., 2018) • Dermatologists saw 33% more patients per clinic post-scribe (Mojeski et al., 2020) • Emergency physicians' productivity increased post-scribe: patients per hour per doctor increased 15.9% and primary consultations per hour per doctor increased 25.6% (Walker et al., 2019)

Table D.9
Effects of scribes on physician efficiency – Grey literature

Table D.9	
• Medical office visit duration	• Primary care provider EHR system time per appointment & documentation time decreased with a scribe, while overall provider efficiency profile score increased post-scribe (McGuire et al., 2018) • Single otolaryngologist increased number of patients seen per day by 2.93%, clinical workday decreased by 11-17% (Ondrey & Schutte, 2018) • Number of patients seen per clinic session & time to check-out improved but not significantly in a general internal medicine clinic (Pozdnyakova et al., 2019) • Mean number of patients seen per day increased post-scribe (Seng et al., 2019)
• Documentation time	• Physician note completion in urgent care significantly shorter post-scribe (Cleland, 2017) • Scribe use in ophthalmology clinics significantly decreased physician documentation time (Dusek et al., 2019; Hribar et al., 2020) • Internists reported decreased after-hours documentation & clerical burdens, and were willing to add on patients to their schedules for urgent care (Morawski et al., 2017) • Time spent documenting outside of clinic times decreased (Ondrey & Schutte, 2018) • In emergency medicine scribes decreased charting time

	(Ramirez, 2016)
• Procedure time	• Gastroenterology clinic pre-op time & procedure length decreased significantly when a scribe was present (Iqbal et al., 2017)

Table D.10
Effects of scribes on the physician-patient relationship – Peer-reviewed studies

Table D.10	
Amount of time physician spent starting at a computer screen decreased post-scribe	• In a cardiology outpatient clinic (Bank et al., 2013) • In emergency medicine (Cowan et al., 2018) • Patients reported physicians used the computer less often when a scribe was present (53% post-scribe vs. 93% pre-scribe) (Danak et al., 2019) • Emergency physicians spent one-third of their shift interacting with the EHR pre-scribe; this decreased by 30% post-scribe (Heaton et al., 2018) • In primary care (Mishra et al., 2018) • In primary care (Van Tiem et al., 2019) • Physician time spent facing the computer decreased by 27% & time spent facing the patient increased by 57% post-scribe (Zallman et al., 2018)
Face-to-face interaction between physicians & patients increased when a scribe was present	• Direct interaction increased > fourfold in cardiology (Bank et al., 2013) • 76% of physicians felt that scribes increased the amount of time they were able to spend with patients, and they estimated a relative increase of 30% in time spent with patients (Hess et al., 2015) • Time spent in direct patient interaction doubled (Shuaib et al., 2019)
Medical visits more patient-centered post-scribe	• In outpatient urology (Koshy et al., 2010) • Team-based care created through scribing allowed for more engagement between providers & patients (Van Tiem et al., 2019)
Physicians reported increased quality of interactions with patients post-scribe	• 78% of pediatricians reported this (Addesso et al., 2019) • Patients in the ER liked having more information verbalized by their physician & had fewer questions post-scribe (Cowan et al., 2018) • Increased uptake of vaccinations & increased referrals for bone density tests in a gastroenterology clinic (Ewelukwa et al., 2018) • Physician noted better relationships & face-to-face conversations with patients (Ewelukwa et al., 2018) • 89% of primary care physicians reported this (Mishra et al., 2018) • Family physicians felt that working with a scribe contributed to better connections with patients & better care (Platt & Altman, 2019) • 83% of physicians reported this (Pozdnyakova et al., 2018b)

	• Primary care physicians reported having more time to engage more fully with patients post-scribe (Taylor et al., 2019) • Evidence of improved physician-patient interactions through interviews with patients, physicians, and scribes (Yan et al., 2016)
Physician ability to focus on the patient improved post-scribe	• Oncologists noted improved patient-physician interactions when not having to attend to the computer screen (Gao et al., 2020) • Qualitative feedback was that physicians were better able to pay undivided attention to patients post-scribe (Martel et al., 2018) • One third of patients felt that physicians were more focused on them post-scribe (Pozdnyakova et al., 2018b) • Patients felt that having a scribe present "definitely positively impacted the visit" 77% of the time (Rohlfing et al., 2019, p. 3) • Physicians were better able to pay attention to patient body language when working with a scribe (Sattler et al., 2018) • Primary care physicians were less distracted by the computer & had improved eye contact with patients post-scribe (Yan et al., 2016)

Table D.11
Effects of scribes on the physician-patient relationship – Grey literature

Table D.11
• Internal medicine physicians spent more time facing the patient (57% vs. 49%) and less time facing the EHR (27% vs. 38%) when working with a scribe (Lancey, 2019) • Patients felt that their internist physician gave them undivided attention more often when working with a scribe (97% vs. 83%) (Lancey, 2019) • Dermatology patients reported that scribes improved the patient-doctor experience (Nambudiri et al., 2018b)

Table D.12
Scribe-physician team

Table D.12	
Some programs had initial challenges in scribe implementation, others didn't	• Impact of scribes in this study was not delayed in onset, and authors stated this meant that "providers needed minimal time to adjust to the new workflow" (Addesso et al., 2019, p. 180) • "Warm up" period of 2 to 4 weeks was required before scribes decreased documentation burden for physicians (DiSanto & Prasad, 2017) • Scribes can review physicians' modifications to their scribed notes to learn a particular physician's style (DiSanto & Prasad, 2017) • Pilot study in a pediatric outpatient clinic found that physicians felt scribes needed more training in medical terminology, navigating the EMR, & effective use of note templates (Hudson et al., 2020)

	• Some physicians may struggle with relinquishing total control of their documentation, and they must learn to call out their physical exam findings for the scribe to document (Yan et al., 2016) • Depending on their educational background, some scribes may have a big learning curve for medical terms (Yan et al., 2016)
Repeated pairing of same physician and scribe	• Emergency physicians preferred to work with the same scribe over time if they had a good working relationship (Cowan et al., 2018) • Each physician was assigned to work with the same scribe during the study (Danila et al., 2018) • Urologists worked with the same scribe each week (McCormick et al., 2018) • Scribes and physicians were repeatedly paired together when possible, to improve team building and a scribe's familiarity with a physician's documentation preferences (Morawski et al., 2017) • Physicians were matched with scribes of their choosing when possible, to increase physician autonomy (Shuaib et al., 2019)
Teamwork between physician & scribe	• Matching personalities of scribes & providers important to forming a high-quality working relationship (Corby et al., 2019) • Several physicians noted that the scribe-physician working relationship improved with time (Cowan et la., 2018) • Working relationship between physicians & scribes "develops slowly and is dependent on interpersonal fit within the physician-scribe team "(Danila et al., 2018, p. 119) • Scribing had a generative effect through improved teamwork and interprofessional connections (Van Tiem et al., 2019)
Problem of rapid scribe turnover	• In primary care this is a major concern of physicians (Anderson & Tschirhart, 2017; Danak et al., 2019) • 2 of 3 scribes resigned from the contracted commercial scribe company during a pilot study & had to be replaced, which interrupted the study (Hudson et al., 2020) • Major problem in primary care clinics (C. Lowry et al., 2017) • Adaptability and trust between the physician and scribe are important, and requires staff continuity to develop; high scribe turnover limits sustainable partnerships from forming (Yan et al., 2016)

Table D.13
Need for clarity in scribe role

Table D.13	
Need for clear scope of practice for scribes	• In their study of Veterans Health Administration clinics which have implemented scribes, Van Tiem et al. (2019) recommended that a clear scope of practice for scribes in outpatient clinics be developed when implementing scribes
Basic scribe role vs. advanced role	• The AMA Steps Forward Team Documentation module describes two possible models involving scribe assistance: clerical documentation assistant (CDA) and advanced team-based care

	(Sinsky, 2014) • The clerical documentation assistant (CDA) model aligns with the current definition of a medical scribe • In the advanced team-based care model, the assistant must have clinical skills that allow them to provide services beyond just documentation, such as taking vital signs, past medical history, & giving immunizations (Sinsky, 2014) • Scribes in emergency department settings often have duties in addition to documentation, such as tracking lab & imaging results, calling primary care physicians & family members, keeping a task list, & organizing specialist consultations (Bastani et al., 2014; Cowan et al., 2018; Shuaib et al., 2019) • Qualitative study of 5 sites which included numerous specialities and primary care found that scribe models can be categorized as preprofessional, professional, clinical, & virtual (Ash et al., 2020)
EHR/EMR security clearance	• Role-based EHR security access requires that a scribe and a clinical assistant have different security clearances (Campbell et al., 2012)
Dual roles	• Possibility of medical office assistants taking on the role of scribes to help reduce turnover, though the authors acknowledged that this cross-over role type would be complicated & require further investigation (Danak et al., 2019) • If a clinical assistant who already works for a physician is asked to also take on the role of medical scribe, these two roles should not be fulfilled simultaneously as this can raise legal issues (Campbell et al., 2012) • Nurses may take on the scribe role plus other clinical duties in the advanced team-based care model (Sinsky, 2014)

Table D.14
Quality of scribe-generated documentation – Peer-reviewed studies

Table D.14	
Medical record details	• Physicians reported that real-time documentation when working with a scribe improved medical record details (Cowan et al., 2018; Yan et al., 2016) • Pilot study in pediatrics found that some physicians felt scribes' documentation lacked adequate detail while other physicians felt that scribes documented too much (Hudson et al., 2020) • Documentation of 4 (out of 8) pay-for-performance measures improved post-scribe (Platt & Altman, 2019)
Medical record accuracy	• 54% of emergency medicine physicians felt that working with a scribe improved their charting accuracy, while 25% felt that scribes had a negative impact on charting accuracy (Hess et al., 2015) • Gastroenterology proof-of-concept study found that history & physical notes identified a mean of 4.0 abnormal findings per patient when a scribe documented, vs. 3.5 abnormal findings per patient when a physician documented (MacPhail et al., 2018)

Medical record overall quality	• Family physicians found to have 7.3 adjusted odds of satisfaction with their chart quality & 4.6 adjusted odds of satisfaction with their chart accuracy post-scribe (Gidwani et al., 2017) • Misra-Hebert et al. (2016) assessed note quality using the Physician Documentation Quality Instrument 9 (PDQI-9). They found that scribed notes were slightly higher in quality for diabetes encounters, but there was no difference between scribe & physician-generated notes for same-day appointments • No change in physician satisfaction with quality of documentation (Pozdnyakova et al., 2018b) • Gastroenterology endoscopic procedure reports were not different when evaluated for quality in a small proof-of-concept study (MacPhail et al., 2018) • Family physicians reported high satisfaction with quality & accuracy of scribed notes (Sattler et al., 2018) • Walker et al. (2017) determined that the PDQI-9 is not useful in evaluating the quality of scribed notes in emergency department EMR notes due to poor agreement between raters. However, they did not find any evidence that scribed notes were lower quality than non-scribed notes
Use of standardized template for note	• A qualitative study found that scribes, physicians, & managers all feel that scribe documentation is completer & more accurate and that this quality is improved with the use of standard documentation templates (Ash et al., 2020) • Comprehensive, standardized note templates were used in 15% of encounters pre-scribe vs. 96% of encounters post-scribe (Imdieke & Martel, 2017) • Primary care physicians noted that scribing had an organizing effect by requiring the formalization of a note template (Van Tiem et al, 2019)

Table D.15
Quality of scribe-generated documentation – Grey literature

Table D.15	
• Medical record details	• Trauma documentation was more accurate and complete, with a more comprehensive chronology when completed by medical student scribes compared to standard trauma team documentation (Bryce et al., 2019) • Ophthalmology clinic notes had a 640-character increase in note length post-scribe, an unintended consequence which raised questions about note accuracy & impact (Dusek et al., 2019) • The notes of internists working with scribes were not different in overall quality to their pre-scribe notes, but one section of the history was more complete when documented by scribes (Pozdnyakova et al., 2018a) • Notes in a pediatric inpatient setting were more succinct & complete post-scribe (Tegen & O'Connell, 2012)
• Medical record accuracy	• Morawski et al. (2017) stated that documentation done in real-time by a scribe is more likely to be accurate than notes completed after

	hours by physicians • Rates of reconciliation of external information & review of problem list were higher post-scribe (Pozdnyakova et al., 2019)
• Medical record overall quality	• Emergency physicians noted improved chart legibility post-scribe (Chen et al., 2012) • EHR note quality increased from 76% without scribes to 98% with scribes in a community oncology center (Lerner et al., 2016) • Nurses in a neuroscience ICU reported improved quality of intensive care physician EHR notes post-scribe (Wright et al., 2019)

Table D.16
Scribe salaries (salaries in American dollars unless otherwise stated)

Table D.16	
Home-grown scribes	• In 2018, Martel et al. paid a starting salary of $18/hour to their homegrown scribes
Scribes contracted from scribe vendor companies	• Scribes were paid on average $20/hour (Danila et al., 2018) • Scribes were paid $19.70/hour (Golob et al., 2018) • The only Canadian peer-reviewed published study stated that scribes in this study were paid $27/hour (Graves et al., 2018). • Scribes were paid $22/hour (McCormick et al., 2018) • Costs tend to be higher when scribes are contracted through a scribe service vendor (Miller et al. 2016)

Table D.17
Effects of scribes on medical learners – Peer-reviewed studies

Table D.17	
Attending (faculty) physician perceptions	• Emergency medicine physicians felt that scribes increased the amount of time they had for teaching medical students & residents (Hess et al., 2015) • Dermatologists felt that scribes increased their time for direct teaching & improved overall education for dermatology trainees (Zhong et al., 2019)
Medical student perceptions	• 100% of students reported more time with attending physicians for teaching & feedback (Hafer et al., 2018) • Scribes were viewed as an EMR/EHR resource by medical students & some students liked the culture of teamwork created by working with scribes (Hafer et al., 2018)
Resident physician perceptions	• Emergency medicine residents reported increased satisfaction, increased efficiency, decreased stress, & improved quality of life when working with a scribe (Allen et al., 2014) • Resident physicians working with scribes gained an improved ability to work in inter-professional teams (Hafer et al., 2018) • Emergency medicine residents noted increased face-to-face teaching time with faculty physicians & increased faculty supervision for procedures post-scribe (Ou et al., 2017) • Dermatology residents & fellows felt that scribes increased attending physician direct teaching & improved their overall

	education, and that scribes taught them how to document efficiently (Zhong et al., 2019)

Table D.18
Effects of scribes on medical learners – Conference abstracts

Table D.18	
Medical Students	• Medical students trained as scribes felt that this experience benefitted their education & should be added to medical school curriculum (Abelev et al., 2020) • Medical students given the experience of working as a scribe felt it benefitted their education & benefitted patients (Bryce et al., 2019) • Medical students who had worked as scribes in the past felt it benefitted their education, helped with career exploration, & gave them experience dealing with difficult situations (J.E. Lowry, 2017)
Resident Physicians	• Emergency medicine resident physicians had more time to teach, focus on patient care, and adhere to work-hour restrictions when working with a scribe (Jones et al., 2018) • Resident physicians were more satisfied with efficiency of documentation, time spent documenting after hours, & ability to listen to patients when working with a scribe (Lorigiano et al., 2020) • Resident involvement in patient visits increased post-scribe (Seng et al., 2019) • Resident physicians overall perceived scribe presence as a neutral interaction (Tanaka et al., 2012) • Resident physicians noted increased educational satisfaction & improved educational experience when working with a scribe, decreased fatigue, and more time for patient care & teaching (Thompson et al., 2016) • Emergency medicine resident & attending physicians agreed that higher quality & more frequent teaching occurred during scribed shifts compared to unscribed shifts (Wegg et al., 2014) • Resident physicians were able to see more patients during scribed shifts (Wegg et al., 2014)

Table D.19
Peer-reviewed articles
(Note. EM = emergency medicine; ED = emergency department; NP = nurse practitioner; PA = physician assistant; CPOE = computerized physician order entry)

Author	**Year**	**Setting / Specialty**	**Method**	**Results**
Addesso et al.	2019	USA Pediatric ED of a large, urban, academic medical center	Observational pre-post study Non-validated surveys 22 providers in efficiency sample 34 providers in satisfaction sample	Patient satisfaction – unchanged Physician satisfaction – increased Physician efficiency – increased Nurses felt neutral towards scribes 78% of providers felt that working with a scribe improved quality of care, 88% preferred to work with a scribe Increased feelings of effectiveness among

			Providers included EM physicians, general pediatricians, NPs, PAs, EM fellows 43 nurses 651 patients	providers post-scribe, which lowers risk of burnout Some patients were unsure who the scribe was – emphasized need for healthcare providers to have education on how to introduce scribes Impact of scribes in this study was not delayed in onset, and authors stated this meant that "providers needed minimal time to adjust to the new workflow" (p. 180) Limitations: residents/medical students were rarely present in non-urgent area of the ED where this study was conducted thus results may not generalize to settings with trainees; lack of validated survey tool
Allen et al.	2014	USA ED EM	Mixed methods Quantitative arm – retrospective statistical analysis Qualitative arm – physician survey Surveys not validated 18 resident physicians 4 NPs 8 PAs	Physician satisfaction – increased Physician efficiency – increased Physician burnout or stress – decreased 100% of providers reported that they enjoyed working with scribes, 90% felt that scribes improved their workplace satisfaction & quality of life, 80% felt that scribes decreased their level of stress at work 70% of providers felt that scribes decreased their levels of stress at home 63% of providers indicated that "the use of scribes will likely extend their careers" (p. 6) Limitations: study done at academic hospital thus results may not generalize to non-academic hospitals; retrospective study, risk of selection bias; no attending (staff) physicians surveyed, only residents surveyed
Ash et al.	2020	USA Speciality clinics, primary care clinics, urgent care clinics	8-dimensional sociotechnical framework and the Rapid Assessment Process Ethnographic data gathering through interviews and site visits Data analyzed using grounded inductive/hermeneutic approach 81 people interviewed: physicians, scribes, managers, quality improvement specialists	12 themes emerged: the EHR; ergonomics; scribe industry; compliance & risk; pros & cons of scribing from different perspectives; training, knowledge, & synthesis; scribe/provider interaction; workflow; quality of documentation/coding; scribe models; variety/variability; human resources aspects Physicians, scribes, & managers all considered scribes to be EHR experts & often "super users" who could help others Best practices authors of this study recommend: -scribes should be informed about EHR updates & encouraged to use templates -ergonomic considerations include adequate space for scribes in exam rooms & up-to-date computers -further exploration of the best designs for scribe models is required -avoid inappropriate scribe role expansion -introduce the scribe to patients -provide classroom, on-site, & ongoing training for scribes -providers require training on how to work with scribes -scribes should be trained to adjust to the workflow of individual providers -standardize documentation through

				templates & monitor scribes' work consistently -explore different scribe models (preprofessional, professional, clinical, & virtual) to find the best fit for an organization -standardize scribe documentation & duties as much as possible -more state & national guidance needed, plus licensing standards for scribes -organizations should foster communication channels for scribes to connect with other members of the healthcare team Limitations: authors were unable to verify participants' responses with data from EHR use; patients not studied directly; virtual scribes not studied; clinical scribes not studied
Bank et al.	2013	USA Outpatient cardiology clinic	Prospective controlled study Observation of 1 physician by performance improvement manager for 4 hrs of scribed visits and 4 hrs of control visits Non-validated surveys 4 cardiologists 1 scribe Number of patients surveyed not stated	Patient satisfaction – unchanged (started very high & remained very high) Physician satisfaction – increased Physician efficiency – increased Most patients were neutral towards or liked the scribe system Time motion analysis done for 9 control visits & 14 scribed visits found that average duration of visit (including documentation) was 37% shorter for scribed visits vs. control visits Patient/physician interaction – increased direct interaction over fourfold & increased quality of interaction By-product of scribe use was improved patient access to care due to increased physician productivity Limitations: small study size; lack of description of survey development; sub-study of time-motion analysis & observation by manager only involved 1 physician & 23 patient visits
Bank & Gage	2015	USA Cardiology clinic owned by a large health care organization	Retrospective study of productivity, tracked patients per hour and patients per year seen per physician 10 cardiologists who worked with scribes, 15 cardiologists who did not work with scribes 16 scribes	Physicians working with scribes saw 9.6% more patients per hour, which resulted in 84 more new and 423 more follow-up patients in total seen by this clinic in one year Physicians working with scribes estimated that scribes saved them 2.5 hours/day due to decreased documentation burden, despite seeing approx. 10% more patients per day
Bastani et al.	2014	USA Suburban community hospital EM	Before and after study of ED throughput metrics collected using EMR-generated reports Validated Press Ganey surveys of patient satisfaction 12,609 patients	Patient satisfaction – increased (patient satisfaction with the emergency physician increased from 72% pre-scribe to 87% post-scribe) Physician efficiency – increased (door-to-doc time improved from 74 minutes pre-scribe to 61 minutes post-scribe) EMR and CPOE impose documentation-related burden on community hospital ER

				physicians who do not have help from medical students & residents Scribes in this study tracked lab results, imaging results, kept a task list, & ensured chart completion; they did NOT input orders into CPOE Limitations: before-and-after design; possible experimenter bias
Bossen et al.	2019	N/A	Literature review until 2017 60 publications identified	50 studies from USA, 9 from Australia, 1 from Canada Growth of medical scribe occupation seems to be linked to spread of EHRs Implementation of EHRs led to "vertical substitution by physicians of documentation leading to the emergence and stabilization of a new occupation, medical scribes" (p.82) Authors were not able to find alternative terms for the occupation in English or non-English speaking countries Limitations: search limited to journals in English; authors were unable to find alternative terms for occupation of medical scribes
Cabilan & Eley	2015	Literature review of studies done in EDs	Literature review 7 publications identified	6 studies from USA, 1 from Australia Scribes mostly beneficial: improved physician satisfaction, increased physician efficiency Impact on revenue unclear Results "overwhelmingly suggest that scribes are advantageous in the ED environment" (p. 510) Limitations: detailed methodological appraisal not done
Cho et al.	2019	USA Pediatric plastic surgery practice	Prospective cohort study Quality improvement initiative 2 pediatric plastic surgeons 117 cases (45 with a scribe & 72 without) Time spent for each patient visit task measured & recorded by scribe & physicians using their smart phones	Medical visits were an average of 1.58 min. shorter when a scribe was present Limitations: possible bias as physicians & scribes could not be blinded to scribe presence; possible measurement errors in data collection due to self-reporting
Cowan et al.	2018	Australia ED	Prospective, qualitative study conducted as part of a scribe economics study 13 physicians – 11 who agreed to work with a scribe & 2 who declined to work with a scribe Individual, semi-structured interviews Interviews analyzed by deductive & inductive methodology Interview transcripts coded using open & axial coding to extract	Physician satisfaction – increased Physician efficiency – increased Physicians reported increased productivity, increased job satisfaction, decreased stress, decreased cognitive loading, & decreased fatigue when working with a scribe Scribes improved ability of ED physicians to multitask & simultaneously manage several complex patients Scribes changed communication style between physicians & patients; patients seemed to like having more information verbalized by their physician & had fewer questions when a scribe was present Role of scribes: documentation in the EMR, facilitate tests, gather information, facilitate patient disposition & appointments, call primary care physicians, call family, call inpatient consultants

			themes & subthemes	Consultants had to edit scribe notes if medical synthesis required Physicians valued capture of details by scribes when seeing complex patients Physicians preferred to work with the same scribe over time if they had a good working relationship Several physicians noted that the scribe-physician working relationship improved with time Physicians who declined scribes were concerned about patients not revealing private information when scribe present, lack of space in small patient cubicles, & preference for their own style of note writing Limitations: small single-centre pilot evaluation with small number of physicians & scribes; scribes & physicians worked together for relatively short period of time; study susceptible to sponsor, social desirability, & confirmation bias
Danak et al.	2019	USA Large Midwestern academic family medicine center	Quasi-experimental pilot study with convergent mixed methods design Patient surveys – included the Communication Assessment Tool (CAT) Physician semi-structured interviews Retrospective chart review Clinician encounters were video taped Unclear if surveys validated 3 physician-scribe pairs 34 patients	Patient satisfaction – unchanged, very high satisfaction with physician communication with & without scribe present Physician satisfaction – not stated Physician efficiency – no significant differences between scribed & non-scribed encounters in time to close charts Patients in scribed encounters reported that physicians used the computer less often (53% vs 93%) Idea raised of combining medical assistant & scribe role to decrease turnover of scribes Physicians did not report any patient concern with scribe gender, but some reported that they asked the scribe to leave the room during sensitive exams Scribe turnover was common concern of physicians Scribes were contracted through a vendor Limitations: small sample of physician-scribe pairs; physicians & scribes were aware of which encounters were being recorded & thus could have altered their behaviour; survey responses were not anonymous to study staff & thus patients answers may have been affected by this`
Danila et al.	2018	USA Outpatient rheumatology and endocrinology clinics affiliated with university hospital	Within-practice pre-post pilot study Patient & physician surveys Unclear if surveys validated 6 physicians 496 patients	Patient satisfaction – unchanged Physician satisfaction – unchanged High level of patient & physician satisfaction before & after scribe intervention: possible ceiling effect & social desirability bias 96% of patients felt comfortable having a scribe in the room Working relationship between physicians & scribes "develops slowly and is dependent on interpersonal fit within the physician-scribe team and availability of system support" (p. 119) Scribe salaries in this study were an average of $20/hr and scribes were contracted from a scribe vendor company Limitations: small sample size & convenience sampling of physicians limits generalizability;

				no objective measures of clinic workflow efficiency; social desirability bias may have influenced patient satisfaction questionnaire; possible ceiling effect for measurement of physician & patient satisfaction, both of which were high pre-scribe
Delage et al.	2020	USA	Third-year medical students were trained as scribes Preceptors completed training to have students scribe in their practice Students, faculty preceptors, & staff who worked with students were surveyed at the conclusion of the study 18 faculty physicians 11 clinical staff 20 medical students	Physicians, clinical staff, & medical students felt that scribing was beneficial for medical students & that scribe training should be added to the 3rd year medical school curriculum Medical students did not think that scribing detracted from their student role Faculty reported that medical students with scribing responsibilities were more engaged overall Having a student scribe decreased documentation burden for physicians & made it easier for them to teach Limitations: this study included only the Epic EHR
DiSanto & Prasad	2017	USA Primary care	Time required to complete documentation Not stated if surveys validated or not 2 physicians 1 scribe 320 patient visits	Physician satisfaction – increased Daily time savings of 60 minutes per physician due to decreased time spent on documentation Scribes decreased time physicians spent documenting by 41-66% Principal goal of scribe use is to decrease documentation burden & allow physicians to reallocate their time to other care delivery tasks "Warm up" period of 2-4 weeks needed before scribes help decrease documentation burden for physicians Scribe can review physician's note modifications to help learn the physician's style Limitations: small number of physicians studied
Dunlop et al.	2018	Australia Tertiary care hospital EM	Qualitative & quantitative methods Explorative semi-structured interviews & patient questionnaire Themes derived using grounded theory approach & thematic analysis Thematic saturation achieved after 7 interviews Some items in patient surveys were validated items from Press Ganey 215 patients surveyed 5 scribes	Patient satisfaction – unchanged No negative comments about the presence of a scribe In over 2000 scribed consultations, no patient asked a scribe to leave Authors stated that impact of this study is non-inferior Authors concluded that "the use of scribes is unlikely to affect patients' disclosure of private information in ED consultations, nor inconvenience or bother patients" (p. 65) Limitations: responses to survey could be influenced by social desirability bias & sponsor bias; possible researcher bias as researchers were involved in the scribe programme
Earls et al.	2017	USA Rural family medicine clinic – a residency training site	Pilot mixed-method quality improvement study Physician and patient surveys 19 questions from the	Patients reported high level of comfort with scribes and positive comments about scribes Patients reported that having a scribe present had little impact on what they told their physician Less than 10% of patients declined to have a

			36-item Physician Work-Life Survey 6 physicians 313 patients 4 part-time scribes	scribe present Physician morale improved despite 29% increase in patient volume Physician efficiency – increased Working with a scribe decreased physician time in clinic by 13%, decreased physician time spent working at home by 38%, and increased patient appointments per clinical session by 29% Management of this clinic mandated a 25% return on investment for new initiatives thus more patients were scheduled for physicians working with scribes Limitations: small number of physicians, possible social desirability bias to patient & physician feedback, possible biased interpretation of focus group discussions
Ewelukwa et al.	2018	USA Outpatient gastroenterology clinic	Quality improvement project Pre- and post-scribe data on appointment lengths Patient satisfaction questionnaire Physician interview 1 physician Clinic staff 824 patients	Patient satisfaction – increased from average of 6.8/10 pre-scribe to average of 9.2/10 post-scribe Physician satisfaction – increased Physician efficiency – increased Average appointment length decreased from 31 minutes pre-scribe to 18 minutes post-scribe Quality outcomes – improved (increased uptake of vaccinations & referrals for bone density tests) Scribe use improved doctor-patient conversations Limitations: only 1 physician thus results may not be generalizable
Gao et al.	2020	USA Large academic medical center oncology practice	Retrospective, qualitative & quantitative methods analysis of survey data & patient visit durations Qualitative comments were coded using conventional content analysis 33 oncologists with scribes (medical, surgical, & radiation oncologists) 127,710 patient encounters (13,032 with scribes, 109,761 without scribes)	Patient visit duration decreased by 11-14% post-scribe, a savings of approx. 10-15 min. per patient Physicians reported spending less time documenting at the end of the clinic & less time documenting at home Physicians reported savings of "cognitive time" when working with a scribe 100% of physicians surveyed strongly agreed that scribes improved their quality of life Scribes improved quality of physician-patient interactions by increasing patient face time with physicians & decreasing physician time spent interacting with the computer during the visit Limitations: results are from an academic medical center & may not apply to community-based practices
Gidwani et al.	2017	USA Academic family medicine clinic	Randomized controlled trial – physicians served as their own controls Physician & patient satisfaction questionnaires 4 physicians 1475 patients 2 scribes	Patient satisfaction – unchanged (remained high) Physician satisfaction – increased Physician efficiency – increased Scribes may have a protective effect on physicians' well-being Physicians had 10.8 adjusted odds of high satisfaction with clinic day post-scribe Physicians had 86.1 adjusted odds of high satisfaction with amount of time spent charting post-scribe Physicians had 7.3 adjusted odds of being satisfied with chart quality & 4.6 adjusted odds of being satisfied with chart accuracy post-scribe

				In academic medical centres scribes increase time that faculty physicians have for teaching Limitations: small number of physicians & scribes; lack of validated surveys; lack of objective assessment of chart quality
Golob et al.	2018	USA Level 1 trauma center Trauma surgery rounds on ICU & trauma floors	Secondary analysis of hospital's EMR and billing system 3 trauma physicians 3 scribes	Physician efficiency – increased; mean number of progress notes written per week was significantly higher post-scribe Physician satisfaction – subjectively increased Physician burnout – subjectively decreased Inpatient progress notes were written earlier in the day and fewer notes were written in the late evening during the post-scribe period Cost of scribes was covered by billings for additional notes generated; scribes were paid $19.70/hour (article states the cost was $32,787 for 1,664 hours of scribe time) Article did not state if scribes were home-grown or contracted Limitations: chance that findings were not due to use of scribes
Gottlieb et al.	2021	N/A	Systematic review & meta-analysis 39 studies identified	14 of 16 studies reported favorable provider satisfaction with scribes 7 of 18 studies reported favorable patient satisfaction with scribes No studies reported negative provider or patient satisfaction with scribes Scribes increased patients treated per hour by 0.30 Studies were found to be good quality overall Limitations: funnel plot indicated publication bias may be present towards positive findings; may reflect an absence of published negative results; lack of validated tools to measure satisfaction, stress, & burnout in studies identified; most identified studies conducted in the United States; authors did not assess for harms associated with scribe use or effect of scribes on resident physician education
Graves et al.	2018	Canada Community ED EM	Quality improvement project Physician productivity measured 22 physicians 11 scribes	Physician efficiency – increased 82% of physicians saw more patients per hour when working with a scribe 13% more patients per hour per physician were seen during shifts with a scribe Scribes in this study were employees of a scribe vendor company & were paid $27/hour Limitations: authors are owners of a scribe company
Hafer et al.	2018	USA Academic family medicine center Medical students	Mixed-methods pilot study 16 medical students	Medical student satisfaction with learning experience – increased 4 main themes: more time with the attending physician for teaching, attending physicians less stressed & more attentive, students liked the culture of teamwork with a scribe, & scribes were an EHR resource for medical students Limitations: small sample size, lack of control group, possible selection bias, lack of specificity of questionnaire
Heaton et al.	2016	N/A	Systematic review and meta-analysis – until May 2015	17 studies met inclusion criteria 8 studies investigated scribe impact on patient/provider satisfaction Only 6 of the included studies were published, peer-reviewed research; the others were

				published abstracts Patient satisfaction – increased Physician satisfaction – increased Limitations: small number of peer-reviewed studies; lack of standardized & validated measures of patient & physician satisfaction prevented meta-analysis
Heaton et al.	2018	USA Academic ED EM	Prospective observational cohort study 48 ER shifts were observed (not stated how many physicians observed) 4 research assistants	Physician efficiency – increased Scribes decreased amount of time physicians spent with shift documentation & decreased post-shift documentation by almost 50% Scribes decreased physician time spent interacting with the EHR by approx. 30% Scribes did not significantly affect time spent at patient bedside Limitations: potential errors in categorization & time recordings of work activities of physicians; work that took place after shifts relied on self-reported data of physicians; research assistants could not observe work that occurred in the attending physician workroom outside of the patient care area
Heaton et al.	2019	USA Academic ED EM	Prospective observational cohort study – pilot study 8 ER shifts were observed 8 physicians as no physician was shadowed twice 2 research assistants	Physician efficiency – increased After-shift documentation time decreased from 67 min to 16 min post-scribe Scribes decreased physician documentation time by 33% on average Limitations: due to funding constraints only afternoon ER shifts were staffed by scribes; small number of ER shifts were shadowed by research assistants due to funding constraints
Heckman et al.	2020	USA Academic hospital-based general internal medicine practice	Pilot study Single-center quasi-experimental study 2 medical scribes worked with convenience sample of 4 intervention physicians, who were compared with 9 control physicians using a difference-in-differences approach Intervention physician appointment lengths shortened by 25% (20 min to 15 min and 40 min to 30 min) Physician satisfaction measured with AMA Steps Forward 5-item physician satisfaction survey (5-point Likert-like scale); patient satisfaction measured with similar survey using the same Likert-like scale 2130 patient surveys (34% response rate) Physicians had 82% response rate (survey to be done after each	Physician perception of being rushed & staying on schedule did not differ despite 25% shorter appointment length in scribe group Physician satisfaction only statistically significantly different for single item of "feeling that work for the encounter would be completed during the visit": this score was higher for scribe group Patient satisfaction was high in both scribe and non-scribe groups, with no statistically significant difference even though appointments were shorter in scribe group Working with a scribe increased physician efficiency without having negative effects of physicians or patients

			session)	
Hess et al.	2015	USA 2 academic EDs EM	Prospective quasi-experimental pre-post design Surveys and administrative data 74 physicians	Physician satisfaction – increased Physician efficiency – increased (36% relative reduction in time charting post-scribe) 60% of physicians reported increased time spent teaching medical students & residents post-scribe 74% of physicians reported positive attitude toward working with scribes, 9.5% had negative perceptions 76% of physicians felt that working with scribes increased their time spent with patients Limitations: observational study, self-administered surveys, intervention assessed shortly after its implementation, no validated instruments available for assessing outcomes
Hudson et al.	2020	USA Large academic outpatient pediatrics clinic	3-month quasi-experimental pilot project Baseline surveys assessed physician satisfaction with scheduling & documentation time Qualitative data collected in 3 focus groups & 2 interviews 15 physicians 5 scribes	Providers perceived patient satisfaction to be high at baseline & most felt they did have enough time for the visits pre-scribe & were able to stay on schedule Physicians reported poor consistency with scribe pairing, as they were not able to work with the same scribe (2 resigned from the scribe company during the study & had to be replaced) Physicians reported that scribes took time to learn their documentation preferences & scribes' performance improved with time Frequent technical problems were reported – scribes losing internet connection & thus not being able to access medical records Physicians felt that scribes need more training in medical terminology, navigating the EMR, & effective use of note templates Physicians reported that scribes were less effective in charting for children with complex healthcare needs & children in Spanish-speaking families; physicians often had to translate for the scribes Most physicians reported that scribes improved their workflow & decreased their workload Limitations: 2 of the 3 scribes resigned from the scribe company during this study & had to be replaced, which interrupted the study; physicians in this study knew the investigator who conducted the focus groups & interviews
Imdieke & Martel	2017	USA Safety net hospital-based, outpatient primary care clinic caring for underserved population	Quasi-experimental, non-randomized pre- and post-intervention study 2 physicians 8 scribes 2 NPs 5 support staff 256 patients	Patient satisfaction – slightly decreased (98% pre-scribe vs. 91% post-scribe were happy with the care received that day) Physician satisfaction – increased Physician efficiency – increased 90% of patients were comfortable with a medical scribe present Provider documentation time decreased by more than 50% Comprehensive, standardized note templates were used in 15% of encounters pre-scribe vs. 96% of encounters post-scribe Patient satisfaction scores pre-intervention were close to 100% positive Limitations: quasi-experimental design, convenience sampling may limit generalizability, ceiling effect may confound patient satisfaction data as patient satisfaction

				scores were nearly 100% positive pre-scribe
Keefe et al.	2020	USA Otolaryngology Department, academic setting with medical learners present	Retrospective study of Press Ganey surveys completed by patients 3 physicians 86 patients 2 scribes (one male & one female)	No significant difference in patient satisfaction with medical visit with scribe present vs. no scribe Patients were highly satisfied with their care whether or not a scribe was present No significant difference in patient satisfaction with wait time whether or not a scribe present Limitations: low proportion of patients fill out surveys thus limiting sample size & possibly creating responder bias Scribes in this study were master's students planning to apply to medical school and thus may not be typical of the average scribe
Koshy et al.	2010	USA Academic outpatient urology clinic	Patient and physician surveys 5 physicians 487 patients 4 scribes	Patient satisfaction – slightly higher with scribe present Patient comfort with presence of scribe - high Physician satisfaction – increased Patients were comfortable with having a scribe present and gender or age of scribe did not affect patient satisfaction > 80% of patients were comfortable with discussing sensitive urological issues with a scribe present Physicians were more satisfied with office hours when working with a scribe (69% post-scribe vs. 19% pre-scribe) Patient interviews were more patient-centered when physicians were not focused on the computer Limitations: no female physicians participated in this study; assessment tool used was not validated as no validated tool existed
Lin et al.	2020	USA Stanford University School of Medicine	Clinical Observation and Medical Transcription (COMET) Program launched in 2015 Program also known as the Stanford Medical Scribe Fellowship 13-month certificate-granting postbaccalaureate premedical program Cost supported by students' tuition & some donations Scholarships available to students with financial need In 2020 the program had 55 scribes and 75 physicians (half in primary care half in specialty care) Faculty physicians & student scribes completed satisfaction surveys & written reflections Participants' comments were	COMET students undergo 50 hours of medical scribe training followed by 20 hours of in-clinic training with an expert scribe Scribes are paired with 1-3 physicians for one year and work with these physicians 20 hours a week Faculty physicians provide mentorship to scribes & mentor them in scholarly projects COMET program reports that the scholarly project opportunity can help its students get into medical school & other health professional schools Student scribes report high satisfaction with their physician mentors Student scribes felt that the COMET program help them increase their chances of admission to medical school Participants comments had 7 recurring themes: mentorship, clinical teaching, valued team member, career advice, scholarship, application support, & didactic teaching Physicians reported high satisfaction with their student scribes Physicians reported that working with student scribes improved their joy of practice Limitations: scalability & generalizability remain uncertain

			analyzed thematically	
C. Lowry et al.	2017	USA Academically affiliated safety net primary care clinics	4 metrics with a control group for each: 3 efficiency metrics and patient survey Study considered an evaluation of a quality improvement program 51 physicians 5863 patients Scribes were unpaid volunteers	Patient satisfaction – unchanged Physician satisfaction – increased Physician efficiency – increased 70% of physicians were more efficient when working with a scribe Note completion time after clinic sessions was 14 min post-scribe compared to 30 min pre-scribe High turnover of scribes noted Limitations: Turnover of scribes, self-selection of participants, survey metrics subject to recall & selection bias,
MacPhail et al.	2018	USA Gastroenterology endoscopic surgery center	Proof-of-concept study 1 gastroenterologist 88 procedures without a scribe & 92 procedures with a scribe Time was measured by a research assistant with a stopwatch 10 history/physical notes and 10 procedure reports written by the scribe & 10 of each written by the physician were randomly selected & blindly evaluated for quality	Mean assessment time to complete history & physical notes decreased by a mean of 34%, or 1.59 min. per patient, when a scribe was present Time the gastroenterologist spent on the procedure report decreased by a mean of 71% when a scribe was present Non-significant increase in mean procedure time from 19.55 to 20.99 min. without a scribe vs. with a scribe Patient time in the recovery room increased from 2.39 to 3.40 min. without a scribe vs. with a scribe present Authors felt that patient satisfaction was likely greater when a scribe was present, as they had more time in the recovery room to ask questions about the results of their procedure Gastroenterologist saved a mean of 3.71 min. per procedure Scribing saved the physician a mean of 41 min. over a 6.5 h session, enough time to schedule an additional procedure or complete other tasks Limitations: only 1 physician studied; this physician was the one who blindly reviewed reports & notes for quality which could introduce bias
Martel et al.	2018	USA Academic, inner-city, safety-net hospital-based clinic system Variety of specialities	Prospective quasi-experimental study 51 providers: 37 physicians & 14 nurse practitioners / physician assistants 256 patients	Patient satisfaction – slight decrease (from 100% to 90 % satisfied) Physician satisfaction – increased Physician efficiency – increased Documentation time at the office improved: 75% of providers rated it as poor pre-scribe, 24% rated it as poor post-scribe Time spent on EHR at home decreased: 64% excessive or moderately high pre-scribe, 32% post-scribe Qualitative reports from providers on scribes were overwhelmingly positive Negative qualitative feedback from providers mainly on 2 topics: inexperienced scribes & overlap of sections of the record documented by scribes Out of approximately 100 physicians, 3 later requested not to work with scribes because they preferred to maintain their personal documentation style "Scribes allow physicians to provide undivided attention to the patient, which would be valuable even with exceptional EHR usability"

				(p. 247) For many providers "the addition of scribes was one of the most substantive changes they had ever experienced in their practice" (p. 244) Some physicians in this study felt that scribes had saved their careers These authors found nearly uniform acceptance of scribes by patients, as they want the provider's focused attention Starting salary for scribes is $18/hr
McCormick et al.	2018	USA Academic urology practice	Observational study 6 physicians 202 patients	Patient satisfaction – unchanged Physician satisfaction – increased Physician efficiency – increased 97% of patients felt comfortable or very comfortable with a scribe present All physicians reported decrease in after-work & weekend hours spent on EHR documentation post-scribe Physicians worked with the same scribe each week during this study Physicians were able to see 4.3 more patients per day post-scribe: 25% increase Mean 8.7 day decrease in time to closure of patient encounter records in EHR post-scribe Scribes were hired through a scribe vendor company & were paid $22/hour Limitations: small sample size of 6 physicians studied, observational study
Mishra et al.	2018	USA Outpatient primary care centers	Dual-balanced crossover design – physicians served as their own controls 18 primary care physicians (internal med & family practice) 735 patients	Patient satisfaction – neutral or increased; 61% of patients reported that scribes had a positive effect on their visit Physician satisfaction – increased Physician efficiency – increased 94% of physicians reported improved job satisfaction when working with a scribe Physicians working with a scribe had decreased documentation time, decreased off-hour out of clinic documentation, improved work efficiency, & improved visit interactions Off-hour EHR documentation work > 1 hour on weekdays decreased from 69% of physicians pre-scribe to 17% post-scribe 89% of physicians reported improved clinical interactions with patients post-scribe "For every hour of direct patient care, physicians spend nearly 2 additional hours on unpaid EHR and desk work" (P. E2) "One in every 2 physicians experience symptoms of burnout, with primary care providers experiencing the highest rates" (p. E2) Limitations: relatively small sample size, possible recall bias
Misra-Hebert et al.	2016	USA 8 primary care sites within one health system	Retrospective review of ambulatory care notes for diabetes visits or same-day appointments 108 notes from pre-scribe period and 109 notes from scribe period were reviewed Notes assessed using the PDQI-9	Scribed notes were of equal or higher quality compared to notes written by a physician, but only for diabetes encounters No differences in note quality were found for same-day appointment notes Limitations: results may not generalize to other note types; reviewers were not blinded to whether a scribe wrote the note

			18 primary care physicians & 36 medical assistants acting as scribes	
Mojeski et al.	2020	USA Tertiary care dermatology clinic	Retrospective analysis of multiple clinic metrics 21-months pre-scribe period, 3-months transitional period, 12-months post-scribe period 2 dermatologists	After implementation of scribes there was a 33% increase in the number of patient visits per clinic and 8.75-day decrease in time to note signing Scribes in this program were pre-professional students interested in careers in healthcare Scribes in this program are assigned to a specialty clinic for their tenure & thus learn specialty-specific documentation Limitations: only 2 physicians at a single clinic; study does not compare scribes trained at this institution to professional scribe services
Ou et al.	2017	USA ED of a large, urban medical center EM resident physicians	Pre-post design Anonymous pre- and post-surveys 47 resident physicians	Resident physicians – increased satisfaction with all aspects of resident educational experience Resident physicians directly attributed improvements in their educational experience to scribe program implementation; they noted increased face-to-face teaching with faculty physicians & increased faculty supervision for procedures Limitations: pre-and post-surveys were administered at different times of the academic year; survey tool not tested prior to use; data collected soon after implementation of the scribe program
Platt & Altman	2019	USA Family medicine clinic	EHR records reviewed for documentation of quality measures Patient surveys Physician surveys 5 physicians 3 scribes 150 patients	Patient satisfaction – increased Physician satisfaction – increased Physician efficiency – increased 96% of patients felt comfortable with the scribe in the room 61% of patients were more satisfied with their office visit when scribe was present Physicians reported that working with a scribe improved patient/physician interaction, improved patient care, decreased documentation time, improved workflow Physicians estimated that working with a scribe saved a mean of 1.5 hrs/day of their time Documentation of 4 (out of 8) pay-for-performance measures improved post-scribe: fall risk assessment (OR 5.5), follow-up tobacco screen (OR 6.4), follow-up body mass index plan (OR 6.2), follow-up blood pressure plan (OR 39.6) Limitations: Small sample size, lack of validated measures, short time periods, EHRs reviewed were chosen sequentially, wide confidence intervals
Pozdnyakova et al.	2018 b	USA Academic general internal medicine clinic	Prospective pre-post pilot study 6 physicians 373 patients 1 scribe	Patient satisfaction – unchanged Physician satisfaction – increased Physician stress – decreased Physician efficiency – increased 33% of physicians were satisfied with workflow pre-scribe, 100% were satisfied post-scribe No change in physician satisfaction with quality of documentation (p. 3) 83% of physicians were dissatisfied with time for documentation pre-scribe, 0% were

				dissatisfied post-scribe Improved interactions with patients reported by 83% of physicians, better connections reported by 67% of physicians 1/3 of patients felt that their physician listened most attentively when a scribe was present 7% of patients felt negatively about a scribe being present Male patients were more likely than female patients to report that they disliked having a scribe present (55% vs. 36%) (p. 5) Post-visit documentation time was decreased by half when a scribe was present Limitations: small physician sample size; only 1 scribe who was female, no male scribe; short duration of pilot study; possible recall bias in survey results; patient survey only available in English
Rohlfing et al.	2019	USA Academic otolaryngology (ENT) clinic	Retrospective cohort survey study – designed as a quality improvement project 2 physicians 153 patients	Patient satisfaction – unchanged (high at baseline and remained high) Patients reported that scribe "definitely positively impacted the visit" 77% of the time (p. 3) Authors stated that "these results validate the role of the scribe in the otolaryngology clinic" as scribes provide benefits to physicians (p. 5) Limitations: small number of physicians; possible ceiling effect on patient satisfaction which was high at baseline
Sattler et al.	2018	USA Academic family medicine clinic	Longitudinal observational design Physician experience assessed by open-ended written reflections 4 physicians 2 scribes	Physician satisfaction – increased Physician efficiency – increased Physicians reported high satisfaction with scribe EHR charting & scribe help with other tasks (paperwork, forms, letters, assisting with procedures) (p. 51) Joy of practice increased when scribes present Some negative comments from physicians in first few weeks when scribes first started, and some minor documentation errors occurred Authors stated that justification for scribes should be more than financial – should include quality of care, patient experience, joy of practice Limitations: small number of physicians and scribes; each physician's perspective is not equally represented in final data set
Shuaib et al.	2019	USA ED of a suburban, non-academic community hospital EM	Quasi-experimental before-and-after study Throughput measures, time-motion analysis, patient surveys Number of physicians surveyed not stated 13,598 patients	Patient satisfaction – unchanged (high at baseline & remained high; vast majority of patients were either neutral or liked the scribe system Physician satisfaction – increased (from 66% pre-scribe to 81% post-scribe Physician efficiency – increased Mean visit time (including documentation) was 31% lower in the post-scribe period, while time spent in direct patient interaction doubled post-scribe ED throughput metrics improved post-scribe Authors note that scribes are especially valuable in community EDs where there are no medical students and residents to help decrease documentation burden for physicians Physicians matched with scribes of their choosing when possible, to increase physician

				autonomy Scribes in the ER can have duties in addition to documentation, such as checking when lab and imaging results are back and when a patient bed is ready The vast majority of patients had neutral to positive attitudes towards scribes Limitations: pre-and-post-scribe design limits capacity to make causal claims
Shultz & Holmstrom	2015	N/A	Systematic review	5 studies identified: 3 in ED, 1 in cardiology clinic, 1 in urology clinic 2 of 3 found no change in patient satisfaction, 1 found increase in patient satisfaction 2 of 2 found increased physician satisfaction Authors conclude that there is insufficient high-quality evidence to support any beneficial claims about medical scribes: B category evidence rating Limitations: some studies may have been missed; this review only included peer-reviewed studies
Taylor et al.	2019	USA Outpatient military ambulatory care treatment facility Family medicine and internal medicine	Non-experimental pilot project using a mixed methods approach 2 physicians 4 hospital corpsmen trained as scribes 185 patients	Patient satisfaction – slightly decreased Physician satisfaction – increased; physicians reported improved work life balance post-scribe Physician efficiency – increased After work hours physician charting in the EHR decreased from 20-26 hrs/week pre-scribe to < 10 hrs/week post-scribe: an improvement of at least 50% Qualitative analysis found 4 themes: improved efficiency, decreased EHR documentation time, improved efficiency, & physician concern that "the presence of scribes may hinder the full transparency of a patient's concerns" (p. 3) Limitations: small size of the pilot project; lack of validated questionnaires
Van Tiem et al.	2019	USA Veterans Health Administration (VHA) clinics at 5 sites across the USA Primary care	Ethnographic process evaluation using Normalization Process Theory Semi-structured interviews and direct observations of physicians & scribes	Scribing had an organizing effect: required formalized note template development Scribing had a generative effect: improved teamwork & emphasized complementarity of professional roles Increased physician engagement with patients: more face-to-face time with patients, decreased documentation time Increased patient-centeredness of visits Scribes felt valued & trusted as part of healthcare team Limitations: focus was only on teams that successfully implemented a scribing practice; findings may not generalize to non-VHA clinics
Walker et al.	2017	Australia ED of a not-for-profit private hospital	Retrospective, observational study comparing scribed to non-scribed notes in the emergency department 13 emergency physicians worked with scribes 5 scribes 220 randomly	Scribed notes were longer non-scribed notes (357 vs. 237 words) No difference in PDQI-9 scores between scribed & non-scribed notes Very poor agreement of PDQI-9 scores between raters: very poor inter-rater reliability Limitations: raters were not trained in how to use the PDQI-9; single centre study; compared structured, template documentation of scribes against free-text, unstructured documentation of physicians thus true blinding was not

			selected consultation notes (110 scribes, 110 non-scribed) and analyzed by 2 raters each (one EM physician and one senior resident or nurse) Notes were analyzed for quality using the Physician Documentation Quality Instrument, Nine-item Tool (PDQI-9)	possible as rates could identify the template structure of scribed notes
Walker et al.	2019	Australia 5 ER departments	Prospective, multicentre, non-blinded, randomised clinical trial Physicians' productivity was measured, self-reported harms of scribes analyzed 88 ER physicians 12 scribes (5 male, 7 female); half of the scribes were medical students & half were pre-medical students 589 scribed shifts & 3296 non-scribed shifts	Scribes increased physicians' productivity by 15.9% for patients per hour per doctor and 25.6% for primary consultations per hour per doctor Primary consultation was defined as when the physician was the main physician for the patient No significant harms involving scribes were reported Scribes & physicians were encouraged to report patient safety incidents involving scribes into an anonymous, online, specialty specific incident reporting system 16 safety incidents were recorded (1 in every 300 consultations) Most common possible error was wrong patient record selected (usually for an investigation order); in all cases the scribe or physician realised the error & prevented the wrong investigation from occurring In 8 of the 16 safety incidents reported, the scribe actively prevented a medical error
Yan et al.	2016	USA 6 health systems Primary care	Qualitative content analysis of semi-structured interviews 18 physicians 17 scribes 36 patients	Qualitative comments 3 core themes: documentation, patient care, & teamwork Physicians felt that real-time documentation when working with a scribe improved medical record details Adaptability & trust between the physician & scribe are important Some physicians have difficulty with giving up some control & with change Learning medical terms was "a big learning curve" for scribes (p. 992) Physicians, scribes & patients all felt that physician attention to patients during visits improved post-scribe: improved eye contact, less distraction of the physician's attention by the computer Problem with high scribe turnover limits sustainable partnerships between physicians & scribes Scribes developed working relationships with patients, who would ask them for information they had forgotten or were confused about Limitations: small sample size; lack of quantitative analysis
Yan et al.	2018	USA Primary care	Quantitative survey of patient opinions	67% of patients had no preference about the scribe's presence, 31% preferred that a scribe

			123 patients (the patients of 8 physician-scribe pairs at 4 clinics)	be present Sexual history was the exception though with 79% of female patients & 57% of male patients at least somewhat comfortable discussing sexual topics with a scribe present 68% of patients were very or extremely comfortable with a scribe of a different gender All scribes in this study were female Limitations: use of a convenience sample of established patients; possible selection bias as only patients who agreed to a scribe visit were surveyed
Zallman et al.	2018	USA Urban safety net clinic Primary care (family practice or internal medicine)	Prospective observational pre-post study Direct observation of physicians Physician self-timing Patient surveys 5 physicians 7 scribes 181 patients	Patient satisfaction – not stated, but patient comfort was measured (see below) Physician satisfaction – not directly stated Physician efficiency – increased Time physician spent facing the patient increased by 57% Time spent facing the computer decreased by 27% 69% of patients felt comfortable with a scribe in the room, but proportion of patients who felt comfortable with the number of people in the room decreased from 93% to 66% Many patients in this study brought family members with them to their visit to translate Limitations: small sample sizes; post-scribe productivity data included 10% of visits that did not have a scribe; time estimates could be subject to bias
Zhong et al.	2019	USA Dermatology department of an academic hospital	Cross-sectional anonymous survey 25 dermatology trainees (residents & fellows) 14 faculty dermatologists	Most faculty & trainees felt that scribes decreased documentation time (92% faculty, 88% trainees) 76% of trainees felt scribes increased faculty direct teaching 80% of trainees felt that scribes improved overall education 57% of faculty felt that scribes increased faculty direct teaching & improved overall education for trainees Across most domains trainees perceived benefits of scribes on teaching more strongly than faculty did Trainees felt that scribes taught them how to document efficiently Most trainees felt that scribes allowed them to focus more on learning Limitations: single institution, use of subjective measures of educational impact

Table D.20

Scientific / conference abstracts not yet published as full studies
(Note. ED = emergency department; EM = emergency medicine)

Author	Year	Setting / Specialty	Method	Results
Abelev et al.	2020	Canada	Mixed-methods model Exit interview & semi-structured interviews coded into themes using constructivist grounded theory approach	Students found this student volunteer model of scribing to be helpful for their future career goals Medical students felt that scribing provided them with a

			5 undergraduate students & 5 medical students were trained as scribes	valuable experience & should be added to the medical school curriculum
Anderson & Tschirhart	2017	USA Scribe pilot project at a "large provider organization" Primary care	Semi-structured 45-min interviews Code structure of common themes was developed using a consensus-based procedure Interview transcripts coded using the constant comparative method 23 "informants" (organization leaders, site administrators, primary care clinicians, medical scribes)	93% of physicians reported decreased emotional exhaustion 67% of physicians reported greater professional competence Physicians reported concerns with scribe turnover, variability in scribe competence, & investment in training scribe
Brown et al.	2014	USA Urban academic university hospital, level 1 trauma center EM	Randomized control group design with 8 randomly selected ED attending physicians working with scribes & control group working without scribes Authors developed valid & reliable measures of authenticity & burnout with 4 subscales Composite scale called the self-assessed authenticity score	Working with scribes increased physician self-assessed authenticity score & mitigated factors thought to lead to physician burnout Impact on attending physicians of working with a scribe is separate from any benefit from working with a medical student
Bryce et al.	2019	England Trauma hospital	Truro Trauma Scribes initiative launched in 2016 to help improve trauma documentation quality & improve students' educational experience of major trauma Trauma booklets completed by students were compared to those completed by trauma team members	Student scribes outperformed other members of the trauma team in quality of trauma documentation: increased accuracy & completeness, more comprehensive chronology, increased completion of the 10 core data fields 88% of medical student scribes felt that the experience of acting as trauma scribe was of educational benefit & 75% felt that their presence benefitted the patient
Cancian et al.	2017	USA Ambulatory urology practice – private & academic	Retrospective review of billing and survey of physicians 9 urologists (100% response rate)	Physicians reported increase in productivity & quality of life when working with a scribe Physicians reported an average decrease of 5.9 hrs in after-hours documentation when working with a scribe
Chen et al.	2012	Canada ED of an urban hospital EM	Pilot project Physician survey Convenience sample of 15 physicians who each worked 8 control shifts and 8 scribed shifts	Physicians reported increased satisfaction when working with a scribe & increased time spent on clinical tasks vs. clerical tasks Physician efficiency did not improve Chart legibility improved with scribes
Dick et al.	2018	Canada ED of an urban hospital	Pilot study Physician surveys using a 10-point Likert scale	Mean physician mental fatigue decreased by 33% & physical fatigue decreased by 23%

		EM	3 physicians – each with different typing skills measured in words/min.	Mean physician work enjoyment increased by 10%
Dusek et al.	2019	USA Ophthalmology clinics	Metrics obtained from EHR audit log 4 physicians 17,608 office visits analyzed (13,270 with scribes, 4338 without scribes)	Use of scribes associated with decrease of 1.9 minutes during the visit, 2.7 minutes overall Use of scribes associated with 640-character increase in note length – an unanticipated consequence of scribe use Use of scribes associated with decreases in documentation time after the visit (0.79 minutes)
Feld et al.	2017	USA Primary care (general internal medicine) clinic at the University of Chicago	Survey of physicians 35 physicians responded (90% response rate)	25% of physicians reported active symptoms of burnout 79% of physicians reported insufficient time for EHR documentation and only 33% were satisfied with the EHR 58% of physicians were interested in piloting scribes in the clinic and activities they most wanted help with were allergy review, reconciling medications, reminders about medication refills, review of best practice alerts, & navigating the patient through clinic Only 32% of physicians interested in working with a scribe were willing to see extra patients in order to work with a scribe
Hribar et al.	2020	USA Ophthalmology at an academic center	Efficiency metrics compared with vs. without a scribe: provider documentation time, visit length, time to chart closure Note length & percent of note edited by provider also assessed 7 ophthalmologists	Mean total documentation time decreased with a scribe compared to no scribe (4.7 min. vs. 7.6 min) Mean documentation time during the visit decreased with a scribe compared to no scribe (2.7 min. vs. 5.9 min.) Physicians edited scribed notes less Scribe use was associated with longer office visit length & longer time to chart closure, impact of scribes on workflow requires further study
Iqbal et al.	2017	USA Gastroenterology lab of a tertiary care hospital	Retrospective chart review 866 procedures without a scribe & 278 procedures with a scribe Time metrics calculated for procedures where a scribe was present vs. no scribe	Mean pre-op time decreased from 45.60 min. without a scribe to 40.94 min. with a scribe Mean time in endoscopy room decreased from 33.46 min. without a scribe to 25.20 min. with a scribe Mean procedure time decreased from 22.07 min. without a scribe to 10.99 min. with a scribe
Jones et al.	2018	USA ED of academic	Anonymous electronic survey	Resident physician educational satisfaction – increased

		level-1 trauma center Resident physicians	12 resident physicians	Working with a scribe increased time that residents had to teach & focus on patient care Scribes improved residents' adherence to work-hour restrictions
Lancey	2019	USA Academic general internal medicine outpatient practice associated with a university	Prospective observational trial studying interaction between physicians, patients, exam room computers, and scribes Time data recorded and project assistants observed interactions Patients surveyed	Physicians spent more time facing patients when scribe present (57% vs. 49%) Physicians spent less time facing EMR when scribe present (27% vs. 38%) Physicians spent more time examining patients when scribe present (15% vs. 10%) Patients felt their physician gave them undivided attention significantly more often with a scribe present (97% vs. 83%)
Leeman & Schaal	2019	Location not stated Academic ophthalmology center	Prospective study utilizing 4 effectiveness metrics: physician satisfaction, patient satisfaction, productivity, & financial implications 9 physicians 1 scribe	Average physician satisfaction increased by 14.28% from baseline when a scribe was present Preliminary data for patient satisfaction & wait-times inconclusive until more data is collected
Lerner et al.	2016	USA Community cancer center	Quality improvement project 3 oncologists worked with scribes Data extracted from EHR data warehouse Patients & physicians completed questionnaires Quality of documentation assessed by independent blinded reviewers	Physicians working with a scribe reported improvements in satisfaction with amount of time spent with patients, ability to complete documentation, & in work-life balance compared to non-participating physicians Patient satisfaction was high and remained high post-scribe 90% of patients reported being comfortable with having a scribe present EHR note quality improved from 76% without scribes to 98% with scribes (note quality scored on elements from institutional note optimization guidelines)
Lorigiano et al.	2020	USA Ambulatory urgent care clinic	Resident physicians were surveyed after 2 weeks working with a scribe 19 residents completed the survey (50% response rate)	Residents were more satisfied with efficiency of documentation & time spent on documentation outside of visits when working with a scribe Residents felt their ability to listen to patients improved when working with a scribe Residents felt that documentation note quality was unchanged when working with a scribe Diagnostic capture increased when working with a scribe (as measured by medical complexity factor score)

McGuire et al.	2018	USA Academically affiliated primary care group	Impact of scribes on provider efficiency metrics calculated using a provider efficiency profile generated by the EHR 6 providers who worked with scribes were compared to 17 providers who did not work with scribes	Overall provider efficiency profile score for providers who worked with scribes increased by 20.0% vs. a decline of 16.9% in providers who didn't work with scribes EHR system time per appointment decreased from 24.8 min. without a scribe to 19.9 min. with a scribe Documentation time decreased from 8.30 min. without a scribe to 3.64 min. with a scribe No significant differences in after-hours time or note length
Misra-Hebert et al.	2017	USA Internal Medicine and Family Medicine physicians at 29 practice sites	Physician burnout levels assessed using survey including the Maslach Burnout Inventory (MBI) 76 physicians completed surveys	9 (12%) of physicians worked with a scribe On the MBI – 38% of physicians scored high for emotional exhaustion & 24% scored high for depersonalization; 58% of physician scored high on personal accomplishment No significant differences in MBI scores found between physicians working with or without a scribe
Ondrey & Schutte	2018	Not stated Otolaryngology	Pilot project 1 oncology-focused otolaryngologist 1808 charts analyzed for pre-and post-metrics of scribe implementation (903 pre-scribe and 905 post-scribe)	Number of patients seen per day increased by 2.93% Clinical workday shortened by 11-17% Time spent completing documentation outside of clinic times decreased from ½ day per month to ½ day per quarter Need for excellent charting templates noted
Perozich et al.	2017	USA Primary care	Pilot study Objective was to develop partnership between school of medicine, premedical advising program, & ambulatory medical practice to implement a scribe program & determine if scribes increased joy of practice 6 physicians & 6 premedical student scribes 3-week scribe training course developed	Qualitative surveys found that "joy of practice" increased among all physicians working with a scribe No significant change in workflow, quality, & patient satisfaction during 4-month pilot
Pozdnyakova et al.	2018 a	USA Academic general internal medicine practice	Pilot study 6 physicians & 1 full-time scribe Retrospective chart review of EHR note quality conducted using 11-item tool based on items from 2 validated tools Scribed & unscribed notes randomly selected &	150 notes reviewed (75 scribed & 75 unscribed) No difference in overall documentation quality between scribed & unscribed notes Scribed notes more likely to contain complete History of Present Illness (HPI) section compared to unscribed notes

			physician identifiers removed	(52% vs. 33%) & this section was more likely to be clear in scribed vs. unscribed notes (92% vs. 69%)
Pozdnyakova et al.	2019	USA Academic general internal medicine clinic	Pilot study 6 physicians 1 full-time professional medical scribe 1,184 encounters (579 without scribe & 605 with scribe) Aim was to assess impact of scribe on clinical productivity	Rates of reconciliation of external information were higher post-scribe (68.8% pre-scribe vs. 77.0% post-scribe) Rates of review of the problem list were higher post-scribe (6.10% pre-scribe vs. 9.42% post-scribe) Number of patients seen per clinic session & time to check-out improved slightly but not significantly post-scribe
Ramirez	2016	USA Academic ED of a Level 1 Trauma Center EM Residency Program	Scribe performance constantly evaluated via chart audits and provider evaluations	"Providers quickly appreciated use of scribes as shown by a Likert scale survey at the end of the first six months of the program" (p. S151) "Scribes were felt to increase provider well-being, billing, efficiency, number of patients seen per shift and decreased the amount of charting time" (p. S151)
Seng et al.	2019	USA Single tertiary-care institution outpatient surgical oncology clinic	Pilot program Retrospective cohort review 2 surgical oncologists 384 clinic encounters (183 pre- and 202 post-scribe) Surrogate variables for visit complexity & resident physician involvement were recorded	Mean number of patients seen per day increased from 9.6 pre-scribe to 12.6 post-scribe Resident physician involvement in patient visits increased from 33.9% pre-scribe to 45.1% post-scribe
Tanaka et al.	2012	USA Academic EM residency program	Online 10 question survey with Likert scale responses administered to 21 resident physicians	21 of 31 resident physicians completed the survey (68% response rate) Residents overall perceived scribe presence at their teaching site as a neutral interaction Residents felt that scribes did not impact overall learning process, or direct interaction time, teaching time, & quality of teaching from attending physicians Resident physicians reported feeling positive about working with scribes upon graduation
Thompson et al.	2016	USA Academic emergency department Emergency medicine	Observational survey of third-year EM resident physicians 7 resident physicians responded (88% response rate)	86% of participants felt that working with a scribe improved their educational experiences 71% of participants felt that working with a scribe was an effective fatigue mitigation strategy and decreased work hours

				86% of participants agreed that working with a scribe increased their focus on patient care & gave them more time to teach junior physicians
Wegg et al.	2014	USA Single hospital ED EM	Standardized post-shift survey used to assess resident physician & attending physician impression of amount & quality of teaching when resident physicians had assistance of a scribe compared to when they did not 39 control shifts & 72 scribe shifts	24% of resident physicians & 16% of attending physicians felt that high-quality teaching occurred during regular shifts, compared with 65% and 53% during scribed shifts 5% of resident physicians & 9% of attending physicians felt that teaching occurred on "almost every patient encounter" during regular shifts, compared to 24% and 33% during scribed shifts These were all statistically significant differences Qualitative comments – scribed shifts provided increased opportunity for direct teaching with immediate feedback Resident physicians were able to see more patients during scribed shifts
Williams et al.	2016	USA ED EM	Prospective observational study on convenience sample of ED patients 12 Likert-style questions 130 patients (68% response rate)	Patient attitudes toward medical scribes were "generally positive" (average attitude score of 3.7 out of 5) 8.4% of patients were concerned about privacy when scribes present
Wright et al.	2019	USA Neuroscience ICU	Prospective survey of nursing views of intensivist performance while working with a scribe 98 pre-scribe responses (53% response rate) and 80 post-scribe responses (41% response rate)	84% of nurses reported that the scribe program improved the intensivists' daily rounds

Table D.21

Dissertations, clinical scholarly projects, and theses

Author	**Year**	**Setting / Specialty**	**Method**	**Results**
Cleland	2017	USA Urgent care medical clinic	Provider satisfaction measured using a 6-item Likert survey Survey came from the UCSF team documentation and excellence in primary care program Convenience sample 2 physicians 2 nurse practitioners 1 physician assistant	Patient satisfaction – not measured Physician satisfaction – increased Physician efficiency – increased Note completion significantly shorter when working with a scribe - > 20 min in 85% of cases when physician working without a scribe vs. < 5 min. in 64% of cases when working with a scribe (p. 40)
Glynn	2018	USA	Pre-post study design	Patient satisfaction – slightly

		Pediatric urgent care	Provider satisfaction measured by third-party reporting system NRC Connect Experience provided by National Research Corporation, Health Patient satisfaction measured by hospital-based Family Experience Survey (FES) scores Number of physicians and patients surveyed not stated	increased from average of 87.6 pre-scribe to 88.0 post-scribe (max. score possible unknown) Physician satisfaction – increased from average of 3.52 pre-scribe to 4.07 post-scribe (max. score possible = 5) Provider attrition rates decreased from 45% pre-scribe to 12% post-scribe
J. E. Lowry	2017	USA Medical students who had worked as scribes in the past	Purposive convenience sampling and snowball sampling In person interviews which were audio recorded Inductive thematic analysis used to determine main ideas from interviews 16 medical students	Primary themes identified: framework for learning, confidence, commitment to the profession Major sub-themes identified: clinical knowledge, career exploration, mentors & role models, experiences dealing with difficult situations

Table D.22
Grey literature

Author	**Year**	**Setting / Specialty**	**Method**	**Results**
Campbell et al.	2012	USA	Practice brief	Using scribes may improve overall quality of documentation – increased level of specificity & increased granularity Scribed consults may be available more quickly Possible disadvantages of using scribes include documentation errors, providers missing computer prompts, & providers being unable to navigate the computer system independently if scribe is unavailable Role & signature of the scribe must be clearly identifiable & distinguishable from that of the physician Scribes should be assessed with competency & performance evaluations Job expectations & responsibilities for scribe must be clearly defined and in writing; dual roles at same time should be avoided
Corby et al.	2019	USA	Sociotechnical approach using the Rapid Assessment Process model Grounded theory approach based on the 8 dimensions of sociotechnical model for health information technology 81 people interviewed: 30 physicians, 27 scribes, 24 administrators	This paper focused on the scribe-provider interaction theme, which had 6 subthemes: characteristics of an ideal scribe, characteristics of a good provider, provider variability, quality of relationship between scribe & provider, negative relationship between scribe & provider, evaluation & supervision of scribes Scribes need to communicate their needs, be able to handle criticism & feedback, be flexible/adaptable, be able to handle pressure Ideal scribe should have a medical or healthcare background Scribes needs to have knowledge of

			5 sites including primary care and specialty clinics	medical terminology Professionalism in interactions with patients & providers is key for scribes Scribes need to have strong technology/computer skills & have good typing, grammar & spelling skills Scribes must have a passion for medicine Physicians (and other providers working with scribes) must communicate effectively with scribes: clarify exam findings, be clear what they want in the note, think aloud Providers must be organized & provide feedback to scribes Providers must be willing to give up some control of the wording on medical notes written by scribes Providers must have patience with new scribes Good rapport & trust between scribe & provider key Scope of tasks to be done by scribes should be clearly defined Scribed notes should be routinely evaluated for quality
DeWitt & Harrison	2018	USA Medical school applicants	De-identified review of medical school admissions data	Applicants with self-reported scribing experience had 1.61 OR of receiving admission offer Authors of this study concerned that scribing may become a hidden pre-requisite for entry into medical school, which could disadvantage low-income applicants if they can't afford to take low paying scribe job ($12/hr) Authors debate whether scribes take away physician time from teaching, or allow physicians to redirect documentation time to teaching
Miller et al.	2016	USA Multiple specialities in a large group practice	Pilot project Measured productivity, patient & physician satisfaction 6 physicians (family physician, subspecialist, 2 surgeons, 2 cardiologists) Unknown number of patients	Patient satisfaction – unchanged Physician satisfaction – increased Physician efficiency – increased Both EHR-challenged and EHR-savvy physicians reported increased satisfaction & productivity when working with a scribe 5 or 6 physicians reported decreased documentation time & increased joy of practice post-scribe 1 physician preferred using dictation service but had increased efficiency when working with a scribe Turnover of scribes is high, most work as scribes for about one year (p. 24)
Morawski et al.	2017	USA Internal medicine outpatient clinic	Pilot project measuring physician burnout and patient satisfaction 5 physicians & 1 physician assistant Unknown number of patients	Patient satisfaction – increased Physician burnout – decreased Physician efficiency – increased Providers working with scribes had improvement on all Maslach Burnout Inventory (MBI) sub scores All dimensions of patient experience improved post-scribe Providers saw more patients per week & were more likely to add on urgent patients to their schedules when working with a

				scribe Documentation burden after-hours decreased post-scribe "Documentation is time consuming, can be delegated, and is more likely to be accurate if completed in real time" (p. 95)
Nambudiri et al.	2018 a	USA Academic dermatology practice	Multi-practice quality improvement pilot project Physician surveys 12 physicians	Physician satisfaction – increased Physician efficiency – increased 80% of documentation was completed outside of clinical session time when physicians weren't working with a scribe Physicians reported decreased documentation burden & increased job satisfaction when working with scribes
Nambudiri et al.	2018 b	USA 5 practice locations across an academic dermatology practice	Departmental quality improvement initiative Patient surveys 652 patients	Patient satisfaction – increased 59% of patients had no preference for the gender of the scribe, 39% of patient preferred a female scribe (mainly female patients seeing a female dermatologist) Limitations: only female scribes were employed at the sites that participated in this study
Tegen & O'Connell	2012	USA Children's Hospital	Not described	Patient (parent) satisfaction – increased Physician satisfaction – increased Physician efficiency – increased Notes were more succinct & complete post-scribe

Appendix E

Survey instruments

Table E.1

Details of survey instruments used in studies of effect of medical scribes on patient and physician satisfaction

Author	**Year**	**Validated Survey Used**	**Details of Surveys**	**Development Process**
Addesso et al.	2019	No	Developed by study authors Surveys were piloted with patient families, providers, and nurses	Patient questions were adapted and modified from the Consumer Assessment of Healthcare Providers and Systems survey
Allen et al.	2014	No	17 questions – yes/no options and open-ended questions	Survey questions developed and revised by multiple ED physicians and scribes
Bank et al.	2013	No	Responses were graded using a 5-point Liker-Type scale	Not stated
Bastani et al.	2014	Yes	Patient satisfaction measured using Press Ganey surveys	N/A
Danak et al.	2019	Unclear	Patient survey "included the Communication Assessment Tool (CAT), a 15-item instrument … using a 5-point Likert-type response scale" Physicians complet4ed semi-structure interviews	Not described

Danila et al.	2018	Unclear	4 items from work control scale used to assess physician autonomy 5-item job satisfaction scale used to assess physician professional satisfaction Modified version of the Health Information Technology Usability Evaluation Scale (Health-ITUES) used to assess usability 5-point Likert type item from the Clinician Group Adult Survey used to survey patients	Physician perception of clinic workflow was assessed using a "previously described 5- point Likert item"
Delage et al.	2020	No	Clinical faculty survey included 8 questions using a 5-point Likert scale Clinical staff survey included 6 questions using a 5-point Likert scale Student survey included 9 questions using a 5-point Likert scale	Not described
DiSanto & Prasad	2017	Not stated	Not stated	Not described
Dunlop et al.	2018	Yes and No	Validated patient satisfaction surveys searched for relevant items Items extracted from Press Ganey survey	Explorative semi-structured interviews used to identify themes
Earls et al.	2017	Yes and No	19 questions from the 36-item Physician Work-Life Survey	Patient surveys consisted of 6 closed-end questions plus open-ended questions Physician surveys included 5 closed-end questions plus open-ended questions
Gidwani et al.	2017	Yes and No	Physician satisfaction survey instrument was not a validated survey Patient satisfaction measured using a shortened, validated, 6-item questionnaire designed for the primary care setting	Physician satisfaction measured by a 5-item questionnaire
Gao et al.	2020	Not stated	Physician satisfaction was assessed using an online Qualtrics survey & written survey that allowed for open-ended comments Survey questions were answered on a 1-5 or 1-6 agreement scale	Not described
Hafer et al.	2018	Not stated	Medical student survey had three 7-point Likert scale questions about quality of teaching they received	Likert scale questions lacked specificity Medical student survey also included open-ended question about their overall learning experience
Heckman et al.	2020	Yes	Physician satisfaction measured using survey recommended by the American Medical Association in its Steps Forward Team Documentation Module; this survey uses a 5-point Likert-like	Surveys developed by the American Medical Association for its Steps Forward Team Documentation Module

			scale Patient satisfaction was measured using a similar survey with the same Likert-like scale	
Hess et al.	2015	No	No validated survey instrument was available Surveys were self-administered anonymously online Questions were a mix of categorical and ordinal variables including Likert scales and continuous variables	Surveys were drafted using a logic model of provider satisfaction and charting activities Surveys were tested on a convenience sample of faculty & revised based on input
Hudson et al.	2020	No	Provider survey had 4 statements rated on a 5-point scale	Not described
Imdieke & Martel	2017	No	All survey questions were designed using a 5-point Likert scale Provider satisfaction survey had 8 items Patient satisfaction survey had 5 items Medical staff survey had 5 items	Not described
Keefe et al.	2020	Yes	Patient satisfaction measured by responses to the Press Ganey survey Providers briefly surveyed using 5-point Likert-scale	Likert-scale provider question development not described
Koshy et al.	2010	No	"Patient and physician satisfaction surveys were developed"	Not described
Lin et al.	2020	No	Faculty physicians completed mid-year and end-year survey questions about student scribes on a 5-point Likert-like scale Student scribes completed mid-year and end-year survey questions about their physician mentors on a 5-point Likert-like scale	Not described
C. Lowry et al.	2017	Yes and No	Patient surveys were mailed Clinician and Group Consumer Assessment of Healthcare Providers and Systems (CG-CAHPS) visit survey Physician surveys were not described	Not described
Martel et al.	2018	No	Patient survey had 5 items rated on a 5-point Likert-type scale Physician survey had 10 items rated on a 5-point Likert-type scale	Not described
McCormick et al.	2018	No	Likert-type patient and providers surveys	Surveys were developed "based on previously published studies examining medical scribes in ambulatory clinics"
Mishra et al.	2018	No	Physicians completed a 4-question survey at baseline and a 6-question survey near the end of the study periods Clerical work burden & physician perception of time spent on EHRs & direct patient interaction were measured using a 4-level ordinal scale Physician perception of	Not described

			association of scribe use with quality of patient interactions & work satisfaction were measured using a 5-point Likert- scale	
Morawski et al.	2017	Yes	Patients surveyed using the Press Ganey survey Physicians surveyed using the Maslach Burnout Inventory (MBI)	N/A
Nambudiri et al.	2018 a	Not stated	Physicians completed 7 prescribe questions and 10 post scribe questions All responses were scored on a 4-point Likert scale	Not described
Nambudiri et al.	2018 b	Not stated	Patients completed 3 post-visit questions; survey was anonymous All questions were scored on a 5-point Likert scale	Not described
Ou et al.	2017	No	Resident physicians completed a 10-item pre-scribe survey and 16-item post-scribe survey Questions were scored on 5-point Likert-type scale Surveys were anonymous	Surveys were developed by the authors and were not tested prior to use
Platt & Altman	2019	No	Patient surveys were anonymous, included 5 questions Physician surveys included 10 items scored on a 5-point Likert scale	Not described
Pozdnyakova et al.	2018 b	Some questions were from validated surveys	Physician survey included 21-item pre- and 44-item post-pilot questions and included the validated single-item burnout assessment and questions adapted from the Consumer Assessment of Healthcare Physicians and Systems Clinician & Group Survey (CG-CAHPS) Patient survey included 27-items and incorporated CG-CAHPS questions Questions were scored on a 5-point Likert scale	Pre- and post-pilot physician surveys were developed based on a literature review
Rohlfing et al.	2019	Yes	Patient survey included 11 questions taken directly from the Press Ganey survey	N/A
Sattler et al.	2018	No	Physician experience was measured by open-ended written reflections Constant comparative method with grounded theory approach used to generate a codebook	N/A
Shuaib et al.	2019	Yes	Patient satisfaction measured by 6-item Press Ganey surveys Questions measured with a 5-point Likert-type scale Physician satisfaction measurement not described	N/A
Taylor et al.	2019	No	Patient satisfaction measured using a 2 to 3 question survey with a Likert scale Patient satisfaction also measured through the Interactive Customer Evaluation (ICE) and the Joint Outpatient Experience Survey	Not described

			(JOES) Physician satisfaction measured using an 11-question survey with a Likert scale	
Yan et al.	2016	No	Semi-structured interviews analyzed using interpretive description thematic analysis	N/A
Yan et al.	2018	No	16-item questionnaire	Questionnaire was developed iteratively with committee of physicians & health system researchers Questionnaire was pilot tested with 10 patients Option of selecting N/A for sensitive topics was added based on patient feedback
Zallman et al.	2018	No	Questions used a 4-point Likert scale	Authors state that "because there were no standardized instruments to assess level of comfort with scribes, we created questions based on our experience" (p. 614)
Zhong et al.	2019	No	Attending physician & resident/fellow survey questions were rated on a 5-point Likert scale	Not described