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Digital Scribes: A Possible Solution for Provider Burnout by Reducing Provider Workload

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Abstract

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Background: Provider burnout is continuing to be a massive problem for our healthcare industry. One major contributor to provider burnout is burdensome administrative tasks associated with documentation of electronic medical records (EMR). This review aims to uncover the applications for artificially intelligent digital scribes as a solution to reduce EMR documentation burden.

Purpose: Provider burnout has shown to increase the incidence of major mistakes and decreased patient safety grades. Digital scribes could be a solution in reducing provider burnout by reducing the administrative burden of EMR documentation.

Methods: A comprehensive literature review was conducted using articles from PubMed using search phrases "AI digital scribes, "digital scribe in practice". An advanced search was conducted through PubMed searching for article titles using key phrases "digital scribes" and "automatic speech recognition". Exclusion criteria included systematic reviews, any articles published prior to 2019, and any articles that did not contain any variation of the key words above in their titles.

Conclusions: Early trials of current digital scribe technology have shown the ability to reduce provider workload by accurately documenting pertinent summaries from the patient-provider encounter into EMR systems. Digital scribe technology is only in its infancy stages and still requires extensive trialing to allow for seamless integration into provider practice.

Key Words: AI digital scribes, digital scribes in practice, digital scribes, artificial intelligence, provider efficiency, provider burnout.

Digital Scribes: A Possible Solution for Provider Burnout by Reducing Provider Workload

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Introduction

In the rapidly evolving landscape of healthcare, the integration of artificial intelligence (AI) technologies offers promising avenues to streamline clinic flow, reduce provider workload, and improve patient care. One such problem in modern medicine is provider burnout. The American Medical Association[1] cites that nearly 63% of physicians report signs of burnout such as emotional exhaustion and depersonalization at least once per week. Researchers Tawfik et al[2] conducted a survey with 6695 participating physicians and found that increased levels of burnout are leading to failing patient safety grades as well as increased incidences of major medical errors within the past 3 months. Provider burnout is a devastating reality of modern medicine as many clinics and hospitals are losing brilliant medical providers due to the increased demand for high quality patient care.

The AMA recognizes that when providers experience burnout there is a significant impact on their organizational productivity which leads to many providers unable to fulfill their administrative duties. Examples of administrative duties are entering patient notes into the electronic medical record or responding to patient or other provider inquiries through electronic health portals. The consequences of providers falling behind on administrative work is that it directly impacts the amount of time that a provider can spend with their patients in a clinic. The Agency for Healthcare Research and Quality (AHQR)[3] reports the major causes for provider burnout are time pressures, chaotic environments, low control of pace, electronic health records, and family responsibilities. It was found that nearly a third of providers report they need at least

50% more time for patient care functions during any given visit and at least 50% more time for patient follow up visits.

Medical providers are working well over the number of hours that are required of them. Throughout each workday healthcare practitioners are doing their best to give each of their patients the attention and time they deserve while at the same time being backlogged by tedious and time-consuming entry of electronic medical health records (EMR) and other administrative duties their clinics and hospitals require.

The AHRQ[3] states that implementation of electronic health record systems can increase the rate of provider burnout. One study that the AHRQ cites reports, "fully mature EHR systems, especially with shorter visits, were associated with physician stress, burnout, and intent to leave." This constant battle for providers to try and catch up on administrative duties while also trying to provide quality patient care can be quite damaging to a provider's morale. Healthcare providers entered their careers to help patients and provide care solutions for their ailments, not to be desk workers or IT personnel.

Now, clinics and healthcare systems have tried to alleviate provider workload by hiring medical scribes. Medical scribes are trained documentation specialists who aid providers in typing notes from patient encounters and entering pertinent electronic medical health records. Authors such as Coiera et al[4] reported that skilled human medical scribes have proven to improve the efficiency of their providers, improve clinic flow, and boost revenue for their clinics. Many clinics and healthcare systems are recognizing the risk of provider burnout and are starting to hire more medical scribes in-house or partnering with medical scribe companies to contract out trained medical scribes.

The task of hiring medical scribes can be very difficult for clinics as this profession experiences an immense amount of turnover. The medical scribe profession is often seen as a stepping stone in one's own profession as many medical scribes aspire to become higher level practitioners. Cubell[5] of the Journal of Lancaster General Hospital cites, according to ScribeAmerica, the average tenure for a medical scribe is 18 months. This high rate of turnover creates increased struggle for providers to be paired with highly skilled medical scribes who fully understands their role and can be a collaborating member of the healthcare team rather than a weight who struggles to maintain the visit notes. An undertrained medical scribe can often create more work for providers.

Medical scribes have a unique role in that their role directly reflects upon a provider's work. Ultimately, providers must sign off on all the work that a medical scribe completes. If a medical scribe creates a patient encounter note with multiple errors or missed history, the provider is left to correct the errors and fill-in the missing details. Unfortunately, this again adds to the provider's workload and can impact a provider's efficiency and clinic flow.

Background

Artificial intelligence is rapidly evolving, and its applications seem to be endless. According to IBM (International Business Machines)[6] the definition of artificial intelligence is, "technology that enables computers and machines to stimulate human intelligence and problem-solving capabilities." One such application possibility for AI is the use of digital scribes. Digital scribes are a promising application of AI that can use voice recognition software to write encounter notes and fill in pertinent electronic medical health records. With rates of provider burnout continuing to rise, the major contributors of burnout, such as administrative burden, need

to be addressed and improved upon. Healthcare systems need to continue to find new avenues in which they can help their providers reduce their overall workload and improve efficiency.
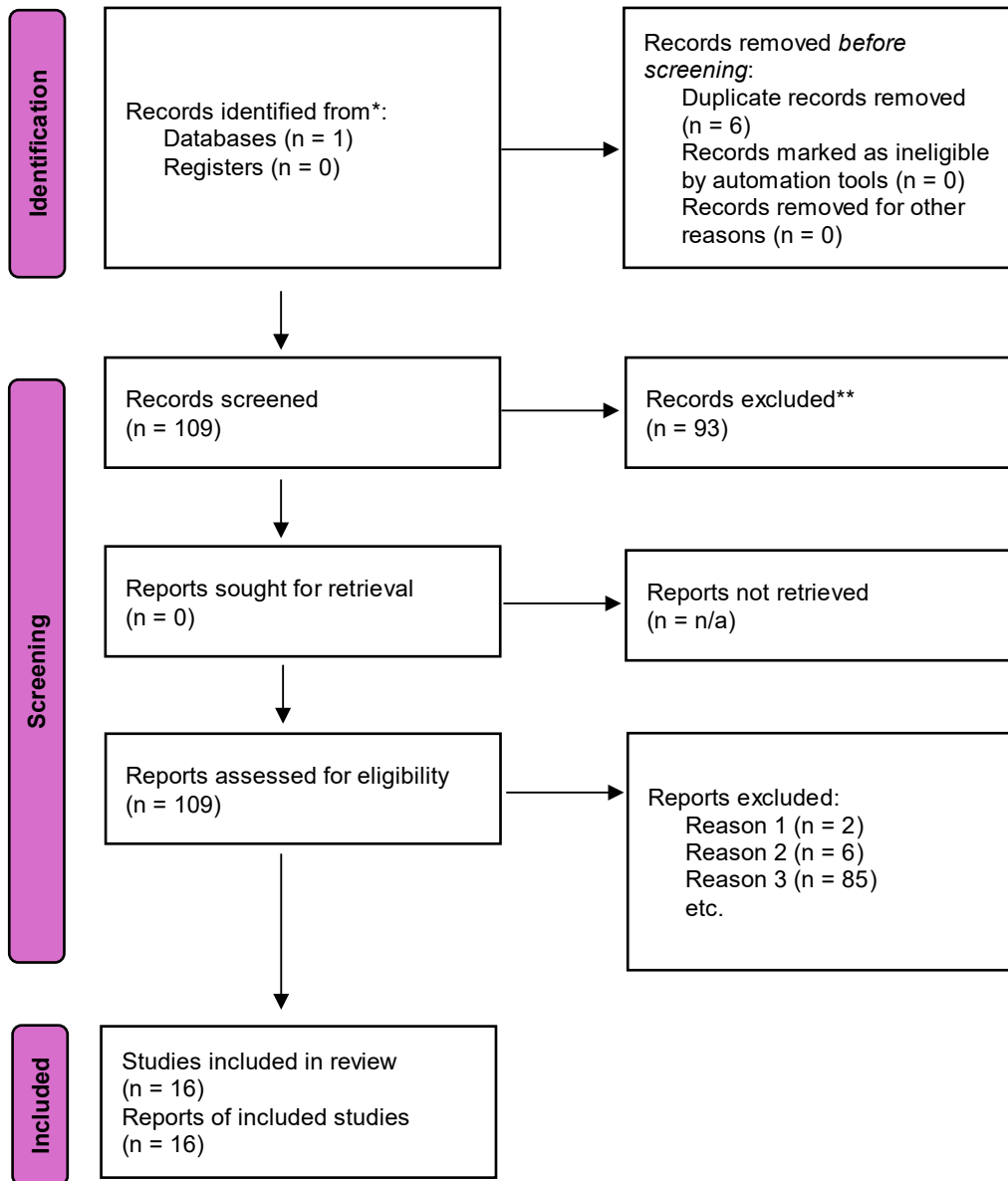
As discussed above, human medical scribes are one such way that clinics have tried to help their providers in reducing overall administrative workload. The unfortunate reality of the medical scribe profession is that turnover rates are high and not all providers/clinics have access to well-trained medical scribes. Artificially intelligent digital scribes pose a promising solution to improve provider efficiency and in turn reduce symptoms of burnout.

This literature review aims to explore how AI digital scribes can be utilized to reduce provider workload and improve efficiency all with the goal of maintaining healthy patient outcomes. The current literature surrounding AI digital scribes will be presented with a focus on its documentation efficiency, impact on clinic flow, accuracy and precision, cost savings, and finally, provider and patient satisfaction. This will be followed by a comprehensive discussion analyzing the entirety of the literature and conclusion with proposals for future research and applications of AI digital scribes.

Methods

A comprehensive literature review of relevant literature was conducted utilizing PubMed, focusing on studies published since 2018. The search strategy included keywords such as "AI digital scribes", "digital scribe in practice". An advanced search was conducted through PubMed searching for article titles using key phrases "digital scribes" and "automatic speech recognition". Exclusion criteria included systematic reviews, articles that did not contain the above keywords or some variation of the above keywords in their titles, or any articles focusing on "medical scribes". Articles were selected based on their relevance to the topic and the quality of evidence presented.

Identification of studies via databases and registers

Identification

Records identified from*:
Databases (n = 1)
Registers (n = 0)

→

Records removed *before screening*:
Duplicate records removed (n = 6)
Records marked as ineligible by automation tools (n = 0)
Records removed for other reasons (n = 0)

Screening

Records screened
(n = 109)

→

Records excluded**
(n = 93)

Reports sought for retrieval
(n = 0)

→

Reports not retrieved
(n = n/a)

Reports assessed for eligibility
(n = 109)

→

Reports excluded:
Reason 1 (n = 2)
Reason 2 (n = 6)
Reason 3 (n = 85)
etc.

Included

Studies included in review
(n = 16)
Reports of included studies
(n = 16)

Results

This systematic review was conducted by reviewing the results of 16 articles following the above methods criteria. Many of the following articles discuss the opportunity for digital scribes to make a significant impact on clinic flow, physician efficiency, and improve provider satisfaction while maintaining patient security and safety.

Artificially intelligent digital scribe technology is in its infancy and many of the pitfalls with the technology are still being uncovered. Quiroz et al[7] dive into the development of automated speech-based digital scribes. The authors discuss the challenges of automated speech-based digital scribes which must be addressed if the technology is to accurately perform documentation tasks.

One such challenge is developing accessible high-quality audio recording devices that can accurately determine spoken words in less-than-ideal audio settings, conversion of audio to transcripts, extracting medical concepts from laymen terms, inducing topic structure from conversation data, generation of clinically meaningful summaries of conversations, and obtaining clinical data for AI and machine learning algorithms. Many of the following articles provide evidence on how current digital scribing technology can overcome these challenges. In developing an accurate digital scribe, there are human challenges that must be overcome. For digital scribes to be useful, they must be incredibly user friendly for the healthcare provider who will utilize the technology.

One massive undertaking for medical providers is navigation of electronic medical records. Ghatnekar et al[8] discuss that the adoption of electronic medical records (EMR) provided medical providers a, "central location to access and share data, write notes, order labs and prescriptions, and bill for visits." However, as non-clinical requirements have increased, time spent using EMRs eclipsed time spent on direct patient care." Ghatnekar et al[10] go on to highlight that talk-to-text digital scribe technology as a solution to inefficient interaction with EMRs. Authors van Buchem et al[9] reviewed the use of automatic speech recognition (ASR) and natural language processing (NLP) and found both forms of digital scribing technologies could

address the problem of provider burnout through automation of clinical documentation and in turn reduce the overall workload of the provider.

Coiera et al[4] also support the notion that digital scribe technology improves efficiency by investigating three broad stages of digital scribing (Human-Led systems, Mixed-Initiative systems, and Computer-Led systems). Human-Led systems task clinicians with documentation though utilize dictation support, semantic checking, and automated templates to simplify the manual documentation process. Mixed-Initiative systems aim to convert conversations in the patient encounter into simplified summaries that are input directly to the electronic record. Computer-Led systems are delegated full control of documentation and only request human interaction when exceptions are encountered during the visit. However, the authors note that Computer-Led systems raise concern for "automation bias" and may see clinicians automatically accept recorded documents without revising prior to submitting. On the contrary, authors Ghatnekar et al[10] found in a proof-of-concept study that digital scribes are beneficial with a 98% accurate transcription rate.

The results from authors Wang et al[11] provide further evidence that digital scribes can improve provider efficiency as well as increase clinic flow. Their results from a proof-of-concept study state that digital scribes are about 2.7 times faster than both typing and dictation in documenting a history section. Digital scribes are also 2.17 times faster than typing and 3.12 times faster than dictation in documentation of the physical exam. The authors also go on to add that providers required "minimal training" to use the digital scribes. Avendano et al[12] share the same conclusion that incorporating artificial intelligence documentation software such as digital scribes have shown to be faster at documenting the history and physical exams for patient encounters as compared to typing or dictation. The article goes on to state that artificial

intelligent machine learning software can increase its accuracy and speed over time. The authors note some potential drawbacks for artificial intelligent digital scribes such as ethical concerns and that this technology is so new that it has few examples of real-world implementation.

On the contrary, Haberle et al[13] found that use of digital scribing technology had no significant change to provider productivity, however, provider satisfaction improved with use of digital scribes. This study evaluated the impact in using nuance Dragon Ambient Experience (DAX), an ambient listening/digital scribing solution. A total of 99 providers across 12 specialties enrolled in this study and it concluded that DAX had no significant improvement in provider productivity, however, use of DAX did show positive trends in provider interaction, improved provider experience, as well as decreased after-hour EHR documentation in the participants who fully interacted with the program. This study also sheds light on how a digital scribing program can perform across multiple specialties. The research concluded that ambient documentation dictation technology could be a viable tool in improving the overall satisfaction of providers but did not demonstrate significant improvement in provider productivity.

In comparison, research done by Sezgin et al[14] demonstrates that AI-assisted tools have the potential to reduce clinical documentation burden. This study compared four pre-trained large language models (T5-small, T5-base, PEGASUS-PubMed, and BART-Large-CNN) to establish a digital scribe system. These large language models summarized 100 referral conversations among emergency department clinicians and medical records. The researchers found that the BART-Large-CNN model demonstrated the greatest performance in summarization tasks with the ability to identify 71.4% key information and a 67.7% accuracy rate. The researchers discussed that based on these results the BART-Large-CNN model demonstrates a high level of understanding clinical dialogue structure, but it is also noted the

model has definite room for improvement in consistent correctness. This research concluded that the results provide evidence that AI-assisted tools can reduce the burden of clinical documentation performed by medical providers.

One important aspect of the digital scribe is the modality in which the digital scribe operates. Avendano et al[12] compared modalities for documentation such as voice recognition software/dictation, medical scribes, and preset templates. Voice recognition shows potential benefit in fewer grammatical errors versus typed notes. Drawbacks for voice recognition being that there is conflicting evidence for improvements for turnaround time/improved clinic flow. The authors also reviewed the benefits and drawbacks of medical scribes and found that they improve resident and physician wellness as well as decreased physician burnout. However, medical scribes have shown no improvement in patient satisfaction and ultimately no change in time for patients to be discharged. Lastly, preset templates have shown to increase the likelihood of completing and documenting a more detailed physical examination as well as increased detection of concomitant injuries. Preset template drawbacks included unspecific prompts to clinical pictures which require burdensome edits needed to be done by the provider leading to low physician satisfaction.

Burdensome administrative duties have proven to cause provider burnout. Digital scribes offer a potential solution to provider burnout; however, it is important to note what specific aspects of the digital scribe improve burnout symptoms. Authors Nguyen et al[15] conducted a survey at a cancer center which assessed provider demographics, workplace stress and burnout, sleep quality, and implementation outcomes. The researchers reviewed nine survey responses and conducted eight interviews. The providers rated the use of digital scribes as marginally acceptable and appropriate. The usability of digital scribes was rated as marginally usable. The

providers reported that the use of digital scribes for one month did not significantly improve feelings of burnout, but improved perceptions of having sufficient documentation time. The providers who took part in this survey were given an opportunity to provide feedback and a common suggestion was to incorporate individualized training and provide on-site support. The practitioners felt that both improved training and support would increase the feasibility and usability of digital scribes.

As digital scribes are more widely adopted, the training for use of digital scribes will improve and medical providers will become more fluent with the technology. The use of digital scribe technology is in its infancy and many trials still need to be conducted to fully comprehend the pearls and pitfalls in using digital scribes. Authors Coiera[16] and Liu[16] endorse that three major concerns must be addressed prior to widespread deployment of AI in medicine all with patient safety at the forefront of these concerns. First, there is concern for little effort to replicate AI trials to expose any methodologic errors and biases. Secondly, there is little reporting for patient harm in many of these trials. Finally, the authors show concern in the effectiveness of AI across different specialties and clinical settings. The authors go on to compare the current rate of AI deployment to the rate of deployment of EHR technology. "The past 10 years were a "dangerous decade" when HER systems were deployed *en masse* around the world, in the face of immature safety and governance processes, and a weak understanding of the positive and negative impacts of the technology."

One study focused on the percentage of errors made by digital scribe technology that utilize automatic speech recognition (ASR). Tran et al[17] evaluated the percentage of word errors documented by specialized ASR models created by Google and Amazon. The researchers conducted trials evaluating the accuracy of a general model as well as a conversational model

created by both brands. The results from this study state that all four models have shown improvement compared to previous trials with a range word error rate (WER) of 8.8% to 10.5%. The researchers discussed the limitations of this study and noted that this study only focused on performance in a primary care setting. A concern from Coiera[16] and Liu[16] were that most studies do not provide a comprehensive outlook on how digital scribe technology would perform in a wide variation of specialties and or differing clinic environments. Another limitation from this study is that it was only tried with native-English speakers with good-quality recording devices. The researchers acknowledge that their results could have been much worse had they tested this automatic speech recognition under less-than-ideal/real-world clinical conditions.

Studies that are focused on the percentage of word errors made by current automatic speech recognition technology has helped in development of more accurate digital scribes. Furthermore, review of doctor-patient transcripts to determine the number of words needed to document an accurate summary of the visit will help in the programing of digital scribes. Quiroz et al[18] conducted a study which reviewed forty-four general practitioner doctor-patient transcripts to highlight the phrases necessary to generate a summary of the consultation. It was found that on average only 20% of all the words in the transcripts were needed to document a thorough summary of the consultation. Digital scribes must be programmed to recognize this 20% of the transcript to accurately document doctor-patient encounters. Digital scribes should be programmed with the most efficient parameters to reach the goal of improving provider efficiency and clinic flow.

A major undertaking for digital scribes is to improve overall clinic workflow. Author Kataria et al[19] state that the current state of EMR makes it very difficult for interoperability amongst various EMR software systems and, "is creating obstacles in seamless workflow." It is

discussed that AI technologies are being deployed to improve the efficiency of interoperative EMR systems allowing providers to locate pertinent patient health information more easily outside of their own practice. Ghatnekar et al[8] state digital scribes can improve clinic flow by reducing the number of persons needed in the exam room. The benefits of limiting the number of persons in the exam room include increased privacy during sensitive discussions and improved accommodation when in-person contact should be limited, for example, during a pandemic.

Research related the financial impact of digital scribes, authors Ghatnekar et al[10] determine that this technology could reduce the overall cost of healthcare visits. The article notes that traditional medical scribes cost upwards of $50,000 per year and have high turnover rates. The article notes that digital scribes would perform all the tasks of a human medical scribe and require less financial backing per year. One issue from this article is that it does not substantiate their claims with any real data other than the general average wage for a medical scribe. This source also seems to have bias in favor of digital scribes as it does not shed any light on the potential complications of digital scribes. Some sources such as, Ghatnekar et al[8], state that adoption of digital scribing service may hold hefty upfront costs to implement into current EHR systems.

Authors like Coiera E.[20] discuss the price of adopting automated AI services in healthcare. "AI is likely to be associated with some of the biggest changes we will see in healthcare in our lifetime. To fully engage with this change brings promise of the greatest reward. To not engage is to pay the highest price." It is indicated that the adoption of AI technology could allow doctors to focus their expertise on challenging cases and provide more attentive care to their patients. The author discusses the use of AI and digital scribes to reduce costs of more tedious tasks such as triage or telemedicine consultations.

Discussion

Based on the literature that has been presented under the search criteria stated above, artificially intelligent digital scribes are proving to be a viable option for automatic EHR documentation. In turn, automating EHR documentation with the use of digital scribes could significantly increase provider efficiency, improve provider satisfaction, and diminish symptoms of provider burnout. The intention of introducing electronic medical records was to give healthcare systems a centralized location to access all aspects of clinic function and patient health information. EHR has proven to become a useful database that allows for documentation of every aspect of the healthcare process and for providers to locate pertinent patient health information to improve treatment outcomes. However, one major downfall of the current EHR model is that providers are becoming increasingly burdened with tedious administrative duties to fulfill the documentation requirements set by healthcare systems.

The results of this review have shed light that current applications of digital scribes demonstrate the potential to significantly improve the efficiency of providers, especially in general practice settings. Trials with current digital scribing applications have shown to greatly increase the speed at which a patient's history of present illness and physical exams are documented into the EHR chart[14]. With the assistance of digital scribes, more providers will be able to access this technology and reduce the amount of time spent after-hours documenting patient encounters. In a clinic that deploys digital scribe technology, providers will simply be tasked with reviewing the notes that their digital scribes have documented before signing off on the encounter. With increased efficiency comes decreased workload and in turn will help to diminish symptoms of burnout amongst medical providers[12]. It was discussed that many clinics are attempting to employ more human medical scribes who have proven to improve the

efficiency of their providers as well as increase provider satisfaction. Oregon Health & Science University (OHSU)[21] reports that the turnover rate of medical scribes is one of the largest pitfalls for the profession. The overwhelming turnover amongst scribes often leaves providers without medical scribes as it becomes increasingly difficult to continuously fill in the missing medical scribe position within a clinic[21]. Adopting the digital scribe can increase access to clinics and providers across an array of clinical settings and specialties.

Another challenge in treating symptoms of provider burnout is tending to provider satisfaction in their role. This review found that digital scribes can boost provider satisfaction by completing tedious documentation and administrative tasks with greater ease. In trials to evaluate efficacy of current digital scribe technologies, it was found that providers who engaged with the technology experienced greater satisfaction in their documentation as compared to providers who did not engage with the technology. It is promising to see this level of satisfaction amongst providers who embrace this early technology. In the discussion of these trials, they note that providers had the ability to provide feedback on the technology and recommended that digital scribes could improve with individualized training as well as implementing on site support. Individualized training and on-site support would have to come with complete embrace of the technology. Most articles in this review would agree that digital scribing technology still has much room for improvement, but the current state of the technology is that of satisfactory for clinical purposes and trials continue to prove that digital scribes are accurate in their documentation and will only continue to improve with more trials. With more trials, the digital scribe technology can learn and more accurately recognize the pertinent medical information and provide a concise summary of the provider-patient conversation.

Available research does not address the full financial impact that digital scribes have on the healthcare industry. It is speculated that digital scribes, in the long run, could reduce the cost of healthcare by filling in for tasks such as triage, telemedicine consults, preliminary imaging interpretation, and time spent documenting patient health information. However, the previous articles did not provide much data on how much money digital scribes could save clinics. Ghatnekar et al[9] report that medical scribes earn on average $50,000 per year and state that digital scribes could overall reduce yearly costs for clinics and hospitals. There is concern that implementing digital scribing technology could have significant upfront costs. As digital scribing technology is improved and is more widely adopted a better picture for overall financial burden will come to light.

One issue that comes to light with the implementation of digital scribes is, "death of the medical scribe." Should digital scribes be universally adopted by health systems, the human medical scribe may become obsolete. According to OHSU[20], there were an estimated 20,000 medical scribes working in hospitals and clinics around the country in 2016. By 2020, there were projections of 100,000 medical scribes working around the country. This amount of growth made medical scribes the fastest growing healthcare profession in the nation. Deciding between digital scribes and human medical scribes may come down to the overall financial burden between both options. However, there could be an option in which hospitals and clinics provide documentation assistance based on provider preference. The choice between a digital scribe or medical scribe could be made by the providers.

Conclusions

A massive problem in our healthcare industry is the rate of provider burnout with the majority of medical providers reporting burnout symptoms[1]. This level of burnout leads to more

providers leaving their clinics and hospitals for new opportunities as well as leaving the medical profession all together. Digital scribes provide a possible solution to increased provider efficiency and reduced burnout. Digital scribe technology is considered to be in its infancy stage and has much room to improve. Preliminary trials have provided proof that digital scribes can increase the efficiency of medical providers in completion of EHR documentation. Digital scribes have also shown the potential of increasing the level of satisfaction amongst providers who have had access to current digital scribe technology.

Next steps would include more trials for current digital scribe technology to improve documentation accuracy as well as trialing the technology in more clinical settings and specialties to evaluate how the technology performs. Financial burden of adopting digital scribes still needs further investigation to provide a clearer picture. This review ultimately sheds light onto a promising future of collaboration amongst providers and artificially intelligent digital scribes.

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