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Clinical Reviews

THE EFFECT OF MEDICAL SCRIBES IN EMERGENCY DEPARTMENTS: A SYSTEMATIC REVIEW

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□ **Abstract—Background: Integrating medical scribes with clinicians has been suggested to improve access, quality of care, enhance patient/clinician satisfaction, and increase productivity revenue. Objective: Conduct a systematic review to evaluate the effects of medical scribes in emergency departments. Methods: Electronic databases from 2010 through December 2019. Two individuals independently reviewed study eligibility, rated risk of bias, and determined overall certainty of evidence. Data abstracted included study and population characteristics, outcomes (efficiency, patient or clinician satisfaction, financial productivity, documentation quality, cost, and training time), and the effect of compensation structure, qualifications, duties, and setting on outcomes. Results: Twenty studies (18 observational) were included; 12 from two institutions. All utilized in-person rather than virtual scribes. Fifteen were rated as serious or critical risk of bias; five were rated moderate. Findings indicate that scribes may increase patients seen per day and decrease length of stay; however, effects were small and may vary by setting and outcome measured (low certainty). Scribes may increase financial productivity; however, costs associated with developing, implementing, and maintaining scribe programs were not adequately reported. Results were mixed for door-to-room or door-to-provider time, patients left without being seen, and patient/clinician satisfaction. No studies examined the effects of scribes based on compensation structure, qualifications or duties. Conclusions: Although information quality, quantity, and applicability are limited, in-person medical scribes may improve emergency department efficiency and financial productivity. There was no information on virtual scribes. There was little information on patient or clinician satisfaction, scribe documentation quality, or whether results vary by in-house vs. contracted hiring and training. Published by Elsevier Inc.**

□ **Key words—medical scribes; scribes; systematic review**

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INTRODUCTION

Medical scribes are individuals who assist clinicians with day-to-day tasks including recording and documenting information in real-time during patient visits (1,2). In addition to documenting medical visits, medical scribe duties include communicating with patients and completing clerical tasks; verifying and correcting mistakes or inconsistencies in medical records; collecting, organizing, and cataloging data for clinicians; and attending practice-related training. Integrating medical scribes with clinicians is suggested to improve access, quality and timeliness of care, enhance patient and clinician satisfaction, and increase productivity and health system revenue (3–5).

Medical scribe use has increased markedly in the past 10 years, due, in part, to implementation of electronic medical records (EMRs) required by legislation.

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In 2009 the Health Information Technology for Economic and Clinical Health Act, part of the American Recovery and Reinvestment Act, was enacted and required meaningful use of health information technology (2). These acts created a large demand for electronic data entry by clinicians, as well as an increase in documentation requirements for billing and reporting initiatives (2).

EMRs provide important advantages, such as structural and process-related benefits and enhanced patient care (6,7). However, EMRs increased the burden of clinical documentation, disrupted face-to-face patient encounters, and reduced time available for resident and student training (8,9). Additionally, efficiency measures required by the quality-reporting program enacted by the Centers for Medicare & Medicaid Services, such as door-to-doctor time or length of stay, has increased pressure on clinicians and health systems to meet these quality metrics (10).

Although formal training, accreditation, and recertification are not required for all scribe positions, there are two scribe accreditation programs available in the United States. In addition to "in house" training, health care systems or individual clinical groups can hire outside companies to train, accredit, place, and conduct performance evaluations of scribes and accompanying documentation through contracting mechanisms. These companies can reduce administrative hiring, training, and oversite burden, and serve as a resource to replace scribes that have relatively high turnover. Additionally, these companies can also contract for "virtual scribes," whereby the scribes are located "off site" and conduct their duties through video teleconferencing (11).

Within the Department of Veterans Affairs (VA), the 2018 MISSION Act aimed to increase veterans' access to health care. Section 507 of the MISSION Act mandates a 2-year pilot of in-clinic medical scribes in VA specialty clinics and emergency departments (EDs) to evaluate clinician efficiency, patient volume, and patient satisfaction (12). To help inform The Section 507 Committee on the use of medical scribes in the VA, the VA Evidence Synthesis Program commissioned a systematic review focusing on the effect of medical scribes; here we present findings from the larger review and note implications for health care practice and policy beyond the VA health care system.

METHODS

A standard protocol was developed and followed, and registered in PROSPERO (CRD42020169079). The full technical report can be accessed at https://www.hsrd.research.va.gov/publications/esp/reports.cfm.

Topic Refinement and Key Questions

Collaboratively with VA Stakeholders (representatives from the Office of Nursing Services on behalf of the MISSION Act Section 507 Committee) and an advisory panel of clinical content experts, the following key questions (KQ) were developed:

1. What is the effect of medical scribes in emergency departments?
2. How do the effects of medical scribes vary based on differences in compensation structure (i.e., contracted through vendor or employees of the institution), qualifications (i.e., training, accreditation, experience), types of entries (i.e., medical orders, medical history, coding [billing, diagnoses, complexity/comorbidities]), or setting (i.e., rural, urban, access-challenged)?

Search Strategy and Study Selection

MEDLINE, Embase, and CINAHL were searched from 2010 through December 2019 using Medical Subject Headings and key words for medical scribes and outcomes of interest (Appendix 1, available online). Eligible citations were screened independently by two reviewers using Distiller SR (Distiller SR, Evidence Partners, Ottawa, Ontario, Canada) with prespecified criteria. Citations moved to full-text review if either reviewer considered the citation eligible. At the full-text review, agreement of two reviewers was needed for study inclusion or exclusion; disputes were resolved by discussion with input from a third reviewer, if needed.

Randomized and observational studies published in English language that compared participation in a medical scribe program with usual care or no intervention were included. Only adult patients or practitioners in EDs were considered eligible for inclusion. Eligible studies reported outcomes related to clinic efficiency and productivity, clinician or patient satisfaction, financial impacts, or quality of documentation.

Data Abstraction and Quality Assessment

For observational studies, risk of bias (ROB) was formally assessed for each individual study by assessing critical elements using the Risk of Bias in Non-randomized Studies of Interventions tool (ROBINS-I) (13). For randomized controlled trials, critical elements were assessed using a modified Cochrane tool (14).

Data abstraction included study characteristics and demographic data from eligible studies with low, moderate, or serious ROB, including scribe duties, clinician and scribe experience, scribe training, age, gender, number of patients admitted, and funding source. Studies

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deemed critical ROB were not abstracted or included in analyses.

Data Synthesis and Certainty of Evidence

Due to heterogeneity of populations and interventions, data were not pooled but rather, narratively synthesized. For KQ 2, our subgroups of interest included: compensation structure (i.e., contract or direct hire), qualifications, duties and type of entry required, and setting.

The following outcomes were defined as critical: number of patients seen per hour or shift, length of stay, patient satisfaction, clinician satisfaction, and relative value units. Certainty of the evidence (COE) was rated for these outcomes using modified Grading of Recommendations Assessment, Development and Evaluation methods based on study limitations, directness, precision, consistency, and publication bias (15). Certainty of evidence was rated as high, moderate, low, or very low. Our summary assessment of "effectiveness" was based on statistical significance rather than an established or derived clinical magnitude of importance.

RESULTS

After removing duplicates, 621 citations were identified for title and abstract triage. A hand search of systematic review bibliographies yielded two additional references. The full text of 45 articles were reviewed, and 20 were identified that met our inclusion criteria (Figure 1).

Study Characteristics and Summary Findings (Table 1)

Six publications (all observational) came from a group at a Rochester, MN-based health care system, and six publications (one randomized controlled trial [RCT], one secondary analysis of the RCT data, four observational) came from a group based in Australia (16–27). The remaining eight publications consisted of one RCT and seven observational studies (28–35). One of these observational studies was conducted in Canada, and the remaining observational studies and the single RCT were conducted in the United States (32).

Sixteen studies reported clinic efficiency, four reported patient satisfaction, five reported clinician satisfaction, six reported financial productivity, eight reported relative value units (RVUs), three reported quality of documentation, and two reported cost/time of training. No studies reported on more than four of seven outcome categories. A summary of eligible publications can be found in Table 1 (16–35).

Of the observational studies, three were rated as moderate ROBs, 14 were rated as serious ROBs, and one was rated as critical and not analyzed further. Both RCTs were rated as moderate ROB. Detailed ROB assessments for eligible studies can be found in Appendix 2 (available online).

Definitions of outcomes varied across studies. Most reports analyzed information after scribes had gone through an in-house training and orientation program and permitted clinicians to select to participate. Reports describing financial impacts typically based the cost of a scribe program on the hourly wages paid for a scribe and did not report administrative or supervisory cost, the cost of identifying, hiring, training, supervising, maintaining, or replacing scribes, documentation verification costs, or costs related to contracting through outside vendors.

Most authors (7/10 authors and 7/19 publications) reported using a vendor service that supplied, trained, and managed scribes. One Australian group used a vendor service for a pilot study (one publication) and then implemented an in-house scribe program (four publications) (22–26). Two U.S.-based groups implemented an in-house scribe program (six publications from one group and one publication from another) (16–21,30). The remaining six authors (6 publications) used a vendor service (28,31–35). One author (one publication) did not report any information on scribe training (29).

Although most publications (16/20) reported on components of how scribes were trained (e.g., on-site training or classroom lecture), very few provided details about training programs or costs associated with training. Two studies reported scribe experience at baseline (26,30). No studies reported associated and peripheral costs with employing scribes (administration or management) or elements such as scribe turnover. All programs utilized in-person rather than virtual or tele-scribes.

KQ 1: What is the Effect of Medical Scribes in Emergency Departments?

Data to address this question are limited in quality and quantity. Summary results are presented in Table 2, and more detailed information for each study in Appendices 3, 4, and 5 (available online). Table 2 highlights the lack of reporting for many outcomes and the limited number of outcomes reported in any one study. Furthermore, when outcomes were reported, they were reported variably within and across studies, and often did not provide sufficient information to judge the magnitude or the statistical significance of their findings. However, available information suggests that medical scribes in EDs may increase the number of patients seen per hour (low COE) and probably decrease length of stay (moderate COE). Detailed COE tables can be found in Appendix 6 (available online). The magnitude of effect is likely small (approximately 1 patient more seen per clinician per

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Table 1. Summary of Eligible Publications

Study (First Author, Year)	Risk of Bias	Location	Outcomes Reported						
			Clinic Efficiency (k = 16)	Patient Satisfaction (k = 4)	Clinician Satisfaction (k = 5)	Financial Productivity (k = 6)	Relative Value Units (k = 8)	Quality of Documentation (k = 2)	Cost/Time of Training (k = 2)
Walker, 2014 (25)	Critical	Australia	X			X			X
Walker, 2016a (26)	Serious	Australia	X	X	X	X			
Walker, 2016b (27)	Serious	Australia				X			
Walker, 2017 (23)	Moderate	Australia						X	
Dunlop 2018 (24)	Serious	Australia	X	X					
Walker, 2019* (22)	Moderate	Australia	X			X		X	X
Heaton, 2016 (17)	Serious	United States	X				X		
Heaton, 2017a (19)	Serious	United States	X				X		
Heaton, 2017b (18)	Moderate	United States					X		
Heaton, 2018 (21)	Serious	United States	X						
Heaton, 2019 (16)	Serious	United States					X		
Heaton, 2020 (20)	Serious	United States	X			X			
Allen, 2014 (29)	Serious	United States	X		X				
Arya, 2010 (30)	Moderate	United States	X				X		
Bastani, 2014 (31)	Serious	United States	X	X					
Friedson, 2018* (28)	Moderate	United States	X				X		
Graves, 2018 (32)	Serious	Canada	X			X			
Hess, 2015 (33)	Serious	United States	X		X		X		
Ou, 2017 (34)	Serious	United States	X		X				
Shuaib, 2017 (35)	Serious	United States	X	X	X		X		

* Randomized controlled trial.

Table 2. Summary of Results

Study (First Author, Year)Risk of Bias	Outcomes									
	Patients per Hour per Clinician	Door-to-Room/Waiting Time (minutes)	Door-to-Provider (minutes)	Appointment Length/Time-to-Disposition	Door-to-Discharge/LOS (minutes)	LWBS	Patient Satisfaction	Clinician Satisfaction	Financial Productivity	Relative Value Units (RVU)
Walker, 2016a (26) Serious	↑ 1.13 vs. 1.02	NR	↔	NR	↔	NR	↔	↔	↔[**]	NR
Walker, 2019 (22) Moderate	↑ 1.31 vs. 1.13	NR	↔	NR	↓ 173 vs. 192	NR	NR	NR	↑[††] −$26.15/h	NR
Dunlop, 2018 (24) Serious	NR	NR	↔	NR	NR	NR	↔	NR	NR	NR
Heaton, 2016 (17) Serious	↔	NR	↔	↔	↑ 265 vs. 255	NR	NR	NR	NR	NR
Heaton, 2017a (19) Serious	NR	NR	↔	↔	↔	NR	NR	NR	NR	NR
Heaton, 2017b (18) Moderate	NR	NR	NR	NR	NR	NR	NR	NR	NR	↑[§§] 4.04 vs. 3.84
Heaton, 2018 (21) Serious	NR	NR	NR	↔	NR	NR	NR	NR	NR	NR
Heaton, 2020 (20) Serious	NR	NR	↔	↔	↔	NR	NR	NR	NR	↔[§§]
Heaton, 2019 (16) Serious	NR	NR	NR	NR	NR	NR	NR	NR	↑[‡‡] $488 vs. $600	NR
Allen, 2014 (29) Serious	↔	↔	↔	↓ 157 vs. 169	↓ 233 vs. 249	↔	NR	+[‡]	NR	NR
Arya, 2010 (30) Moderate	↑ +1.63[*]	NR	NR	NR	↔	NR	NR	NR	NR	↑[‖] +0.24
Bastani, 2013 (31) Serious	NR	↓ 34 vs. 35	↓ 61 vs. 74	↓ 185 vs. 237	↓ 269 vs. 289	NR	↑[†] 58% vs. 75%	↑[†] 62% vs. 92%	NR	NR
Friedson, 2018 (28) Moderate	↑ 2.33 vs. 2.23	NR	NR	↓ 228 vs. 258	NR	NR	NR	NR	NR	↔[¶¶] ↑[***] 72 vs. 77

(*continued on next page*)

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Table 2. (*continued*)

Study (First Author, Year)Risk of Bias	Outcomes Patients per Hour per Clinician	Door-to-Room/Waiting Time (minutes)	Door-to-Provider (minutes)	Appointment Length/Time-to-Disposition	Door-to-Discharge/LOS (minutes)	LWBS	Patient Satisfaction	Clinician Satisfaction	Financial Productivity	Relative Value Units (RVU)
Graves, 2018 (32) Serious	↑ 2.81 vs. 2.49	NR	NR	NR	NR	NR	NR	NR	NR	NR
Hess, 2015 (33) Serious	↔	NR	NR	NR	↔	↑ 2.9% vs. 4.4%	NR	+[§]	NR	↔/↑[†††]
Ou, 2017 (34) Serious	NR	NR	NR	NR	NR	NR	NR	+[‖]	NR	NR
Shuaib, 2017 (35) Serious	↑ 3.2 vs. 2.3	↓ 41 vs. 37	↓ 56 vs. 61	↓ 228 vs. 237	↓ 287 vs. 303	NR	↔	↑[¶] 66% vs. 81%	NR	↔[‡‡‡] ↑[§§§] 241 vs. 336

Numerical data only presented when deemed statistically significant.

[*] Calculated by Evidence Synthesis Program team, unable to calculate for comparison group.

[†] Press Ganey Survey: Overall patient satisfaction percentiles.

[‡] 100% of clinicians reported "scribes are a valuable addition," 77% of clinicians reported "scribes increase workplace satisfaction," 90% of clinicians reported "scribes increase quality of life."

[§] 62% of clinicians "liked or loved working with scribes," 74% of clinicians "positive or very positive attitude towards scribes," 82% clinicians "positive or very positive changes in efficiency."

[‖] 85% of residents reported "my interactions with attendings have improved with scribes," 79% of residents reported "scribes have improved my overall education as a resident in the emergency department."

[¶] "Physician satisfaction increased 15% from pre- to post-scribe" (p = NR).

[**] Billing per patient.

[††] "Cost saving to the hospital per scribed hour of $26.15 when hospital absorbs the cost of training."

[‡‡] Estimated costs of charting per shift .

[§§] Mean RVUs per patient.

[‖‖] RVUs per hour increased by 0.24 units for every 10% increment in scribe usage during a shift.

[¶¶] Total RVUs per shift.

[***] Trimmed RVUs per shift (lowest and highest 10% removed from analysis).

[†††] Pre/post differences in seasonally matched productivity metrics; mean differences in RVU per patient and RVU per hour were mixed.

[‡‡‡] Mean RVUs per patient.

[§§§] Mean total RVUs per hour.↔= no significant difference; ↑ = increase in outcome compared with control group; ↓ = decrease in outcome compared with control group; + = satisfaction reported, but no comparison group; LOS = length of stay; LWBS = left without being seen; NR = not reported.

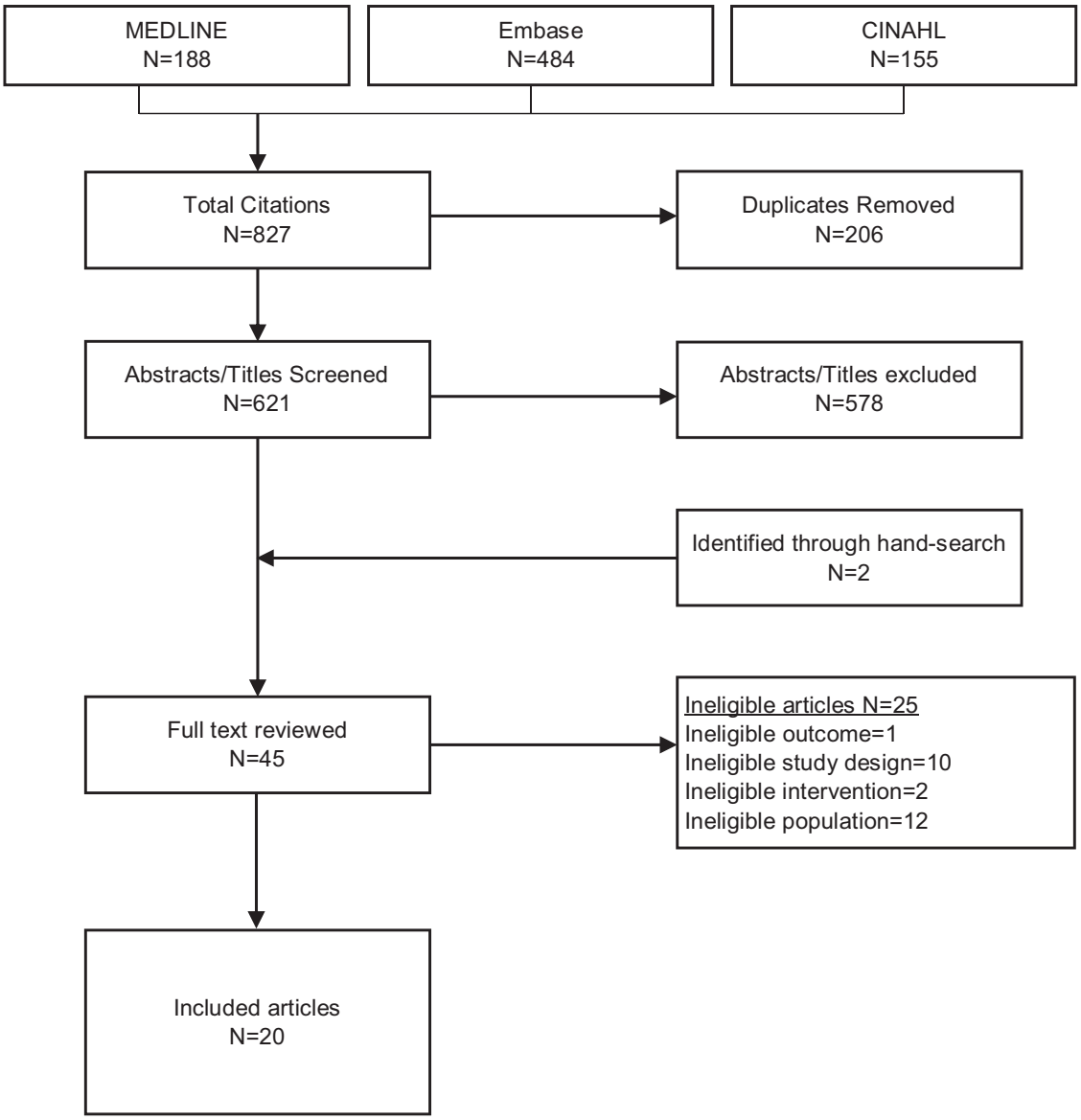

Figure 1. Literature flow.

10-h shift or 10% decrease in length of stay), and may vary based on the setting and definition of outcomes assessed. Scribes were shown to make little to no difference in door-to-room or door-to-provider time, number of patients who left without being seen, and patient or clinician satisfaction, though results were mixed. Two studies estimated financial productivity based on scribe costs and clinician productivity, and another study estimated costs of clinician charting per shift (16,22,32). Medical scribes may increase revenues or RVUs due to more patients seen per hour (low COE). However, resources to train, staff, maintain, and monitor scribes are substantial, and rarely accounted for in these estimations. Financial impacts varied based on how outcomes were measured and defined. Medical scribes may make little to no difference in door-to-room or door-to-provider time, number of patients who left without being seen, and patient or clinician satisfaction, though results were mixed and infrequently reported. There were no data on quality of documentation or medical errors or the role of scribes in VA EDs.

KQ 2: How Do the Effects of Medical Scribes Vary Based on Differences in Compensation Structure, Qualifications, Types of Entries, or Setting?

No eligible studies were identified that reported if the effects of medical scribes varied based on differences in compensation structure, types of entries, or other scribe-permitted tasks or scribe-specific qualifications within

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EDs. Evidence was insufficient to determine whether the effect of medical scribes on ED efficiency varied based on clinician training, experience, or area of service within the ED. Very few articles were identified (k = 5) that addressed how the effects of medical scribes vary based on provider qualifications and setting (17,19,20,22,26). Additionally, no studies compared scribes employed and contracted by outside vendors with those trained and employed by medical institutions. All studies required additional on-the-job training regardless of the hiring mechanism.

DISCUSSION

Key Findings

Findings from our systematic review on the effects of medical scribes in EDs are limited by the quantity and quality of available information. Available information is based on studies mostly rated as having serious risk of bias and of limited applicability to widespread implementation. Furthermore, much of the information is from two sets of investigators who published several papers over an extended period of time based on findings at their two EDs. There are no data in VA health care settings or among veterans.

Evidence suggests that medical scribes may improve efficiency (low COE) and financial productivity (low COE). The magnitude of effect on efficiency is likely small. Efficiency varies based on the setting, outcomes assessed, and methods for evaluating financial productivity. The effect on costs is difficult to ascertain, as complete cost reporting was not provided. Resources to identify, hire, train, staff, maintain, and monitor a scribe program are expected to be substantial and are rarely reported in the literature. Online searches did not provide data. Thus, net financial impact is not known and likely varies by key assumptions and methods for scribe program development, implementation, and maintenance. There no direct comparative data on quality of documentation, medical errors, or scribe training (e.g., time to train, turnover); and no data comparing these outcomes in contracted (i.e., vendor-supplied) scribes vs. scribes trained in house or using virtual scribes.

Additional information on the role of medical scribes in primary care and other specialty settings was beyond the scope of our report and not included. However, these studies are typically of similar methodological quality to those identified in our report; that is, single-site reports with clinician volunteers, vendor-supplied scribes, and limited outcome (including financial) reporting. Their results suggest modest affects for improving documentation time and patient satisfaction (36). It is not known how the results from these settings can be applied to future implementation in EDs. A prior systematic review identified five studies published through 2014 and noted limited quality and quantity of information (5).

Applicability

Current findings have limited applicability and raise important questions about implementation, research gaps, and future research. Despite information that there may be 100,000 medical scribes in the United States in 2020, there is a paucity of data on the effectiveness, harms, costs, and quality of scribes, or on best methods for implementation and evaluation (37). The effectiveness and financial productivity for widespread implementation across a national health care system or even settings outside those evaluated in these reports are not known. Several reports were not from the United States, many evaluated programs after training had been completed, and limited inclusion to clinicians volunteering for scribe services. Additionally, a large amount of information was reported from two ED groups, one in Australia.

Charges and costs for the services provided by the vendor were not described. None of the programs described the possible role of allocating scribe services to employees currently assigned other clinic duties, including administrative, nursing, or "clinician extenders." The effect of scribes to improve efficiency, patient access, and throughput likely also requires additional programmatic factors, including reducing clinic appointment times and increasing the number of patients scheduled per day.

Research Gaps and Future Research

Our principal finding is that there are large gaps in evidence that require future research. Despite the marked increase in the use of medical scribes in the United States, we found no high-quality information evaluating their effects on clinical efficiency, health care access, patient or clinician satisfaction, or financial productivity in EDs. There are no data on the use of virtual scribes, and no published data on the cost of developing, implementing, or maintaining a scribe program. Additionally, there are limited data on other important aspects of a medical scribe program, including documentation quality, the comparative effects of in-house vs. contracted hiring, training, maintaining, and supervising large-scale implementation of medical scribes, and other components to medical scribe programs required to enhance care quality, including productivity. We did not search for or include data from other clinical settings (primary care and specialty clinics), but believe such information would be of limited applicability to ED settings. Although numerous scribe organizations exist, and information on their services is

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readily available online, there is little published information on their costs or clinical findings.

Implications for Policy

Although the use of medical scribes in EDs has increased, our systematic review indicates that more information is needed on the effectiveness, harms, and costs before widespread implementation occurs. If information from this report is deemed sufficient for programmatic rollout, then clear identification and evaluation of programmatic goals are needed. This includes improving access and patient/provider satisfaction, enhancing documentation quality, increasing clinical throughput, determining resources, programmatic models, and personnel required, as well as implementation barriers and facilitators.

CONCLUSIONS

Based on findings from limited and mostly serious risk of bias reports with limited widespread generalizability, in-person medical scribes may improve clinical efficiency and improve financial productivity and revenue as measured by RVUs in EDs. The effects on clinical efficiency may be small in magnitude and dependent on the type and method of outcome assessment. Cost and financial productivity data do not include the cost of hiring, training, maintaining, and supervising scribes. Generalizability of findings outside the reported settings is limited. There is little information on patient or clinician satisfaction, scribe documentation quality, or whether results vary by in-house vs. contracted hiring and training.

Article Summary

1. Why is this topic important?Integrating medical scribes with clinicians has been suggested to improve access, quality of care, enhance patient/clinician satisfaction and increase productivity revenue. Many healthcare systems are implementing medical scribes though quality data on their effectiveness is lacking.
2. What does this review attempt to show?Our results have policy implications and suggest that prior to widespread implementation, more information is needed on the effectiveness, harms and costs of scribe programs in emergency departments.
3. What are the key findings? The effects of scribes on clinical efficiency may be small in magnitude and dependent onthe type and method of outcome assessment Scribes may increase financial productivity; however, costs associated with developing,implementing and maintaining scribe programs are not available and likely not accountedfor in published literature. No studies examined the effects of scribes based on compensation structure, qualificationsor duties.
4. How is patient care impacted?In-person medical scribes may increase clinical efficiency (including door-to-room and door-to- disposition times), which could lead to shorter wait times for patients and less time spent in the emergency department overall.

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SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jemermed.2021.02.024.

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