A Scoping Review and Thematic Analysis of the Effects of Medical Scribes on Patients and Physicians

by

Lisa Shah
M.D., University of British Columbia, 2003

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Abstract

Objective: To investigate the effects of medical scribes on physician and patient satisfaction, physician burnout, and the educational experience of medical students and residents.

Methods: A scoping review was done by searching the databases PubMed, EMBASE, and CINAHL. Google Scholar was searched for grey literature. Relevant studies were analyzed qualitatively.

Results: Medical scribes increase physician satisfaction and decrease physician burnout, while having minimal impact on patient satisfaction. The effects of medical scribes on medical student and resident education appear positive in preliminary studies but have not yet been adequately studied. Very few studies of medical scribes have been conducted in Canada.

Conclusion: 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 regarding the impact of medical scribes in Canada are needed. Administrative hurdles to the implementation of medical scribes in Canadian hospitals could be a barrier to pilot studies in Canada.

Keywords: medical scribe*, physician scribe*, clinical scribe*, scribe*, team documentation, documentation-related burden, physician burnout, physician satisfaction, patient satisfaction, health information system, electronic medical record (EMR), electronic health record (EHR)

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Introduction

Documenting the clinical encounter accurately and thoroughly is vital for high quality healthcare. Progress notes are required to communicate between physicians and other healthcare professionals caring for the same patient (Misra-Hebert et al., 2016). The medical chart is also a legal document. As the common medical saying goes, "if you didn't document it, it didn't happen".

The introduction of electronic health records (EHRs) and electronic medical records (EMRs) brought the promise of increased efficiency for busy physicians. However, the past decade of widespread EHR/EMR implementation has instead increased documentation time, especially for primary care physicians (Zallman et al., 2018, p. 612). Some physicians report that they now spend more time on documentation than on direct patient care. Objective data exists to confirm this claim. Sinsky et al. (2016) found that "for every hour physicians provide direct clinical face time to patients, nearly two additional hours is spent on EHR and desk work within the clinic day" (p. 753). These authors also found that the physicians they studied spent one to two hours of time each evening outside of office hours completing computer and clerical work at home (Sinsky et al., 2016). A study of EHR access time stamps from 2011-14 revealed that primary care physicians spent approximately half their work hours on "desktop medicine", and that this documentation-related burden increased over time (Tai-Seale et al., 2017). These authors found that face-to-face time between physicians and patients decreased from 2011 to 2013, while time spent on desktop medicine increased from 2011 to 2014. Documentation tasks often occur after hours, encroaching on physicians' time with their friends and family. Documentation-related burden, exacerbated by poor EHR usability, is known to decrease physician professional satisfaction (DiSanto & Prasad, 2017; C. Lowry et al., 2017).

With the implementation of EHRs and EMRs in the past few decades, healthcare has become more "data driven", with increased clerical workload for physicians (Bossen et al., 2019, p. 77) . The medical scribe industry developed in response to this new data-centric workload in health care, in an effort to off-load some of the clerical tasks from physicians. It is somewhat ironic that documentation tasks that in the past could be completed by physicians' office staff became tasks that only physicians could complete once EHRs and EMRs were introduced (Bastani et al., 2014). Bastani et al. (2014) remarked that EHR documentation requirements result in "relegating the work previously performed by the secretarial staff to the most highly trained professional in the emergency department" (p. 400). In an effort to return to a more team-based documentation effort and decrease the burden on physicians, medical scribes were hired to chart for physicians in the United States (Marks & Kopp, 2015, p. 33). As the implementation of EHRs and EMRs rose dramatically, so too did the number of medical scribes and their degree of formal organization in the United States (Bossen et al., 2019).

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). Numerous articles emphasize the need to clarify a scribe's role in cases where staff may perform multiple roles at a medical clinic (Campbell et al., 2012). See Appendix A for the Joint Commission definition of a medical scribe and the American Academy of Emergency Medicine position statement on medical scribes. Scribing has also been referred to as "team documentation" or "documentation assistance" (Sinsky & Privitera, 2018, p. 2).

The scope of work for a medical scribe can vary, depending on the practice environment (inpatient versus outpatient), as well as the wishes of the physician. In general, the duties which a scribe is expected to perform include the following (Campbell et al., 2012, p. 64):

- Assisting the provider in navigating the EHR
- Responding to various messages as directed by the provider
- Locating information for review (previous notes, reports, test results)
- Entering information into the EHR as directed by the provider
- Researching information requested by the provider

The term "provider" rather than physician is used in the above description because in the United States, medical scribes may assist nurse practitioners or physician assistants in addition to physicians. Scribes recruited by scribe training companies are often nursing and medical students, or undergraduate students interested in these careers. The clinician must sign and date/time stamp the scribe's clinical note after it is finished, in order to authenticate it (Shultz & Holmstrom, 2015, p. 372).

Woodcock et al. (2017) found that there were not any national, state, or local regulations governing scribe scope of practice in the United States (p. 383). In Canada, the only official comment on the role of medical scribes found during this scoping review is from a Canadian Medical Protective Association (CMPA) article published in 2018 (Canadian Medical Protective Association, 2018 February). The CMPA recommends that physicians clarify who is the scribe's employer, ensure that scribed notes meet legal and professional requirements for physicians' notes, and obtain patient consent for a scribe to be present. The CMPA notes that "medical scribes are neither independent nor regulated professionals" (CMPA, 2018 February, p. 1), and physicians are responsible for supervising scribes.

There are a number of different organizations which offer their own medical scribe certification exams in the United States. The American College of Clinical Information Managers (ACCIM) was started in 2010 by the C.E.O. of ScribeAmerica, the largest scribe company in the United States. This organization's name changed in 2014 to the American College of Medical Scribe Specialists (ACMSS) (Bossen et al., 2019; Campbell et al., 2012). ScribeAmerica describes itself as a sponsor of the scribe industry's only non-profit organization, the ACMSS (ScribeAmerica, 2019b). The American Healthcare Documentation Professionals Group also offers a certification exam for medical scribes. See Appendix B for details of these scribe organizations and the certification/credentialing exams that they have offered over the past decade. Though ScribeAmerica is the largest scribe company in the United States, there were 21 scribe companies with employees in 40 states in 2014. In 2016, Dr. Michael Murphy, the C.E.O. of ScribeAmerica, estimated that there were between 16,000 and 18,000 medical scribes practicing in the United States (Coutre, 2016).

Despite the mounting number of research studies confirming that physician documentation-related burden is rising along with the adoption of digitized medical records, opposing sides view medical scribes either as a valid addition to the healthcare system or unwanted interlopers. Concerns have been raised over whether medical scribes impinge on patient confidentiality to an unreasonable degree (Wangenheim, 2018). Several opinion articles have described concerns that medical scribes act as a workaround for poor EMR/EHR usability, and thus may mask problems and decrease market pressure on the industry to work on innovations that improve usability (Gellert et al., 2015; Schiff et al., 2016). Gellert et al. (2015) raise other objections to the medical scribe industry, including the risk of unintended functional creep that could put patients at risk if scribes are ever permitted to enter orders. They fear that

this possibility would render decision support alerts intended for physicians useless. Schiff et al. (2016) suggest that "something is lost when we streamline documentation via scribed notes" (p. 980). These authors note that time to reflect and write the visit note after a busy clinic is over is an important cognitive process that physicians might miss when working with a scribe.

Success of a medical scribe program can be measured on many levels. Possible goals include "reductions in transcription costs, improvements in overall documentation, reduced turnaround time for authentication and increased patient satisfaction" (Campbell et al., 2012, p. 68).

Rationale

The adoption of health information systems in Canada has exploded over the past ten years. Canada Health Infoway funded an evaluation study of connected health information benefits. The report on this study noted that EMR use among primary care physicians in Canada increased from 24% in 2006 to 85% in 2017 (Canada Health Infoway, 2018). Many physicians lament that they are not able to keep up with the documentation demands of EHRs and EMRs. Physician burnout is increasing, and career satisfaction is decreasing. Many physicians state that they would not choose medicine as a career if they had it to do over. Quality of care may be decreasing due to physicians burdened by excess administrative duties (Olson et al., 2019; Rao et al., 2017, p. 237). Olson et al. (2019) investigated the impact of workplace stressors on physician burnout. They found that insufficient documentation time increased the odds ratio of physician burnout to 5.63. Another recent study found that approximately 70% of physicians using EHRs reported health information technology-related stress, and this predicted burnout symptoms (Gardner et al., 2019). Insufficient time for documentation was the health information technology issue which most strongly predicted burnout symptoms in this study.

Burnout is common among Canadian physicians. A Canadian Medical Association (CMA) survey conducted in 2017 found that 30% of Canadian physicians reported burnout (Canadian Medical Association, 2018). The CMA survey used the two-item Maslach Burnout Inventory (MBI 2), which this article stated had been deemed reliable and valid in physician populations. The MBI 2 can be used as an alternative to the full MBI-22 if necessary, as the MBI 2's questions about emotional exhaustion and depersonalization are indicators of burnout (West et al., 2012). The CMA survey stated that they determined burnout as being present if a physician reported emotional exhaustion and/or depersonalization at a high level, which they defined as "occurring at least weekly" (Canadian Medical Association, 2018).

A possible solution to physician documentation-related burden is redistributing documentation responsibilities to persons other than physicians as part of an "expanded primary care team" (Zallman et al., 2018, p. 613). Medical scribes are a very new phenomenon in Canada, with only a few known formal scribe training companies existing in Canada in 2019. Medical Scribes of Canada was founded in 2014 by an Emergency Medicine physician in Ontario (Medical Scribes of Canada, 2019). ScribeCanada, "a sister company of ScribeAmerica", launched a Physician Navigator programme in emergency departments in the Greater Toronto Area, which expanded to medical scribe services in outpatient health systems in 2018 (ScribeCanada Healthcare, 2018).

Objectives

The goals of this scoping review are to identify and summarize the research evidence on the following issues, with a focus on the Canadian context:

- the effect of medical scribes on physician burnout and professional satisfaction

- the effect of medical scribes on patient satisfaction
- the effect of medical scribes on medical student and resident educational experience

Peer-reviewed published studies and the grey literature will be examined. Themes will be identified and gaps in current knowledge sought. The methodological quality of individual studies will not be assessed in depth, but sample sizes and methods will be ascertained in order to identify current gaps in research (Pham et al., 2014). Directions for future research will be discussed.

Ethics

The University of Victoria Research Ethics Coordinator and the Vice-Chair of the Human Research Ethics Board determined that this project was exempt from human ethics review because it does not involve human participants (see Appendix C).

Methods

Medical scribes are an emerging phenomenon in Canada, with few published research studies. In the United States and Australia, medical scribes are more common, and thus most studies on this topic have been conducted in those countries. The literature is still scant on the qualitative impact of medical scribes on physicians and patients in any country. Those studies that do exist have small sample sizes.

Scoping reviews are more appropriate than systematic reviews for topics with emerging evidence, such as the effect of medical scribes on physician and patient experience (Levac et al., 2010). Therefore, a scoping review methodology was chosen for this project. A scoping review attempts to summarize the evidence "in order to convey the breadth and depth of a field" (Levac et al., 2010, p. 1). The methodological framework for conducting a scoping review developed by

Arksey and O'Malley was followed. This includes 5 stages, with an optional sixth consultation phase (Arskey & O'Malley, 2005; Levac et al., 2010, p. 3):

Stage 1: Identifying the research question

Stage 2: Identifying relevant studies

Stage 3: Study selection

Stage 4: Charting the data

Stage 5: Collating, summarizing and reporting the results

Stage 6: Consultation phase (optional)

The Canadian Institutes of Health Research (CIHR) defines scoping reviews as:

> "exploratory projects that systematically map the literature available on a topic, identifying key concepts, theories, sources of evidence and gaps in the research. They are often preliminary to full syntheses, undertaken when feasibility is a concern - either because the potentially relevant literature is thought to be especially vast and diverse (varying by method, theoretical orientation or discipline) or there is a suspicion that not enough literature exists" (Canadian Institutes of Health Research, 2019).

It is suspected that the literature is scant on the impact of medical scribes on patient and physician experience, particularly in Canada, thus a scoping review methodology was followed. This scoping review will create a thematic analytic framework of the research found.

Stage 1: Identifying the Research Question

As this is a scoping review, broad questions were defined:

What is the effect of medical scribes on physician burnout, physician well-being, and physician professional satisfaction?

What is the effect of medical scribes on patient satisfaction?

What is the effect of medical scribes on medical student and resident education?

What is known about the effects of medical scribes in Canada?

How does the quality of scribed notes compare to notes written by physicians?

A recent systematic review of burnout among physicians found that "because of inconsistencies in definitions of and assessment methods for burnout across studies, associations between burnout and sex, age, geography, time, specialty, and depressive symptoms could not be reliably determined" (Rotenstein et al., 2018, p. 1131). The authors of this systematic review concluded that a consensus definition of burnout and standardized measurement tools are urgently needed to allow the accurate determination of physician burnout worldwide. Most of the studies included in the systematic review by Rotenstein et al. used a burnout inventory based on the Maslach Burnout Inventory (MBI). The MBI includes 3 domains: emotional exhaustion, depersonalization, and low personal accomplishment (Rotenstein et al., 2018, p. 1144). The most recent edition of the MBI manual advises that burnout should be treated as continuous data for each domain. However, many studies are still setting somewhat arbitrary cut-offs to define burnout, which makes comparison of the study results difficult. Olson et al. (2019, p. 158) state that they used the established convention of burnout among physicians as "either a score ≥27 on emotional exhaustion, a score of ≥10 on depersonalization, or both". The Canadian Medical Association (CMA) physician health survey conducted in 2017 used a similar definition of burnout. The CMA survey measured physician burnout using the two item MBI 2. This scoping review will search for studies reporting on the effects of medical scribes on MBI scores in physicians.

Stage 2: Identifying Relevant Studies

Preliminary searches were done to pilot the search strategy using the following terms: "scribe*", "medical scribe*", and "physician scribe*". Many studies were identified that referred to medical scribes simply as "scribes", or as "clinical scribes", a term this author had not previously been aware of. Therefore, a determination was made that the term "scribe*" should be used on its own for the searches in order to maintain breadth of coverage (Arskey & O'Malley, 2005, p. 23). The databases PubMed, EMBASE and CINAHL were searched using the term "scribe*". The results of those searches are summarized in Table 1. Dissertations identified by searches were obtained from the relevant university's website if necessary. Articles that were not available online were obtained through inter-library loans when possible.

Table 1: Number of Studies Identified

Database	Number of studies
PubMed	492
EMBASE	777
CINAHL	272
Total	1541

Search query used: "scribe*"
Filters: English language, from 01/01/2000 to 22/10/2019

The term "scribe*" does not have a related MeSH term in PubMed. EMBASE has "medical scribe" as a subject heading, but using this subject heading yielded only 44 results. This is likely due to the fact that many articles refer to medical scribes by the term "scribes" or "clinical scribes".

A snowball technique was used to identify studies not found in the initial search. This included reviewing the reference lists of the initial studies identified, and also reviewing articles that cite any of the initially identified studies. These citation searches eventually reached a saturation point (Arskey & O'Malley, 2005, p. 23). An updated search was performed in

October 2019. Authors of Canadian conference abstracts were contacted in an attempt to determine if their findings had gone on to publication as full articles, if articles based on these abstracts were not found in the initial searches.

Stage 3: Study Selection

The process of study selection was iterative. The search strategy was refined as abstracts and articles were reviewed (Levac et al., 2010). Articles identified through database searches and grey literature searches were screened in stages. The database search results were imported into EndNote and combined into one group. EndNote de-duplication procedure was used to remove duplicates. Next, a rapid title screen was completed. Those articles deemed possibly relevant were screened by abstract. 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.

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
- 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, i.e. the article reporting the most complete data set was used, as per Pham et al. (2014).

In order to check if an article met the inclusion criteria of being published in a peer-reviewed journal, each journal title of articles being considered for inclusion was searched in Ulrichsweb Global Serials Directory to check if it was refereed (peer-reviewed). A Prisma diagram was generated to display the process for article selection (see Figure 1) (Crampton et al., 2016; PRISMA, 2009).

Stage 4: Charting the Data

Articles meeting the inclusion criteria were read and their contents summarized as per Tables 4 to 7 in Appendix D. These tables were developed in order 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 method, and results were summarized. See Table 3 for details on the number of studies included in the final analysis by category. Table 4 includes studies published in peer-reviewed journals. Table 5 includes data from conference abstracts that met the inclusion criteria but have not yet gone on to publication as full studies. Table 6 includes data from dissertations, clinical scholarly projects, and theses. Lastly, Table 7 includes the grey literature not included in Tables 5 and 6.

Stage 5: 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 of 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 2).

Results

Database searches of PubMed, EMBASE, and CINAHL retrieved 1541 results. Duplicates were removed using EndNote de-duplication procedure and manual scanning, leaving 1174 unique articles. After rapid title screening, 237 articles were deemed eligible for abstract review. Following abstract review, 149 articles remained for full text review. Of these articles, 69 were deemed eligible for inclusion in the scoping review. Two additional references were included after reference and citation screening. Final article count included in the scoping review was 40 peer-reviewed studies and 31 grey literature articles**.**

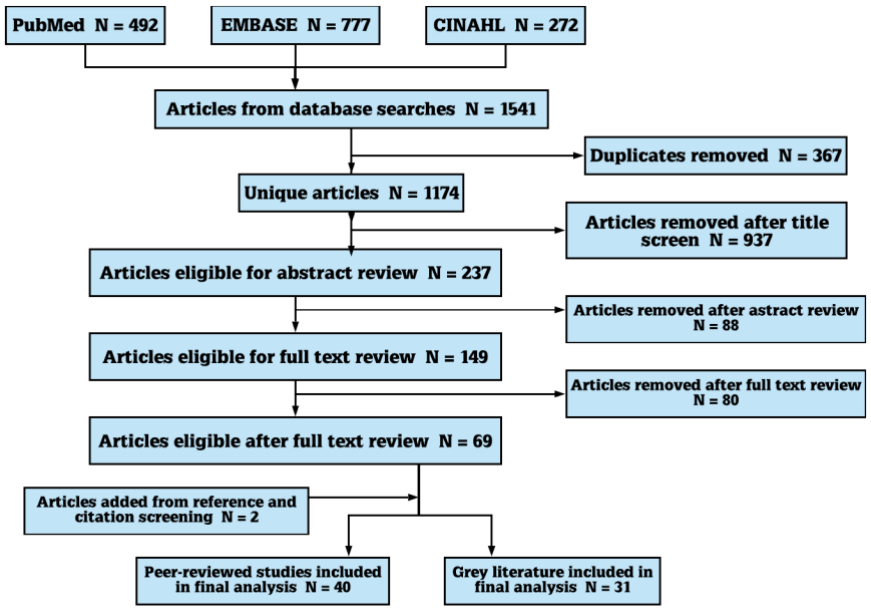

Figure 1 – PRISMA Flow Diagram

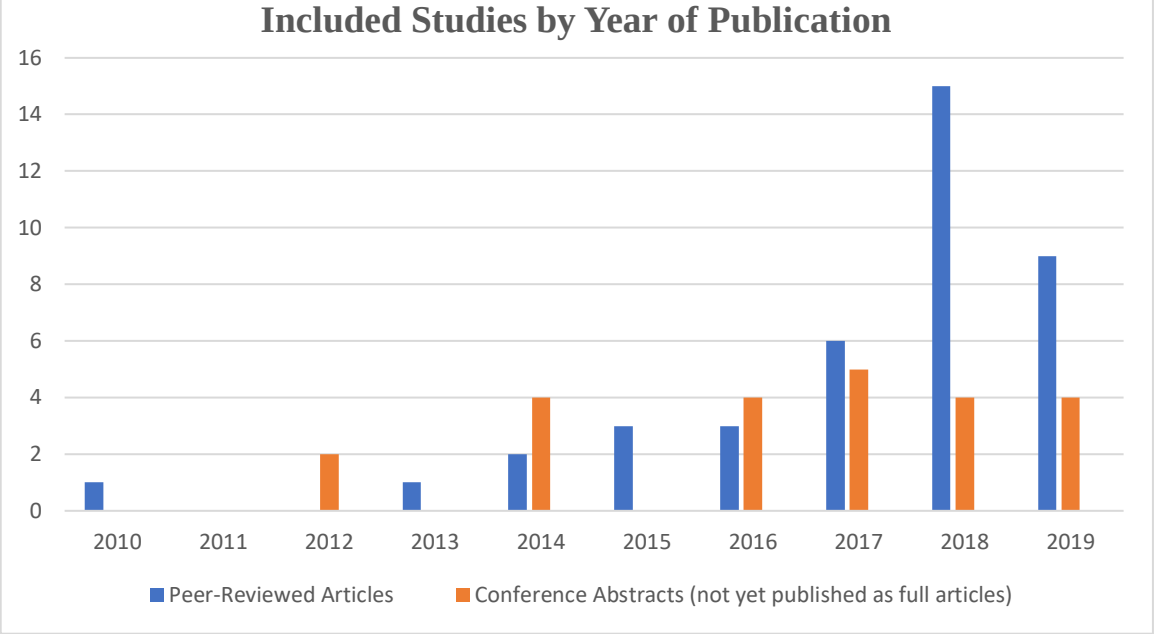

Figure 2: Studies by Year of Publication

Table 2: 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	Doctor 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 Risks of medical scribes Cost Training of scribes Problem of rapid scribe turnover
Effects on medical education	Medical students Residents
Lack of validated measures	Lack of validated surveys Lack of validated measures of burnout Lack of validated measures of note quality

Table 3: Studies by Country of Origin and Type

	No. peer reviewed studies	No. conference abstracts	No. dissertations and theses	No. grey literature articles
USA	33	18	3	7
Australia	2	0	0	0
Canada	1	2	0	0
England	0	1	0	0

Effects on Patients

Patient Satisfaction

Most of the studies reviewed found that patient satisfaction with their medical visit was high in the pre-scribe period and did not change very much post-scribe (Addesso et al., 2019; Danila et al., 2018; Lowry et al., 2017; McCormick et al., 2018). Patient attitudes towards

scribes tended to be neutral to positive (Bank et al., 2013; Rohlfing et al., 2019; Yan et al, 2018). Platt & Altman (2019) reported that 96% of patients felt comfortable with a scribe being present, and 61% of these patients were more satisfied with their family practice office visit when a scribe was present. Patients seeing an ENT specialist felt that the presence of a scribe positively impacted their visit 77% of the time (Rohlfing et al., 2019). In a primary care setting, Yan et al. (2018) found that 67% of patients had no preference about a scribe's presence, while 31% of patients preferred that a scribe be present. Numerous qualitative studies noted that patients found their physician more attentive when a scribe was present. The largest 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). Health care providers who are new to working with a scribe may require education about how best to introduce the scribe.

Some studies, such as that by Martel et al. (2018) found a slight decrease in patient satisfaction, from 100% to >90%. Taylor et al. (2019) also report a slight decrease in patient experience when a scribe is present. However, Martel et al. (2018) state that "we have found near uniform acceptance of scribes by patients, who generally welcome the provider's focused attention, as opposed to the distraction of the computer when scribes are not present" (Martel et al., 2018, p. 247). Morawski et al. (2017) reported improvement across all dimensions of patient experience when physicians had the assistance of scribes. Nambudiri, Watson, Rubenstein et al., (2018) also reported that patients had high levels of satisfaction across multiple domains assessed regarding the presence of a scribe.

A recent conference abstract reported on a study of patient satisfaction with a pilot scribe program in an internal medicine practice. In this study, medical appointments were shortened by

25% when scribes were present (Heckman et al, 2018). Despite the shorter appointments, patient satisfaction remained high and unchanged when physicians were working with a scribe. A thesis study published in 2018 found that patient satisfaction in a pediatric urgent care setting increased post-scribe (Glynn, 2018).

Willingness of patient to discuss sensitive topics with a scribe present

A concern that has repeatedly been raised in the literature is that many patients may not feel comfortable discussing sensitive topics with their physicians if a scribe is present. Some physicians reported a concern that the presence of a scribe may "hinder the full transparency of a patient's concerns" (Taylor et al., 2019, p. 3). Issues such as sexual function, mental health, domestic violence, and substance abuse might be topics that some patients would rather discuss with their physician alone.

Surprisingly, a study in a urology practice found that patients were comfortable discussing urological and sexual function with a scribe present (Koshy et al., 2010). Conversely, a recent study by Yan et al. (2018) found that sexual history was a notable exception to patient comfort with having a scribe present. In this study, male patients reported being more uncomfortable than female patients discussing sexual health with a scribe present. 57% of male patients were at least somewhat comfortable in this scenario, compared with 79% of female patients. All of the scribes in this study were female, thus the authors were not able to determine the effect of scribe gender on patient comfort when discussing sensitive issues.

Numerous authors reported that more studies are needed on the topic of medical scribes and patient disclosure of sensitive topics (Mishra et al., 2018). Dunlop et al. (2018) stated that their study found that patients' disclosure of medical information in the emergency department is unlikely to be affected by the presence of scribes. Earls et al. (2017) also stated that patients

reported a high level of comfort with scribes and that scribe presence had little impact on what they shared with their physician. Less than 10% of patients in this practice declined to have a scribe present during their appointment. A recent study in primary care found that some physicians reported that they "often have scribes leave the room during sensitive physical exams" (Danak et al., 2019, p. 5). 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.

Effects on Physicians

Physician Professional Satisfaction

Physicians were overwhelmingly positive about the impact of working with a medical scribe (Allen et al., 2014; Gidwani et al., 2017; Martel et al., 2018; Mishra et al., 2018). In an emergency department setting, 90% of providers stated that working with a scribe increased their workplace satisfaction and quality of life (Allen et al., 2014). A study of primary care physicians reported that 94% of physicians had improved job satisfaction when working with a scribe (Mishra et al., 2018). Quotes frequently mentioned the huge improvement in workload and work hours that physicians experienced when working with the assistance of a scribe (Cowan et al., 2018; DiSanto & Prasad, 2017). Koshy et al. (2010) found a much higher rate of physician satisfaction with work hours when working with a scribe – 19% pre-scribe vs. 69% post-scribe. Dermatologists were completing 80% of their documentation outside of clinical session time pre-scribe and reported increased job satisfaction and decreased documentation burden post-scribe (Nambudiri, Watson, Buzney, et al., 2018).

Increased joy of practice was mentioned in several studies (Sattler et al., 2018). Some older physicians who were not comfortable using EMRs/EHRs, or physicians who felt burned

out, were able to avoid early retirement by obtaining the assistance of a scribe (Martel et al., 2018). The common practice of charting after-hours was dramatically reduced in many of the studies which examined this issue (McCormick et al., 2018; Mishra et al., 2018). Martel et al. (2018) stated that for many physicians "the addition of scribes was one of the most substantive changes they had ever experienced in their practice" (p. 244). Scribe assistance beyond just documentation was valuable to physicians, as they were also able to help with paperwork and forms (Sattler et al., 2018).

Recent conference abstract studies report similar results to the peer-reviewed articles. Anderson and Tschirhart (2018) found that 67% of primary care physicians felt greater professional competence when working with a scribe. 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). Canadian emergency 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). Emergency physicians in Saskatoon who were surveyed about working with a scribe 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). Internal medicine physicians in the United States did not feel more rushed despite visit lengths being shortened by 25% when they had the assistance of a scribe (Heckman et al., 2018).

Physician burnout

Very few peer-reviewed studies directly measured the impact of medical scribes on physician burnout. Mishra et al. (2018) report that "one in every two physicians experience symptoms of burnout, with primary care providers experiencing the highest rates" (p. E2). Morawski et al. (2017) found that physicians working with scribes had improvement on all

Maslach Burnout Inventory (MBI) sub scores. This was the only peer-reviewed published study found that mentioned using the Maslach Burnout Inventory (MBI) to measure the impact of scribes on physician burnout (Morawski et al., 2017). Golob et al. (2018) found that scribe implementation subjectively decreased surgeon burnout, though they did not measure burnout objectively. Addesso et al. (2019) found that 82% of physicians felt that their skills were more effectively utilized when working with a scribe. They noted that increased feelings of effectiveness among providers lowers the risk of burnout. This is especially relevant to the population of physicians in their study, pediatric emergency medicine (EM) physicians, who experience one of the highest rates of burnout among medical specialities.

Although they did not directly measure burnout, many studies reported that physicians had decreased stress levels at work when assisted by a scribe. Allen et al. (2014) found that 80% of providers noted decreased stress at work post-scribe. Time spent charting at home, after hours, may be viewed as a potential marker of physicians at risk of burnout (Tran et al., 2019). Earls et al. (2017) found that physician time spent working at home decreased by 38% when working with a scribe in clinic. These authors also reported that physician morale increased post-scribe despite increased patient volume as mandated by the return on investment requirement set by management. Martel et al. (2018) noted that medical scribes provide intangible benefits to physicians in terms of work-life balance. Among internists, 83% reported decreased stress at work and at home post-scribe (Pozdnyakova, Laiteerapong, et al., 2018). A recent article recommended that future studies more clearly examine the relationship between scribes and physician burnout (Danak et al., 2019).

Several conference abstracts that have not yet been published as peer-reviewed articles discussed the effects of medical scribes on physician burnout. 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. During semi-structured interviews, 93% of primary care physicians reported decreased emotional exhaustion when working with a scribe (Anderson & Tschirhart, 2017). A study at an academic emergency department measured a "self-assessed authenticity score" which included a burnout subscale (Brown et al., 2014). This study found that working with scribes mitigated factors thought to lead to physician burnout, and increased physician self-assessed authenticity.

Physician efficiency

Studies that focused exclusively on emergency department (ED) throughput metrics were excluded. Articles that assessed physician efficiency in the context of avoiding excessive workload that could lead to burnout were included in this scoping review. Dramatic reductions in documentation times, both during and after clinic hours, were a recurrent theme (Earls et al., 2017; Heaton et al., 2018; Lowry et al, 2017; Martel et al., 2018; Mishra et al., 2018). Taylor et al. (2019) and Heaton et al. (2018) found that physician after-work hours spent charting in the EHR decreased by approximately 50%. In the emergency department, Heaton et al. (2019) found a dramatic decrease in post-shift documentation, from 67 minutes to 16 minutes. Shuaib et al. (2019) found a 31% lower mean visit time during the post-scribe period, as measured using time-motion analysis. Lowry et al. (2017) determined that 70% of physicians were more efficient when working with a scribe, and that chart completion time after clinic sessions decreased from 30 minutes pre-scribe to 14 minutes post-scribe. Urologists working with a scribe saw 25% more patients per day (McCormick et al., 2018). Family physicians estimated that working with a scribe saved them a mean of 1.5 hours per day (Platt & Altman, 2019).

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 physicians offering to see extra patients in order to cover the cost and continue to have the assistance of a scribe (Martel et al., 2018). 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. Mean visit time was 31% lower in the post-scribe period (Shuaib et al., 2019). The only published Canadian study of medical scribes reported that 82% of ED physicians saw more patients per hour when working with a scribe (Graves et al., 2018).

Interactional effects

Doctor 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 (Bank et al., 2013; Cowan et al., 2018; Zallman et al., 2018). Zallman et al. (2018) found through direct observation that physician time spent facing the computer decreased by 27% and time spent facing the patient increased by 57% when a scribe was doing the documentation. Family physicians surveyed by Platt & Altman (2019) felt that working with a scribe improved the quality of their interaction with patients. Internists surveyed by Pozdnyakova, Laiteerapong, et al. (2018) agreed, with 83% noting improved interactions with patients post-scribe. Some studies included quotes from patients who felt more cared for when their physician was working with a scribe, and thus was not distracted by the computer (Yan et al., 2016, p. 992). Other studies reported

that patients were overall neutral towards the presence of a scribe. A physician was quoted as saying "you had me at the first visit… first time in 10 years I was able to truly focus on the patient without the distraction by the EHR" (Pozdnyakova, Laiteerapong, et al., 2018, p. 3). Physicians were better able to pay attention to patient body language when working with a scribe (Sattler et al., 2018). Face-to-face interaction between physicians and patients increased when a scribe was present (Bank et al., 2013). Koshy et al. (2010) found that medical visits were more patient-centered when a scribe was doing the documentation. Dermatology patients reported that scribes improved the patient-doctor experience (Nambudiri, Watson, Rubenstein, et al., 2018).

Recent conference abstracts have reported on studies of physician patient interaction when a scribe is present. 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).

Scribe / Physician team

Interpersonal fit within the physician-scribe team is important, and the working relationship can take time to develop (Danila et al., 2018). One study emphasized the importance of adaptability and trust between the physician and scribe (Yan et al., 2016). "The right personal and skills-based fit between physician and scribe, as well as staff continuity, are both necessary for sustainable partnerships" (Yan et al, 2016, p. 30). Some studies found that a "warm up period" of 2 to 4 weeks was required before scribe assistance decreased documentation time for physicians (DiSanto & Prasad, 2017). Having scribes review physicians' modifications to their scribed notes can help scribes learn a particular physician's style. Some physicians may struggle with relinquishing control of their documentation, and they have to 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 large learning curve for medical terms (Yan et al., 2016). McCormick et al. (2018) noted that urologists in their study worked with the same scribe each week. In the pilot project by Morawski et al. (2017) scribes and physicians were repeatedly paired together when possible to improve team building and a scribe's familiarity with a physician's documentation preferences.

Concern about the number of people in the room

Several studies raised the concern of potentially too many people in the room if a scribe is present. One internal medicine physician felt that working with both a scribe and medical students caused "too many bodies in the room" (Pozdnyakova, Laiteerapong, et al., 2018, p. 1111).

Some medical consult offices are very small, and thus may not be large enough to hold the patient, family member(s) who may have come to the appointment, the scribe, and the physician. Some appointments may also include a translator and medical student or resident physician. Interestingly, academic medical centres where medical trainees are common reported that the high level of patient acceptance of medical scribes could be due to the patients being accustomed to having additional people present during their medical visits (Koshy et al., 2010; 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 medical learners being excluded if there is not enough space in exam rooms for them.

Organizational effects

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 hospitals affiliated with medical schools, attending physicians often have the assistance of medical students and resident physicians when completing documentation. Therefore, medical scribes may have more of an impact at community hospitals and clinics where there are not medical learners to help with documentation (Shuaib et al., 2019).

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

A theme that emerged repeatedly was that the model of documentation assistance provided by a medical scribe needs to be clearly articulated. In a practice brief, Campbell et al. (2012) recommended that 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. Role-based EHR security access requires that a scribe and a clinical assistant have different security clearances (Campbell et al., 2012). A signed agreement between the physician and the scribe outlining responsibilities and expectations is recommended. 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.

The AMA Steps Forward Team Documentation module described two possible models involving scribe assistance: clerical documentation assistant (CDA) and advanced team-based care (Sinsky, 2014). The person chosen to help with team documentation may or may not have skills that will help to determine their scope of work.

The clerical documentation assistant (CDA) model aligns with the current definition of a medical scribe. The advanced team-based care model involves the assistant accompanying "each

patient from the beginning to the end of their appointment to provide team care services" (Sinsky, 2014, p. 4). In this model, the assistant must have clinical skills that allow them to provide services beyond just documentation. For example, the assistant may be a nurse who takes vital signs, asks the patient for their past medical history, and gives immunizations.

Quality of scribe generated documentation

Only a few peer-reviewed studies have directly examined the quality of scribed notes. 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 and physician-generated notes for same-day appointments. They only studied these 2 types of encounters – diabetes as an example of chronic disease notes, and same-day appointments as an example of acute care notes. 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 of lower quality than non-scribed notes.

Physicians reported that real-time documentation when working with a medical scribe improved medical record details (Yan et al., 2016). In a subjective assessment of scribed note quality, 54% of EM physicians surveyed 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). 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 a physician. There is widespread agreement that future studies of scribed note accuracy and completeness are needed (Yan et al., 2016).

More data has recently been reported on scribed note quality in studies presented at conferences and published in conference abstracts. A trauma hospital in England developed a program for medical students to act as scribes during trauma documentation. 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). A community oncology center assessed note quality using institutional optimization guidelines, and found that EHR note quality increased from 76% without scribes to 98% with scribes (Lerner et al., 2016). 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, Del Castillo, et al., 2018).

Risks of medical scribes

Some concerns about the risks of medical scribe implementation were raised. Campbell et al. (2012) caution 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. Physicians who rely on scribes may not be able to navigate an EHR or EMR system when a scribe is not available (Campbell et al., 2012, p. 66).

Several studies mentioned the concern that physicians may miss computer prompts if working with a medical scribe. Campbell et al. (2012) recommended that physicians direct scribes on the correct response to any alerts that arise during documentation in the EHR/EMR.

Cost

The biggest barrier to implementation of scribes in private practice physician offices may be the cost. In studies in the United States, the average cost of a scribe is $20,000-$40,000 per

year (Sines & Griffin, 2018, p. 75). The salary for a medical scribe in the United Sates ranged from $9 to $17/hour in 2016, with an average of $12/hour (Miller et al., 2016). In 2018, Martel et al. paid a starting salary of $18/hour to their homegrown scribes. Costs tend to be higher when scribes are contracted through a scribe service vendor (Miller et al. 2016). The cost required to purchase computers on wheels for scribes also has to be factored in.

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

Many of the studies identified 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. 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 (Lowry et al., 2017). They recommend recruiting university students during semesters and training them during academic breaks. Australian researchers have reported using online training through scribe companies in the United States, followed by some in-house training (Walker et al., 2016; Walker et al., 2017).

Problem of rapid scribe turnover

Many of the studies included in this scoping review mentioned the problem of rapid scribe turnover. Scribes are most often recruited from local universities, and tend to be students interested in healthcare careers, or already enrolled in medical or nursing school (Martel et al., 2018; Lowry et al., 2017). Because of this fact, most scribes only work as scribes for approximately one year (Martel et al., 2018; Miller et al., 2016; Danak et al., 2019). 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 for most small to medium size

medical practices. 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 (Morawski et al., 2017). This learning cannot take place if scribe turnover is too rapid. Yan et al. (2016) noted that high scribe turnover limits sustainable partnerships between physicians and scribes. 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).

Effects of medical scribes on medical students and resident physicians

Only a few published peer-reviewed studies have examined the interaction between medical scribes and medical learners. The few studies that do exist found that scribes seem to have a positive effect on the medical education experience. Learners described that attending physicians working with scribes are more attentive and have more time to focus on teaching (Hafer et al., 2018; Ou et al., 2017). Face-to-ace teaching time with faculty physicians, and faculty supervision for procedures increased post-scribe implementation (Ou et al., 2017). Medical scribes were also viewed as an EMR/EHR resource by medical trainees (Hafer et al., 2018). They were able to ask scribes for advice on how to make good use of all the features of the electronic record, knowledge that their attending physicians who are less computer savvy may well not have. Medical students liked the culture of teamwork created by working with medical scribes, and resident physicians working with scribes gained an improved ability to work in inter-professional teams (Hafer et al., 2018; Jones et al., 2018). Emergency resident physicians in the study by Ou et al. (2017) directly attributed improvements in their educational experiences to implementation of the scribe program.

A subtheme emerged around the common practice of university students in the United States working as medical scribes partly in order to improve their resumes before applying to medical school (Martel et al., 2018). Some experts 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 medical scribes.

A recent conference abstract reported that emergency medicine resident physicians at a level-1 trauma center had more time to teach, focus on patient care, and adhere to work-hour restrictions when working with a scribe (Jones et al., 2018). These residents noted increased educational satisfaction when scribes were part of the health care team. Another abstract reporting on emergency medicine resident physicians also found that residents had an improved educational experience when working with a scribe, with more time to teach and focus on patient care (Thompson et al., 2016). Emergency medicine resident and attending physicians agreed that higher-quality and more frequent teaching occurred during scribed shifts compared to unscribed shifts (Wegg et al., 2014).

Lack of standardized and validated measures for assessing patient and physician satisfaction with scribes

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

Many of the studies identified in this scoping review that assessed patient and physician satisfaction developed their own survey instruments (see Appendix E). Most of these used Likert-type scales. Some studies used Press Ganey surveys to measure patient satisfaction (Bastani et al., 2014; Dunlop et al., 2018; Morawski et al., 2017; Rohlfing et al., 2019; Shuaib et al., 2019). Only one study mentioned using the Maslach Burnout Inventory (MBI) to measure physician burnout (Morawski et al., 2017). The lack of standardized and validated measures of scribe effects on patients and physicians was a major hindrance to the study of this issue in all of the studies that examined it.

Discussion

In other 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).

The documentation-related burden associated with EHRs and EMRs has led some physicians to reduce their practice hours or even retire early. Physician burnout has been described as a public health crisis (Olson et al., 2019, p. 157). As EHRs have increased documentation-related burden for physicians, primary care clinicians have struggled more and more to achieve "all 3 goals of prompt access; continuous, trusting relationships with patients; and physician well-being" (Bodenheimer & Willard-Grace, 2016, p. 135).

It is clear that physicians require assistance to manage all of the EHR/EMR generated tasks safely. 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 medical scribes. As Martel et al. (2018) state, "for many providers the addition of scribes was one of the most substantive changes they had ever experienced in their practice" (p. 244).

An important issue that has been discussed in the literature is the occasional confusion of roles which can occur when staff in physicians' offices are asked to take on the role of medical scribe in addition to their usual duties. For example, medical office assistants (MOAs) may be asked to perform clinical duties such as assisting physicians by passing them equipment when performing minor procedures in the office. If a physician decides to redefine the role of MOA to include acting as a medical scribe

> "it is not recommended, however, to allow an individual to fill the role of scribe and clinical assistant simultaneously during the same encounter. This practice raises legal and other issues regarding job role and responsibilities" (Campbell et al., 2012, p. 64).

When a physician or organization decides to hire a scribe, it is vital that the role of the medical scribe is defined in writing and communicated to all team members. A signed agreement should specify medical scribe duties and ensure accountability (Campbell et al., 2012, p. 64). EHR security rights define role-based access to different parts of a patient's chart. Scribes require virtually the same security rights as physicians, whereas MOAs should have more restricted access to a patient's chart to allow them to carry out clerical tasks (Campbell et al., 2012).

A recurring concern that has been raised in studies of medical scribes is the addition of a third person into the patient-physician relationship. Some people have argued that this could discourage patients from disclosing sensitive issues and make patients uncomfortable during examination of the genital area. These are certainly valid concerns, and every effort must be

made to explain the purpose of the medical scribe to patients and ask for their permission that the scribe be present during the visit. However, cases often arise where physicians or patients may request that a third person be present during medical visits. Medical students and residents are often present during patient encounters at academic centers and private offices affiliated with medical schools. Male physicians often bring in a medical office assistant during female pelvic exams, to protect themselves from any allegation of impropriety. Patients have the right to bring family members into their medical visits, even if this makes the assessment process more difficult for the physician. Translators are frequently present during medical appointments.

These examples illustrate that there are already often three or more people in the room during medical consultations. The addition of a medical scribe is thus not necessarily a major change in the patient-physician relationship, which is already often complicated by the presence of one or more other people. A recent systematic review of the role of companions attending consultations found that 15-25% of all adult patients in primary care or outpatient clinics bring a friend or family member with them (Troy et al. 2019, p. 746). The same systematic review found that the rate of companions present at outpatient medical visits is even higher for older patients, at 36-57%.

Concerns have been raised that the introduction of medical scribes may prevent physicians from adequately responding to clinical decision support generated by the EHR (Bates & Landman, 2018). Workflows may need to change to ensure that the physician must review and sign all decision support before an order can be processed. A recent multicentre randomised trial of scribes in emergency departments is the first study to assess the rate of potential patient safety incidents associated with scribes (Walker et al., 2019). A potential error occurred in 1 in every 300 consultations. The most common error category was patient identification (44% of

cases), with the most common scenario being an investigation ordered for the wrong patient. However, in all of the wrong investigation cases the scribe or physician noticed and prevented the investigation from being done on the wrong patient (Walker et al., 2019, p. 6). Scribes were actively involved in preventing 50% of potential errors. Thus, it appeared that introducing scribes into emergency department workflows was not a major source of errors, and that scribe presence may actually be a protective factor against medical errors (Walker et al., 2019). However, the authors of this study note that reporting of safety incidents was voluntary, and thus likely underestimated the rate of incidents. Although medical scribes allow physicians to more fully focus on their patients, it is not yet known if the use of medical scribes may improve diagnostic accuracy or reduce medical errors.

While it is clear that medical scribes benefit time-stressed physicians, ethical concerns exist. Wangenheim (2018), a physician and former Chair of Bioethics at Saint Barnabas Medical Center, is not in favour of medical scribes. He feels that "in an effort to work around the demands of EHRs, physicians have created solutions that compromise patients' confidentiality" (Wangenheim, 2018, p. 241). He feels that further studies on the comfort of patients with the presence of medical scribes during discussions of sensitive topics need to be carried out. Other authors have had similar concerns, stating that "when a scribe accompanies a provider into an examination room, the scribe becomes an actor in the patient encounter and may affect how the patient interacts with the provider" (Woodcock et al., 2017, p. 383). However, a study of primary care team structure found that "patients can transfer continuous, trusting relationships from single physicians to small, visible teams" (Bodenheimer & Willard-Grace, 2016, p. 136).

Administrative barriers are likely to slow the implementation of medical scribes in Canadian hospitals. As a Canadian pilot study found, expanding a scribe program from a pilot to

a long-term program can be viewed as a potential problem by hospital administration (personal communication). Medical scribes do not currently require any formal qualifications, and thus introducing this new role into a hospital can be seen as taking away union jobs since any hospital employee could theoretically fill the medical scribe role. Paradoxically, current hospital union employees may not want to take on the scribe role for a variety of reasons. This can lead to a circular argument that ultimately stalls the implementation of a scribe program.

In Canada it is likely that some type of government assistance would be required to make the cost of medical scribes feasible for primary care providers. As governments look for ways to attract and retain family physicians to under-served areas, the provision of scribes for new clinics could be a valuable incentive. 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 medical scribes to the healthcare team.

There are currently only two professional scribe companies in Canada. Medical Scribes of Canada is located in Ontario. ScribeCanada Healthcare, a sister company of ScribeAmerica, expanded into Canada in 2018, but also seems to be limited to Ontario (ScribeCanada, 2018). Therefore, Canadian physicians hiring medical scribes would most likely have to conduct in-house training.

It is possible that medical scribes may only be a temporary strategy to help physicians cope with EHRs that have poor human factor ratings (Bates & Landman, 2018). EHR vendors claim to be focusing on user-friendly EHR design, but Ratwani et al. (2015) found that this does not seem to be true in many cases. Some people are wondering if synchronous or asynchronous virtual scribes may be a better solution than in-person scribes, as they remove the extra person

from the exam room (Bates & Landman, 2018). However, virtual scribes introduce the risk of remote data transmission. Speech recognition technology is another alternative to scribes. It records more than what a human has deemed to be important enough to be included in the record. This necessitates the physician dictating the note after the medical encounter has ended, rather than in real-time as when working with a scribe. As Woodcock et al. (2017) state "it remains to be seen whether the use of scribes is a transitional phenomenon or a permanent response to limited EHR usability and the interposition of the computer into the patient-provider relationship" (p. 387).

Coiera et al. (2018) state that "human scribes are a role model for a new generation of documentation technology – the digital scribe" (p. 1). These authors define digital scribes as "intelligent documentation support systems, [that] take advantage of advances in speech recognition, natural language processing and artificial intelligence, to automate the clinical documentation task currently conducted by humans" (Coiera et al., 2018, p. 1). Coiera et al. (2018) acknowledge that digital scribes are still in their infancy and may introduce new patient safety risks. Machine learning to develop artificial intelligence systems for digital scribes requires access to clinical data sets, which creates privacy and ethical concerns (Coiera et al., 2018). It is difficult to anonymise the speech records of medical visits. Automation bias is also a potential risk associated with digital scribes, if physicians do not review the notes in detail to look for errors.

Limitations

The articles were screened for inclusion/exclusion by only one reviewer, which could have introduced selection bias in the inclusion of articles. Interpretation of the included articles could also 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 medical 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 were identified originating from any countries other than the United States, Australia, and Canada. It is not known if medical scribes are described by another term in other English-speaking countries. A recent article with one Danish author was also unable to find any other term for medical scribes that might explain the lack of articles originating from Europe (Bossen et al., 2019). One English abstract from the Netherlands was identified, and the corresponding author was contacted via email to inquire if the article was available in English. However, the article was only available in Dutch. The corresponding author of this article replied that as far as she knows, there is not another term for medical scribes in Europe.

This scoping review excluded studies of medical scribes that focused on their financial impact. The majority of these studies were from the United States, where billing practices are much different than in the rest of the world. Financial studies from Australia may be more relevant to the Canadian healthcare environment and could be examined in a future scoping review.

The majority of studies identified in this scoping review were from the United States. Clinical notes in the United States are "nearly 4 times longer than notes in other countries" (Bates & Landman, 2018, p. 1472). Therefore, it is possible that the effects of medical scribes found in the United States may not be generalizable to other countries. American EHRs are used in both Canada and Europe, thus the difference in length of American clinical notes could be due to system organization.

Need for Future Study

It will be important that validated survey instruments are developed in order to standardize the assessment of medical scribe impact upon physicians and patients. The MBI paired with the Mini-Z survey was recently found to be psychometrically sound to "identify prevalent organizational stressors that were strongly associated with burnout" among physicians (Olson et al., 2019). These authors validated the specific stressors on the Mini-Z survey against the MBI. Olson et al. (2019, p. 161) also found that EHR stressors were the most prevalent workplace factor associated with physician burnout, while control over workload was most highly correlated with burnout. The MBI and the Mini-Z survey could be used in the future to measure the impact of medical scribes on physician burnout.

Another issue that warrants further study is the additional responsibilities that scribes can take on, such as "pre-ordering routine laboratory tests and immunizations for patients by following a standard protocol" (DiSanto & Prasad, 2017, p. 67). Medical scribes generally function as clerical documentation assistants, where their focus is on medical record keeping. An alternative to this model is the advanced team-based care strategy, where medical office assistants have additional duties such as measuring vital signs, taking the patient history, after visit plan reinforcement, placing referrals, and order entry (Basu et al., 2018). Chapman and Blash (2017) have documented new roles for medical office assistants, which have arisen in the effort to redistribute tasks currently burdening primary care physicians. Alternative models of team documentation assistance require formal comparison through research studies aimed at determining the best fit for physician practices depending on speciality and practice size.

Working as a medical scribe can benefit pre-medical and pre-nursing students, by allowing them to observe physician-patient encounters (DiSanto & Prasad, 2017). Future studies could further delineate the impact of working as a medical scribe before medical school.

The studies included in this scoping review have researched issues of patient and physician comfort with the presence of medical scribes. One study noted that 39% of female patients seeing a female dermatologist preferred a female scribe (Nambudiri, Watson, Buzney, et al., 2018). No other studies were found that addressed the issue of gender differences among the three parties of patient, scribe, and physician. This issue requires further study, as do the issues of language differences and how to handle scribe presence during emotionally charged patient disclosure (Schiff & Zucker, 2016). Topics such as sexual health, mental health, and domestic violence are all sensitive topics whose disclosure could be affected by scribe presence, and this requires future study, especially among vulnerable populations. Mishra et al. (2018) concluded that future qualitative research of patient perspectives is needed, focusing on sensitive topics "to assess how scribes may affect such patient disclosures, particularly among vulnerable populations" (p. E5).

It is curious that medical scribes do not seem to be used in Europe, despite the wide-spread implementation of EHRs/EMRs there. It will be important to determine why this is the case. Could this be due to a different style of documentation in Europe compared to the United States, which is less time-consuming for physicians? Or instead due to differences in billing practices?

Future studies are needed on "the degree to which changes in comfort with the number of people in the room after scribe implementation is affected by the number of people already present in visits" (Yan et al., 2016, p. 17). Many patients in this study brought family members

with them to help translate. The comparison of patient discomfort due to the presence of a medical scribe vs. due to 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).

Medical scribe note quality has not been adequately studied. Studies are needed to focus on "quantitative analysis of actual note completeness, note accuracy, patient outcome measures, [and] practice efficiency" (Yan et al., 2016, p. 994). Gidwani et al. (2017) recommended that future studies assess scribed chart quality with blinded observers using a validated instrument. Future research could assess the quality of medical scribe notes using the Physician Documentation Quality Instrument 9 (PDQI-9) assessment tool (Fanucchi et al., 2016).

The use of medical scribes in small physician practices warrants investigation. The annual cost of $20,000 to $40,000 per medical scribe is likely more than most primary care physicians in small practices can afford (Sines & Griffin, 2018, p. 75). Ways of improving scribe retention is another topic which requires future study.

Conclusion

Health care documentation has digitized, and the documentation workload of many physicians is becoming unmanageable and contributing to burnout. Possible solutions to this documentation-related burden include the use of medical 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).

While the medical community waits for digital scribes to become a reality and for EHR/EMR vendors to optimize usability, medical scribes remain a possible salvation for physicians pushed to the brink by documentation demands. EHR redesign is difficult and time consuming, while medical scribes are potentially an immediate solution (Gidwani et al., 2017). The ability of a physician to provide undivided attention to the patient is a benefit of medical scribes that would remain even with excellent EHR usability (Martel et al., 2018, p. 247). Until a better solution is found to relieve the staggering EHR/EMR documentation-related burden from physicians, medical scribes are an option that can be considered in Canada. The implementation of medical scribes in Canadian hospitals is likely to face administrative hurdles, whereas physicians have more autonomy to begin working with medical scribes in their private offices.

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Appendices

Appendix A – Definition of Joint Commission and Position Statement on Medical Scribes

The Joint Commission is "an independent, not-for-profit organization" that "accredits and certifies nearly 21,000 health care organizations and programs in the United States" (The Joint Commission, 2019b).

Joint Commission definition of a medical scribe

> As defined by the Joint Commission (The Joint Commission, 2019a)
>
> > "A documentation assistant or scribe may be an unlicensed, certified, (MA, ophthalmic tech) or licensed person (RN, LPN, PA) who provides documentation assistance to a physician or other licensed independent practitioner (such as a nursing practitioner) consistent with the roles and responsibilities defined in the job description, and within the scope of his or her certification or licensure".

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.

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Appendix B – Organizations in the United States Offering 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 is also the CEO of ScribeAmerica, the largest scribe company at the present time, established in 2003 (ScribeAmerica, 2019a). ScribeAmerica reports that it has over 17,000 employees in 50 states. 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) for certification (Gellert, Ramirez, & Webster, 2015).

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), 2019). Medical Scribe Training Systems, a scribe training company, states that it does not endorse the MSCAT because it was created by Scribe America and is not a government accredited licensing program (A. Thompson, 2015).

Appendix C – University of Victoria Ethics

The Vice-Chair and the Research Ethics Coordinator of the University of Victoria Human Research Ethics Board reviewed the proposal for this project in October 2018. They concluded that this project was exempt from human ethics review under the national ethics policy (TCPS2) and the university's human research ethics policy and guidelines (8100, 8105) because it is a literature review and does not constitute research involving human participants.

Appendix D – Data Charting

Table 4: Peer-Reviewed Articles

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. (Addesso, Nimmer, Visotcky, Fraser, & Brousseau, 2019)	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 Providers included EM physicians, general pediatricians, NPs, PAs, EM fellows 43 nurses 651 patients	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 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 Limitations: Residents/medical students were rarely present in nonurgent 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. (Allen, Banapoor, Weeks, & Payton, 2014)	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 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
Bank et al. (Bank et al., 2013)	2013	USA Outpatient cardiology clinic	Prospective controlled study Observation by manager Non-validated surveys 4 cardiologists Number of patients surveyed not stated	Patient satisfaction – unchanged (started very high & remained very high) Physician satisfaction – increased Physician efficiency – increased Patient/physician interaction – increased direct interaction over fourfold and 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
Bastani et al. (Bastani et al., 2014)	2014	USA Michigan Suburban community hospital EM	Before and after study of ED throughput metrics collected using EMR generated reports Validated Press Ganey surveys of patient satisfaction Number of patients surveyed not stated	Patient satisfaction – increased Physician efficiency – increased 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. (Bossen et al., 2019)	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 et al. (Cabilan & Eley, 2015)	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
Cowan et al. (Cowan et al., 2018)	2018	Australia Melbourne, Victoria	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 themes & subthemes	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 change communication style between physician & patient; 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 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 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
Danak et al. (Danak et al., 2019)	2019	USA Michigan 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
Danila et al. (Danila, Melnick, Curtis, Menachemi, & Saag, 2018)	2018	USA Alabama 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 Small sample size & convenience sampling of physicians limits generalizability No objective measures of clinic workflow efficiency Working relationship between physicians & patients "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

DiSanto & Prasad (DiSanto & Prasad, 2017)	2017	USA North Carolina Primary care	Time required to complete documentation Not stated if surveys validated or not 2 physicians 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 Scribe can review physician's note modifications to help learn the physician's style Limitations: small number of physicians studied
Dunlop et al. (Dunlop et al., 2018)	2018	Australia Melbourne, Victoria Tertiary care hospital EM	Explorative semi-structured interviews 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	Patient satisfaction – unchanged No negative comments about the presence of a scribe 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) Responses to survey could be influenced by social desirability bias & sponsor bias
Earls et al. (Earls et al., 2017)	2017	USA Massachusetts Rural family medicine clinic – a residency training site	Pilot mixed-method quality improvement study Physician and patient surveys 19 questions from the 36-item Physician Work-Life Survey 6 physicians 313 patients 4 part-time scribes	Patients reported high level of comfort with scribes and positive comments about scribes; patients also reported that having a scribe present had little impact on what they told their physician Less than 10% of patients declined to have a scribe present 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
Ewelukwa et al. (Ewelukwa, Perez, Carter, Fernandez, & Glover, 2018)	2018	USA Florida 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 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
Gidwani et al. (Gidwani et al., 2017)	2017	USA California Academic family medicine clinic	Randomized controlled trial – physicians served as their own controls 4 physicians 1475 patients 2 scribes	Patient satisfaction – unchanged Physician satisfaction – increased Physician efficiency – increased Scribes may have a protective effect on physicians' well-being In academic medical centres scribes increase time that faculty physicians have for teaching
Golob et al. (Golob, Como, & Claridge, 2018)	2018	USA Ohio Level 1 trauma center Trauma surgery rounds on ICU & trauma floors	Secondary analysis of hospital's EMR and billing system	Physician efficiency – increased 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
Graves et al. (Graves et al., 2018)	2018	Canada Ontario Community ED EM	Quality improvement project Physician productivity measured 22 physicians	Physician efficiency – increased 82% of physicians saw more patients per hour when working with a scribe 13% more patients per hour were seen during shifts with a scribe
Hafer et al. (Hafer, Wu, & Lin, 2018)	2018	USA California 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

Heaton et al. (Heaton, Castaneda-Guarderas, Trotter, Bellolio, & Erwin, 2016)	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 Lack of standardized & validated measures of patient & physician satisfaction prevented meta-analysis
Heaton et al. (Heaton et al., 2018)	2018	USA Minnesota 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
Heaton et al. (Heaton et al., 2019)	2019	USA Minnesota 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
Hess et al. (Hess et al., 2015)	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) Physician perception of time spent teaching – increased 74% of physicians reported positive attitude toward working with scribes, 9.5% had negative perceptions Almost all physicians felt that working with scribes increased their time for patient care & teaching
Imdieke & Martel (Imdieke & Martel, 2017)	2017	USA Minnesota Safety net hospital-based, outpatient primary care clinic caring for underserved population	Quasi-experimental, non-randomized pre- and post-intervention study 2 physicians 2 NPs 5 support staff 256 patients	Patient satisfaction – slightly decreased Physician satisfaction – increased Physician efficiency – increased 90% of patients were comfortable with a medical scribe present Provider documentation time decreased by more than 50% Patient satisfaction scores pre-intervention were close to 100% positive
Koshy et al. (Koshy, Feustel, Hong, & Kogan, 2010)	2010	USA New York 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 No female physicians participated in this study
Lowry et al. (C. Lowry et al., 2017)	2017	USA California 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 32 min pre-scribe High turnover of scribes noted
Martel et al. (Martel et al., 2018)	2018	USA Minnesota Academic, inner-city, safety-net hospital-based clinic system	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 "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. (McCormick et al., 2018)	2018	USA North Carolina 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 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
Mishra et al. (Mishra, Kiang, & Grant, 2018)	2018	USA California 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 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 "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)
Misra-Hebert et al. (Misra-Hebert et al., 2016)	2016	USA Ohio 8 primary care sites within one health system	Retrospective review of ambulatory care notes for diabetes visits or same-day appointments Notes assessed using the PDQI-9 18 primary care physicians & 36 medical assistants acting as scribes	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
Ou et al. (Ou, Mulcare, Clark, & Sharma, 2017)	2017	USA New York 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
Platt et al. (Platt & Altman, 2019)	2019	USA Massachusetts Family medicine clinic	EHR records reviewed for documentation of quality measures Patient surveys Physician surveys 5 physicians 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
Pozdnyakova et al.	2018	USA Illinois	Prospective pre-post pilot study 6 physicians 373 patients 1 scribe	Patient satisfaction – unchanged Physician satisfaction – increased Physician stress - decreased Physician efficiency – increased

(Pozdnyakova, Laiteerapong, et al., 2018)		Academic general internal medicine clinic		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 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
Rohlfing et al. (Rohlfing et al., 2019)	2019	USA Academic otolaryngology (ENT) clinic	Retrospective cohort survey study – designed as a quality improvement project 2 physicians 153 patients	Patient satisfaction – unchanged 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)
Sattler et al. (Sattler, Rydel, Nguyen, & Lin, 2018)	2018	USA California 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 with 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
Shuaib et al. (Shuaib et al., 2019)	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 26,319 patient surveys	Patient satisfaction – unchanged Physician satisfaction – increased (from 66% pre-scribe to 81% post-scribe Physician efficiency – increased Mean visit time was 31% lower in the post-scribe period 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
Shultz et al. (Shultz & Holmstrom, 2015)	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
Taylor et al. (Taylor, McQuilkin, & Hughes, 2019)	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 185 patients	Patient satisfaction – slightly decreased Physician satisfaction – increased 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)
Van Tiem et al. (Van Tiem et al., 2019)	2019	USA Veterans Health Administration (VHA) clinics at 5 sites across the USA	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

Yan et al. (Yan et al., 2016)	2016	USA Ohio 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) 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
Yan et al. (Yan et al., 2018)	2018	USA Ohio	Quantitative survey of patient opinions 123 patients (the patients of 8 physician-scribe pairs at 4 clinics)	67% of patients had no preference about the scribe's presence, 31% preferred that a scribe 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
Zallman et al. (Zallman et al., 2018)	2018	USA Massachusetts 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 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

Table 5: Scientific / Conference Abstracts Not Yet Published as Full Studies

ED = emergency department
EM = emergency medicine

Author	Year	Setting / Specialty	Method	Results
Anderson & Tschirhart (Anderson & Tschirhart, 2017)	2017	USA Massachusetts Scribe pilot project at a "large provider organization"	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. (Brown et al., 2014)	2014	USA Missouri 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. (Bryce et al., 2019)	2019	England Cornwall Trauma hospital	Truro Trauma Scribes initiative launched in 2016 to help improve trauma documentation quality & improve students'	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

			educational experience of major trauma Trauma booklets completed by students were compared to those completed by trauma team members	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. (Cancian et al., 2017)	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. (Chen et al., 2012)	2012	Canada Calgary, AB 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. (Dick et al., 2018)	2018	Canada Saskatoon, SK ED of an urban hospital EM	Pilot study Physician surveys using a 10-point Likert scale 3 physicians – each with different typing skills measured in words/min.	Mean physician mental fatigue decreased by 33% & physical fatigue decreased by 23% Mean physician work enjoyment increased by 10%
Feld et al. (Feld, Laiteerapong, Volerman, Del Castillo, & Lee, 2017)	2017	USA Illinois 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
Heckman et al. (Heckman et al., 2018)	2018	USA Massachusetts Boston Ambulatory internal medicine practice at a hospital	Pilot study 2 medical scribes worked with 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 Patient satisfaction measured 2130 patient surveys (34% response rate) Physicians had 82% response rate (survey to be done after each session)	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
Jones et al. (Jones et al., 2018)	2018	USA Minnesota ED of academic level-1 trauma center Resident physicians	Anonymous electronic survey 12 resident physicians	Resident physician educational satisfaction – increased Working with a scribe increased time that residents had to teach & focus on patient care Scribes improved residents' adherence to work-hour restrictions
Lancey (Lancey, 2019)	2019	USA Missouri 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%)
Lerner et al. (Lerner et al., 2016)	2016	USA Minnesota Community cancer center	Quality improvement project 3 oncologists worked with scribes Data extracted from EHR data warehouse	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

			Patients & physicians completed questionnaires Quality of documentation assessed by independent blinded reviewers	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)
Misra-Hebert et al. (Misra-Hebert, Fox, Kou, Schramm, & Rothberg, 2017)	2017	USA Ohio 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
Perozich et al. (Perozich et al., 2017)	2017	USA Maryland	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. (Pozdnyakova, Del Castillo, et al., 2018)	2018	USA Illinois 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 & physician identifiers removed	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 (52% vs. 33%) & this section was more likely to be clear in scribed vs. unscribed notes (92% vs. 69%)
Ramirez et al. (Ramirez, 2016)	2016	USA California 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. (Seng, Chang, Malek, Senthil, & Lum, 2019)	2019	USA California Single tertiary-care institution outpatient surgical oncology clinic	Pilot program Retrospective cohort review 2 surgical oncologists Surrogate variables for visit complexity & resident physician involvement were recorded	Resident physician involvement increased from 33.9% pre-scribe to 45.1% post-scribe
Tanaka et al. (Tanaka et al., 2012)	2012	USA Illinois Academic EM residency program	Online 10 question survey with Likert scale responses administered to 31 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. (M. Thompson, Colletti, & Heaton, 2016)	2016	USA (Minnesota) 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. (Wegg et al., 2014)	2014	USA Tennessee 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	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

			scribe compared to when they did not 39 control shifts & 72 scribe shifts	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. (Williams, Mitra, Anderson, & Bastani, 2016)	2016	USA Michigan 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. (Wright, Strickland, Grove, & Wright, 2019)	2019	USA Arizona 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 6: Dissertations, Clinical Scholarly Projects, and Theses

Author	Year	Setting / Specialty	Method	Results
Cleland (Cleland, 2017)	2017	USA California 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 (Glynn, 2018)	2018	USA Washington Pediatric urgent care	Pre-post study design 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	Patient satisfaction – slightly 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
Lowry (J. E. Lowry, 2017)	2017	USA Michigan	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 7: Grey Literature

Author	Year	Setting / Specialty	Method	Results
Campbell et al. (Campbell et al., 2012)	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
DeWitt et al. (DeWitt & Harrison, 2018)	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. (Miller, Howley, & McGuire, 2016)	2016	USA Multiple specialities in a large group practice	Pilot project Measured productivity, patient & physician satisfaction 6 physicians 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. (Morawski, Childs-Roshak, & Weitberg, 2017)	2017	USA Massachusetts 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. (Nambudiri, Watson, Buzney, et al., 2018)	2018	USA Massachusetts 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. (Nambudiri, Watson, Rubenstein, Kupper, & Yang, 2018)	2018	USA Massachusetts 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) Only female scribes were employed at the sites that participated in this study
Tegan & O'Connell (Tegen & O'Connell, 2012)	2012	USA Minnesota Children's Hospital		Patient (parent) satisfaction – increased Physician satisfaction – increased Physician efficiency – increased

Appendix E – Survey Instruments

Table 8: 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	No stated
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"
DiSanto	2017	Not stated	Not stated	Not stated
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
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
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
Koshy et al.	2010	No		"Patient and physician satisfaction surveys were developed"
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 Physicians surveys were not described	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	

Morawski et al.	2017	Yes	Patients surveyed using the Press Ganey survey Physicians surveyed using the Maslach Burnout Inventory (MBI)	
Nambudiri, Watson, Buzney, et al.	2018	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, Watson, Rubenstein, et al.	2018	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	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	
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	
Shuaib et al.	2019	Yes	Patient satisfaction measured by 6-item Press Ganey surveys Questions measured with a 5-point Likert-type scale	
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 (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	
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)