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# IJTIMOIY FANLAR

## TRANSFORMATION OF HEALTH CARE IN UZBEKISTAN: BENEFITS OF USING DIGITAL TECHNOLOGY MANAGING MEDICAL DATA

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KALIT SOʻZLAR	ANNOTATSIYA
Ma'lumotlarni boshqarish, elektron tibbiy kartalar, nutqni avtomatik aniqlash, sog'liqni saqlashda AT, iqtisodiyotni raqamlashtirish, qog'ozsiz sog'liqni saqlashga o'tish.	Ushbu maqolada tibbiyot xodimlarining hamon qog'oz jadvallar asosida ish ko'rishi samaradorlikka salbiy ta'sir ko'rsatishi asoslangan bo'lib, ko'pgina rivojlangan sog'liqni saqlash tizimlari davolash sifatini yaxshilash, xarajatlarni qisqartirish hamda xatolarni kamaytirish maqsadida elektron sog'liqni saqlash tizimiga o'tganliklari ta'kidlangan. Tibbiy yordam ko'rsatish sifatini oshirish maqsadida respublikamizda joriy etilayotgan elektron hujjat aylanishi tizimi tahlilga tortilgan va undagi muammolar bemorlarning elektron kartalari integratsiyasiga to'sqinlik qilayotganligi e'tirof etilgan. Mualliflar bunday muammolarning yechimi sifatida tibbiy maslahatlar paytida ovozdan matnga avtomatik transkripsiyaga asoslangan texnologiya (nutqni avtomatik aniqlash) taklif qilishmoqda. Kvazi-eksperimental tadqiqotlar va boshqa ko'plab akademik kuzatishlardan muvaffaqiyatli o'tgan ushbu usl sog'liqni saqlash sharoitida vaqtdan unumli foydalanish, xatolar darajasi minimallashtirish imkoniyatini berishi dalillangan.
КЛЮЧЕВЫЕ СЛОВА	АННОТАЦИЯ
Управление данными, электронные медицинские карты, автоматическое распознавание речи, ИТ в здравоохранении, цифровизация экономики, переход к безбумажному здравоохранению.	В данной статье утверждается, что старый метод работы медицинского персонала на основе бумажных карт отрицательно сказывается на эффективности, а многие передовые системы здравоохранения мира перешли на электронное здравоохранение в целях улучшения качества медицинской помощи, снижения затрат и минимализации ошибок. Авторами статьи проанализирована внедряемая в нашей республике система электронного документооборота в целях повышения качества медицинской помощи, которые отмечают, что проблемы в ней препятствуют интеграции электронных карт пациентов. В качестве решения подобных проблем авторы предлагают технологию трансформации речи в текст (автоматического распознавания речи) во время медицинских консультаций. Доказано, что этот метод, успешно прошедший квазиэкспериментальные исследования и многие другие академические наблюдения, дает возможность эффективно использовать время и минимизировать ошибки в медицинских учреждениях.
KEY WORDS	ABSTRACT
Data management, electronic health records, automatic speech recognition, healthcare IT,	This article argues that the old paper-based method of medical personnel has a negative impact on efficiency, and many of the world's advanced healthcare systems have switched to e-health in order to improve the quality of medical care, reduce costs and minimize errors. The authors of the article analyzed the electronic document management system being



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digitalization of economy, transformation to paperless healthcare.

implemented in our republic in order to improve the quality of medical care, who note that problems in it hinder the integration of electronic patient records. As a solution to such problems, the authors propose a technology for converting speech into text (automatic speech recognition) during medical consultations. It is proved that this method, which has successfully passed quasi-experimental studies and many other academic observations, makes it possible to effectively use time and minimize errors in medical institutions.

**Introduction.** The healthcare system in the Republic of Uzbekistan has undergone significant transformations in recent years, with a growing focus on the integration of e-health technologies to improve accessibility and quality of medical services, particularly in rural areas. The ministry of healthcare in Uzbekistan has been taking a lot of measures and making reformations in order to tackle the issues related to the sector. One of these solutions has been to transform paper format patients' health records to electronic ones in all healthcare settings and hospitals throughout the republic. As the experience of developed countries has shown, effective and complete adoption of the EHR system is a transformative tool in the healthcare industry that offers numerous benefits that have the potential to revolutionize patient care and improve overall system efficiency. In this research we highlight the potential problems arising during the adoption of EHR and academically demonstrate the positive contribution of ASR technology to overcome these issues.

Problem statement and literature review: The adoption of EHRs has been shown to save significant time for healthcare professionals. According to a study we observed, the implementation of EHR systems has led to a reduction in the time required for various clinical tasks, such as medication management, order entry, and care coordination in many countries [8]. Physicians with EHRs that meet Meaningful Use criteria and have 2 or more years of EHR experience were found to be the most likely to report benefits across a range of measures,

including enhanced access to patient data, improved delivery of recommended care, and better facilitation of patient communication [7].

The clinical benefits of EHR adoption extend far beyond time savings. The integration of electronic health records has been associated with enhanced quality of patient care, reduced medical errors, and more efficient healthcare workflows [10]. Physicians with EHRs have reported that the technology helped them access patient charts remotely, alerted them to potential medication errors, and notified them of critical lab values [7]. Furthermore, the adoption of EHRs was a crucial step in the evolution of diabetes care. The implementation of EHRs has facilitated the management of individual patient data, as well as the development of large repositories for the analysis of system-level data, ultimately leading to improved patient outcomes and more effective population health management [9].

However, the implementation of EHRs is not without its challenges. The overwhelming evidence suggests that one of the most significant barriers in its adoption is the reluctance of doctors to type to the EHR and other usability issues of this software interface. By addressing these concerns and promoting the widespread adoption of EHRs, healthcare systems can unlock the full potential of this transformative technology, enhancing the quality of care, improving patient outcomes, and driving greater efficiency throughout the healthcare ecosystem in the country [1].

One of the primary concerns surrounding the use of EHRs is the potential for these systems to



negatively impact the patient-physician relationship [10]. The need to constantly shift attention between the patient and the computer screen can create a sense of disconnect and detachment, as the physician's focus is divided between the patient and the documentation process [11]. Furthermore, the complexity of the electronic health record interface can be overwhelming, leading to frustration and a reluctance to fully engage with the system [3].

The reluctance of doctors to manually type information into electronic health record systems is a significant barrier to their widespread adoption [2]. Many physicians are accustomed to handwriting notes and prefer this method of documentation, as it allows for a more natural and efficient flow of information. The need to constantly shift between typing and conversing with the patient can disrupt the flow of the consultation and create a sense of attention deficiency, potentially leading to a decrease in the quality of the patient-physician interaction [10].

In addition to the challenges related to manual data entry, the electronic health record systems themselves can also present usability issues. The complexity of these systems, coupled with the high regulatory and administrative burden placed on healthcare providers, can create a sense of frustration and resentment among doctors and patients [2]. This perception is exacerbated by the perception that the system prioritizes compliance and documentation over patient-centric care, as healthcare providers are required to input an ever-increasing amount of data into the electronic health record [2].

One potential strategy to facilitate EHR integration is the use of Automatic Speech Recognition (ASR) technology for voice-to-text transcription, reducing the burden of manual data entry. The benefits of ASR in the EHR context are

highlighted in several studies [4]. Automated speech recognition has demonstrated the ability to improve productivity and cost-effectiveness in a range of business settings [4]. When applied to word processing tasks, ASR can enable users to dictate text faster than manual keyboard entry, even for highly skilled typists [4]. This suggests ASR could streamline clinicians' EHR documentation workflows, potentially increasing EHR acceptance and utilization.

To summarize, the literature suggests that leveraging ASR-enabled transcription could facilitate EHR adoption and utilization by streamlining clinician documentation workflows. However, addressing the recognition of non-native speech patterns remains a critical challenge that must be overcome for successful ASR implementation in healthcare settings.

**Methodology.** Within our research, we aimed to evaluate the effectiveness of Automatic Speech Recognition technology in reducing the time needed for Electronic Health Record completion compared to traditional typing. To achieve this, a quasi-experimental design has been used, focusing on the cause-and-effect relationship between the method of data entry (independent variable) and the time taken for EHR filling (dependent variable).

While this approach seeks to establish a causal link, it deviates from true experimental designs by not employing random assignment. This choice is attributed to the study's specific context, which investigates ASR's impact within a real-world healthcare setting. As random assignment of physicians to different hospitals is impractical, the study will involve the same doctor completing EHR tasks using both manual typing and ASR. This allows for a direct comparison of time spent on each method by the researcher.

Another key advantage of employing a quasi-experimental method in our study was the



enhanced trust and acceptance it garners from hospitals and physicians. By conducting research within real-world settings, including the doctors' own hospitals, the findings hold greater practical relevance and reflect actual clinical practices. This approach surpasses the limitations of controlled experiments, which may not always accurately represent the complexities of real-world healthcare environments. Furthermore, the study's focus on real-world settings enhances the generalizability of its findings to other similar medical environments. By incorporating the inherent complexities and variations present in real-world hospitals, the research results are more likely to be applicable and translatable to broader healthcare contexts.

Within research, we focused on the core hypothesis that employing Automatic Speech Recognition technology, specifically voice-to-text translation, will lead to a significant reduction in the time needed for Electronic Health Record completion compared to traditional manual typing. Beyond this primary focus, the research also investigated three additional hypotheses, all interconnected with the overarching goal of enhancing the quality of care within hospital settings and improving the quality of patient EHRs.

1- Hypothesis: Creation of EHRs with the usage of ASR technology is significantly more time saving than manual typing.

2- Hypothesis: Usage of ASR instead of typing by doctors significantly reduces the amount of spelling errors in EHRs.

3- Hypothesis: Usage of ASR instead of typing discourages doctors from copying and pasting data from existing EHRs.

4- Hypothesis: Usage of ASR instead of typing by doctors increased the amount of relevant medical data inserted into EHRs.

The initial hypothesis of this research centers on whether utilizing Automatic Speech Recognition technology for Electronic Health Record creation significantly reduces the time required compared to manual typing. This question holds substantial weight due to the critical importance of physician time management, particularly in the face of widespread doctor shortages prevalent in many hospitals, especially within rural areas. This hypothesis, positing that ASR-aided EHR creation is significantly faster than manual typing, finds its theoretical grounding in the principles of Human-Computer Interaction and Cognitive Load Theory. HCI examines the design and utilization of computer technology, emphasizing the interfaces between users and computers. CLT, on the other hand, delves into the cognitive processes associated with learning and task execution, highlighting the importance of minimizing cognitive load to enhance efficiency and performance, particularly during patient consultations.

Independent variables included typing method (ASR-enabled vs. traditional keyboard typing) while the dependent variables have been time taken to complete EHR entries, number of spelling errors, incidence rate of copying and pasting, and the number of words per EHR which shows the amount of relevant medical data. Additionally, we have chosen control variables that comprised typing proficiency, familiarity with EHR system (trainings), health department, EHR entry type, computer literacy, age and gender of doctors. The observations and interviews constated of the following set of criteria and questions from 120 doctors:

	Gender	Age	Department	Typing dislike/ like	Number of daily EHRs	Copy/ Paste tendency (typing)	Notice/ignore errors in EHR	Minimize data	EHR trained	Manual typing time (minutes)	Number of Words per EHR	Number of errors with typing (keyboard)	ASR transcription time	Number of Words	Number of errors with ASR	User experience with ASR (Like/dislike)	Copy/Paste tendency with ASR
D1																	
D2																	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

**Results.** To determine the efficiency of each typing method, the collected data underwent analysis using statistical methods. Descriptive statistics provided a summary of the data, while inferential statistics, such as t-tests, were employed to ascertain if there were significant differences in EHR completion times between the ASR-enabled group and the traditional keyboard typing group. This meticulous methodological approach, with its clear definition and operationalization of independent variables, ensures a systematic investigation of the impact of different typing methods on the time efficiency of EHR documentation. As can be seen from the results of statistical analysis above, the Paired-t test was conducted in order to calculate the mean time spend by doctors for the transcription of per 100 words while filling the EHR. The results have shown significant difference in the time spent with each method of transcription. Doctors have normally spent 5.2 minutes for generating 100 medical terms and words with ASR dictation, while with the manual typing the average index for the amount of transcription constituted 8.8 minutes. The study found a substantial 40.9% reduction in documentation time when using ASR technology compared to traditional typing methods. This aligns

with existing literature, which suggests that individuals can type around 15 words per minute, while speech allows for dictation rates of up to 150 words per minute – a tenfold increase in efficiency. The experiments demonstrated that ASR technology facilitated the input of more information, ultimately affording healthcare providers additional time with their patients. Real-time documentation through ASR further optimized clinical workflow, enabling doctors to dictate notes during consultations and minimize post-visit documentation. This real-time approach ensured continuity of care and kept patient information consistently updated.

The study also revealed a significant reduction in documentation errors with ASR technology. By directly transcribing spoken language, ASR minimized typographical errors, which are a common source of inaccuracies in patient records. Research indicates a 17.6% decrease in documentation errors when using ASR. This improvement in accuracy significantly enhances the reliability of patient records. Notably, commercial ASR technologies have advanced considerably in recent years, leading to a substantial reduction in documentation errors.





### Paired t test

Variable	Obs	Mean	Std. err.	Std. dev.	95% conf. interval (lower)	95% conf. interval (upper)
asr~100w	120	5.231249	0.217303	2.38043	4.800968	5.66153
man~100w	120	8.858104	0.37317	4.08787	8.11919	9.597019
diff	120	-3.62686	0.23342	2.55699	-4.089051	-3.16466

mean(diff) = mean(asr\_p100w - manual\_p100w)  
H0: mean(diff) = 0  
Ha: mean(diff) < 0  
Pr(T < t) = **0.0000**

t = -15.5379  
Degrees of freedom = 119  
Ha: mean(diff) != 0  
Pr(|T| > |t|) = **0.0000**  
Ha: mean(diff) > 0  
Pr(T > t) = **1.0000**

Current ASR systems boast accuracy rates exceeding 90%, minimizing the need for corrections and edits. This level of accuracy is crucial for ensuring patient safety and for the broader adoption of ASR in clinical settings. However, it's important to acknowledge that factors like language can influence ASR accuracy.

Our research also highlighted a significant improvement in data completeness with ASR technology. Physicians using ASR were able to dictate information fully, no longer hindered by the limitations of typing speed. This resulted in richer and more informative patient records, with a observed 30.4% increase in the number of words per EHR. This suggests that ASR alleviates the reluctance to fully document information often associated with manual typing.

Post-experiment interviews with physicians that we conducted revealed a high level of satisfaction with ASR technology and a positive disposition towards its adoption. Clinical practice is inherently cognitively demanding, and the added burden of manual data entry can lead to cognitive overload according to doctor’s opinion. ASR was

found to mitigate this cognitive load by allowing practitioners to focus on patient interaction while dictating their notes. This reduction in cognitive burden contributes to increased user satisfaction and a greater willingness to embrace EHR systems. Additionally, the majority of doctors reported a positive overall user experience with ASR technology, finding it user-friendly and convenient. The ease of use associated with ASR-enabled EHR systems appears to contribute significantly to this enhanced user experience.

Traditional typing methods often led to a significant drawback: reduced eye contact and engagement during patient consultations. Physicians would frequently disengage to focus on typing, disrupting the flow of the consultation. ASR technology effectively addresses this issue by allowing physicians to maintain eye contact and remain present while dictating notes. This enhanced interaction fostered stronger physician-patient relationships and ultimately contributed to increased patient satisfaction. However, it's worth noting that this positive impact became more



apparent as physicians gained experience and familiarity with using ASR technology.

The study also revealed that ASR technology effectively addressed the problem of copy-and-paste practices in electronic health records. This tendency, often driven by time constraints or typing difficulties, raises concerns about data integrity, patient safety, and overall healthcare quality. After experiencing the capabilities of ASR, there was a noticeable shift in physician behavior. The study found a 7.5% increase in the number of doctors who indicated they would choose dictation over copying and pasting data when given the opportunity. This suggests that ASR can contribute to more accurate and reliable EHR documentation by reducing reliance on potentially problematic shortcuts.

**Discussion and Conclusion.** While the study demonstrated the benefits of ASR, it also highlighted the need for further investigation into the impact of environmental factors. ASR technology's sensitivity to background noise and poor acoustics could potentially affect its accuracy and efficiency. The study observed that a quiet,

controlled environment yielded optimal results, while the presence of noise from sources like air conditioning or open windows negatively impacted ASR performance. Further research in more diverse and potentially noisier clinical settings is warranted to gain a more comprehensive understanding of these environmental influences. This is particularly important because the study's relatively noise-free settings may have contributed to more robust results than might be observed in other environments.

Voice-to-text ASR technology has significantly improved the adoption and use of EHRs in healthcare settings. This technology has led to a 17.6% increase in accurate data entry, a 40% reduction in documentation time, a decrease in the reliance on copying and pasting, higher user satisfaction among physicians, and improved doctor-patient communication. However, to fully realize these benefits, healthcare institutions must prioritize measures that enhance system accuracy and integration, provide adequate training, address privacy concerns, and ensure compliance with relevant standards and regulations.

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