

Transitioning from Paper to Electronic Medical Records in Austrian Helicopter Emergency Medical Services: A Usability Evaluation

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ABSTRACT

Introduction: This study examines the development and usability evaluation of an electronic documentation application specifically designed for the Austrian Helicopter Emergency Medical Service (HEMS). The primary objective is to assess how HEMS crew members, accustomed to paper-based documentation, perceive the usability of the electronic system.

Method: The application was developed using React Native and tailored to the unique demands of the high-stress environment characteristic of HEMS. No existing digital documentation solutions were analyzed or incorporated; instead, the design was grounded entirely in evidence-based practices. The development process underwent iterative refinement based on user feedback in collaboration with a HEMS crew member. A total of thirty healthcare professionals were recruited through convenience and purposive sampling methods. Usability was evaluated using the System Usability Scale (SUS), complemented by qualitative insights obtained from open-ended questions.

Results: The findings indicate an average SUS score of 79.92. Notably, older and more experienced users, as well as those possessing advanced digital skills, provided favorable ratings for the application. Conversely, younger and less experienced users exhibited lower levels of satisfaction. The qualitative analysis revealed four primary themes: automation and integration, the need for improvement and adaptation, a positive disposition towards the application, and prioritization of simplification and efficiency despite existing concerns.

Conclusion: This study underscores the necessity for ongoing optimization within digital healthcare applications, highlighting the critical alignment with user needs. Future developments should prioritize not only technical enhancements but also the optimization of the overall user experience.

KEYWORDS

Digital health, electronic health records, emergency medical services, air rescue, user-centered design

1. Introduction

The swift evolution of digital technologies has catalyzed a profound transformation across virtually all sectors of healthcare in recent years. This technological revolution offers a compelling opportunity to transition from traditional paper-based methodologies to electronic systems, thereby significantly enhancing the efficiency, accuracy, and accessibility of patient data [1]. Electronic health records (EHR) and mobile applications have become pivotal instruments in optimizing the documentation and management of medical information [2].

The accurate and prompt documentation of patient data is particularly critical in the field of emergency medicine. Emergency physicians and medical personnel frequently operate under time-sensitive and high-stress conditions, necessitating rapid decision-making and meticulous record-keeping. Electronic documentation systems possess the capacity to exceed the capabilities of conventional paper-based approaches, not only by augmenting operational efficiency but also by elevating the quality of data, which in turn supports more informed clinical decision-making [2, 3].

However, despite the myriad benefits associated with electronic documentation systems, numerous healthcare providers face substantial challenges during their implementation. These challenges encompass issues related to user acceptance and the seamless integration of new technologies into established workflows [2, 4]. Empirical studies reveal that initial acceptance of these systems is often inadequate, underscoring a pronounced need for targeted training initiatives to ensure their effective and sustained utilization [1–3, 5, 6].

A notable application of these technological innovations is found within the Helicopter Emergency Medical Service (HEMS) sector. HEMS plays a pivotal role in the swift provision of medical care and transportation for patients in emergency scenarios. The implementation of an electronic documentation application presents an opportunity to enhance documentation processes while concurrently alleviating the workload of emergency personnel [5].

In Austria, HEMS is primarily operated by the *Austrian Automobile, Motorbike and Touring Club (ÖAMTC)* through the Christophorus Flugrettungsverein (CFV) [7]. As the largest private air rescue organization in the country, the CFV has significantly contributed to the evolution of air rescue services in Austria since the introduction of the inaugural Christophorus helicopter in 1983 [8]. Annually, HEMS conducts approximately 37,000 missions across Austria, with the CFV ensuring comprehensive national coverage through 17 strategically positioned bases [7, 8].

The operational challenges and stringent safety requirements inherent in air rescue underscore the importance of introducing an electronic documentation system. Such a system has the potential to streamline documentation processes, enhance accuracy, and reduce the cognitive burden on medical personnel during high-stress situations. This study seeks to analyze the development and usability of an electronic documentation application within the context of Austrian air rescue.

The primary objective of this study is to develop and evaluate the usability of an electronic documentation application specifically tailored for use in Austrian HEMS. A particular emphasis will be placed on the app's user-friendly design, as intuitive operation is critical in the high-pressure environment of emergency situations [6]. Furthermore, the application will be designed to accommodate the specific requirements and workflows of healthcare professionals operating within HEMS.

The research is guided by the following question: How do healthcare professionals accustomed to paper-based documentation assess the usability of an electronic emergency documentation application for the Austrian Helicopter Emergency Medical Service?

2. Methods

A comprehensive literature search served as a foundational basis for the app's design and the theoretical framework of the study. Scientific articles from databases such as PubMed, the Cochrane Database, and Google Scholar, focusing on usability, digital applications in healthcare, and emergency medicine were considered. Studies addressing design principles for mobile applications, particularly within pre-hospital emergency medicine, were also incorporated. Evidence-based approaches identified informed both the app's development and the methodological framework of the study.

The methodological approach for evaluating usability is grounded in the study conducted by Martins [9]. This study employed a Delphi survey to establish a consensus on the planning, implementation, and reporting of usability evaluations for digital solutions within the healthcare sector. The resulting checklist provides a methodological framework for this study. The subsequent sections detail the steps and procedures involved in the usability evaluation of the documentation application.

Sampling

Participants were recruited using a combination of convenience and purposive sampling methods. Convenience sampling facilitated the recruitment of participants based on their accessibility and availability within the target population [10]. Conversely, purposive sampling ensured that participants fulfilled specific, predefined criteria pertinent to the research question [11].

This dual approach to sampling enabled the efficient recruitment of qualified participants for the usability evaluation of the documentation application. The objective was to achieve a representative sample of 30 to 40 participants. As this was the inaugural survey of its kind conducted in this context across Austria, a power calculation was not feasible. The sample size was estimated based on findings from prior studies concerning usability evaluation in the healthcare sector, thereby aiming to generate representative data [12, 13].

To ensure the representativeness of the sample, the inclusion and exclusion criteria for the target group of the usability evaluation were explicitly defined:

Inclusion criteria:

- Active HEMS crew members and emergency physicians within the Austrian air rescue service
- Provision of informed consent to participate
- Proficiency in the German language at a minimum of level B2

Exclusion criteria:

- HEMS crew members and emergency physicians involved in the development of the application
- Pilots of the Austrian air rescue service
- Healthcare professionals who were unavailable during the evaluation period

Recruitment was conducted in several phases. Initially, close collaboration was established with stakeholders from CFV to clarify the study objectives and secure recruitment support. In this consultation, geographically proximate bases were identified, including C11 in Klagenfurt am Wörthersee and C7 in Lienz, East Tyrol. Furthermore, the opportunity to conduct the evaluation as part of a supra-regional air rescue training program was established to ensure a diverse sample.

Potential participants were informed about the usability evaluation in advance via email. This communication included a project description, details regarding the procedure and duration, as well as information on data protection. The consent declaration was attached to the email. Prior to the evaluation, Wi-Fi and appropriate facilities were arranged on-site. The strategic recruitment at specific bases, combined with the integration of supra-regional training, minimized potential selection bias and enhanced the generalizability of the results [14].

Application Development

The primary objective was to create an intuitive and user-friendly application tailored to the specific needs of pre-hospital emergency medicine [15, 16]. Color schemes and typography were selected based on existing research to optimize readability. Dominant shades of blue were incorporated into the color palette, as they are known to evoke a calming effect and enhance concentration [17–19]. The font was chosen according to established recommendations for readability in digital applications [20]. The user interface was designed in close collaboration with healthcare professionals to ensure seamless integration with existing workflows [15, 21]. To mitigate the risk of selection bias, these professionals were excluded from the usability testing phase.

The application was developed using React Native and specifically tailored to the high-stress environment of emergency medical services. No existing digital documentation solutions were analyzed or integrated; instead, the design was based entirely on evidence-based practice and the paper documentation in use. The development process followed an iterative, user-centered approach, incorporating feedback from users to refine the application further. This included collaboration with a member of a HEMS crew to ensure the application addressed operational needs effectively. Special emphasis was placed on the ability to record data swiftly and accurately, facilitating efficient use in time-sensitive situations.

Data Collection

Data collection was conducted from July 1 to August 1, 2024. Participants were thoroughly informed about the study and its procedures in a quiet setting at their respective bases. They received detailed information regarding the study's objectives, data usage, anonymity, and data protection measures, with an assurance that they could withdraw their participation at any time without facing any disadvantages. Following a 10-minute demonstration of the application, during which its functionalities were elucidated, participants had the opportunity to ask questions. Subsequently, they either independently documented an emergency operation with which they were familiar or engaged with a prepared scenario case within the application. These scenarios were developed in coordination with stakeholders from CFV to ensure their realism.

Participants then evaluated the usability of the application using the System Usability Scale (SUS), a standardized tool for assessing the usability of electronic patient documentation systems [22]. The German translation by Gao [23] was employed due to its methodological validation. The questionnaire was accessible via a QR code, directing participants to a Google Forms document on their personal mobile devices, where they could also digitally confirm their consent. In addition to the ten SUS statements, two open-ended qualitative questions were included to gather deeper insights into the user experience.

Ethics

This research project received approval from the Ethics Board of the St. Pölten University of Applied Sciences. Given that this study was entirely non-interventional in nature, a comprehensive ethics application was not deemed necessary. Participants were informed of the study's objectives in advance and provided their informed consent to participate.

Data Analysis

Data analysis was conducted in August 2024 utilizing Excel and PSPP software. The System Usability Scale (SUS) scores were computed using the established formula [24]:

$$\text{SUS-Score} = (\sum \text{raw value}) \times 2.5. \quad (1)$$

Descriptive statistics, including mean, median, minimum, and maximum values, were calculated to assess the distribution of scores. Furthermore, correlations between the SUS scores and baseline characteristics - such as age group, professional experience, and digital competence - were examined using Spearman correlation coefficients.

Qualitative data obtained from open-ended questions were analyzed through thematic analysis as outlined by Schreier [25]. This methodology encompasses several stages, including progressive paraphrasing, streamlining, contrasting, category development, and subsumption. The findings were presented in both qualitative formats (summarized text presentation) and quantitative formats (frequency of categories).

3. Results

As part of the results section, initially, the baseline characteristics of the participating users are detailed. Following this, the quantitative results from the System Usability Scale (SUS) are presented. Subsequently, the qualitative findings, derived from two open-ended questions, are summarized. A total of 30 healthcare professionals from the Austrian Helicopter Emergency Medical Services participated in the usability evaluation. The demographic characteristics of the participants are summarized in Table 1.

Table 1: Baseline characteristics of the participating healthcare professionals (N = 30).

Baseline	n	%
male	28	93.3
Age group 25-39 years	7	23.3
Age group 40-59 years	23	76.7
<1 year work experience	3	10
>1 - <=3 years work experience	1	3.3
>3 - <=5 years work experience	3	10
>5 years work experience	23	76.7
“moderate” digital competence	8	26.7
“good” digital competence	12	40
“excellent” digital competence	10	33.3

Among the 30 participants, 28 (93.3 %) were male, which reflects the HEMS employee representation. Participants were categorized into two age groups: seven individuals (23.3 %) fell within the 25–39 age range, while the majority, comprising 23 individuals (76.7 %), were aged between 40 and 59 years.

The participants' work experience was classified into four distinct groups. Three participants (10 %) had less than one year of work experience, while one participant (3.3 %) possessed between one and three years of experience. Additionally, three participants (10 %) had between three and five years of experience, whereas the largest group consisted of 23 participants (76.7 %) who had more than five years of experience.

Regarding digital competence, eight participants (26.7 %) assessed their skills as moderately competent, 12 participants (40 %) rated themselves as ‘good,’ and ten participants (33.3 %) considered their digital competence to be ‘excellent.’

The characteristics gathered indicate a predominantly experienced and male user group with medium to high levels of digital skills.

Quantitative Results

This section presents an analysis of the data obtained from the System Usability Scale (SUS) to provide comprehensive insights into users' perceptions of the application.

Figure 1 illustrates the individual SUS scores of the 30 participants. The average score of 79.92, along with a median of 78.75, reflects a generally high level of satisfaction regarding usability. However, the presence of lower individual scores indicates areas that require optimization. Additionally, the broad range of scores, spanning from 55 to 100, highlights the variability in user experience.

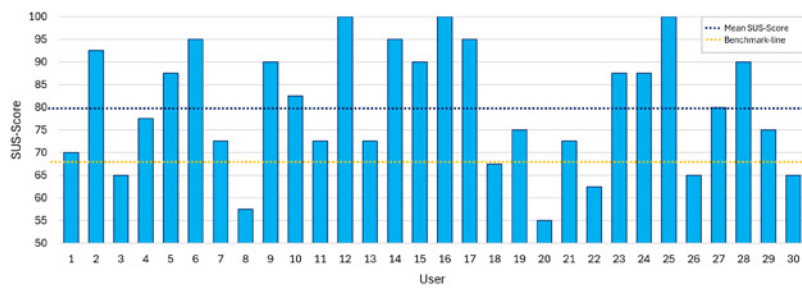


Figure 1: Bar chart illustrating the System Usability Scale (SUS) scores of individual users.

The average SUS rating of 79.92 indicates that the majority of users perceive the usability of the application as good to very good. This is further supported by the frequency of scores ranging from 70 to 95. The median score of 78.75 suggests that most ratings are clustered around the mean, with only a few outliers.

The lowest SUS score recorded is 55, which remains above the critical threshold of 50, below which a system would be deemed clearly inadequate. Users who scored in this range may have encountered specific issues while using the system; however, they do not classify it as entirely unusable.

Additionally, box plots have been generated to illustrate the distribution of user ratings for each of the ten SUS statements. Figure 2 offers in-depth insights into the distribution and trends of individual responses, facilitating a more nuanced interpretation of the usability ratings.

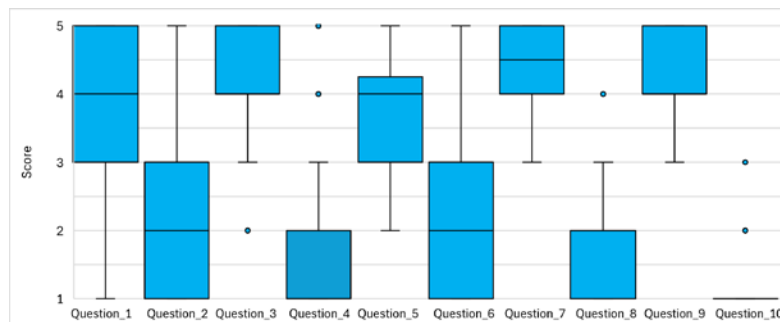


Figure 2: Boxplot of SUS Scores by Question.

Overall, the box plots indicate a predominantly positive user perception of the app. The medians for the questions (1, 3, 5, 7, and 9) fall within a high range, reflecting a strong level of user satisfaction. Conversely, the questions addressing potential negative aspects of usability (2, 4, 6, 8, and 10) show low medians, suggesting that the majority of users did not encounter these issues.

A correlation analysis was conducted to explore the relationships among various variables associated with the usability of the electronic documentation application. The analysis revealed a moderate positive correlation between users' digital competence and their usability ratings ($r = 0.19$, $p = 0.31$), suggesting that individuals with higher digital competence tend to perceive the application as more user-friendly. Conversely, a very weak negative correlation was observed between participants' work experience and their perceived usability ($r = -0.10$, $p = 0.58$), indicating that more experienced users tend to provide lower ratings for the application. Additionally, no significant correlation was identified between participants' age and their usability ratings ($r = 0.11$, $p = 0.53$). These findings imply that digital competence and work experience are more influential factors in shaping users' perceptions of the application than age.

Qualitative Results

While the System Usability Scale (SUS) scores offer a general overview of usability from the user's perspective, the qualitative data provides more profound insights into specific user experiences, challenges, and suggestions for improvement. The qualitative findings are summarized below to present a nuanced understanding of user perspectives regarding the application. Two open-ended questions were posed to capture users' attitudes and opinions on electronic documentation utilizing the app:

- “What additional comments do you have about this app?”
- “If the app were to be launched tomorrow, what are your feelings about it?”

The responses were paraphrased, compared, and organized into meaningful categories. The developed coding framework resulted in the following four categories:

1. **Automation and Integration:** The necessity for automated data transfer and integration with existing systems.
2. **Need for Improvement and Adaptation:** Specific suggestions for optimizing the application and the ongoing need for improvement and adaptation.
3. **Positive Attitude Towards the Application:** General acceptance and a favorable attitude towards the application.
4. **Simplification and Efficiency vs. Concerns:** The desire for straightforward and efficient operation, coupled with certain concerns.

These categories were systematically applied to the responses to provide a comprehensive overview of user opinions. The most significant results of the qualitative analysis are presented below.

1. Automation and Integration (13 of 43 responses, approximately 30 % of all statements)

A considerable proportion of users underscored the importance of automated data transfer from medical devices and integration with existing systems, such as ‘Leonardo’. This technical integration is deemed essential for the effective utilization of the application. One user articulated this need as follows: “[...] *Übertragung des Protokolls ins Leonardo oder eine automatisierte Aufzeichnung der Daten aller unserer medizinischen Geräte in dieses System* [...] ([...]) transfer of the protocol into Leonardo or automated recording of data from all our medical devices into this system [...]” (Statement 2.1). Other comments highlighted the necessity for all relevant data to be automatically transferred to the application without requiring manual input: “*Alle Daten sollten automatisch übernommen werden, ohne sie selber eintragen zu müssen, [...] es sollte wirklich nicht viel Zeit in Anspruch nehmen, so dass man sich immer an den Patienten widmen kann* (All data should be automatically transferred without having to enter it yourself, [...] it really shouldn't take much time so that you can always focus on the patient)” (Statement 1.20). These technical requirements are considered central to the efficient use of the application, as they could significantly reduce the documentation effort.

2. Need for Improvement and Adaptation (15 of 43 responses, approximately 35 % of all statements)

A significant number of users provided specific suggestions for enhancing the application, encompassing both technical and functional aspects. Notable recommendations include the incorporation of additional drop-down menus for medication dosages (statement 1.7) and the addition of a 'Now' button for time entries (statement 1.5). These insights indicate that users possess clear expectations regarding the app's functionality and are inclined to utilize it if it undergoes continuous enhancements. Furthermore, several respondents underscored the importance of allowing for improvements post-launch to better align the app with practical needs: *'[...] es sollte die Möglichkeit bestehen, weiterhin Verbesserungen nachträglich zu implementieren* ([...] it should be possible to continue to implement improvements at a later date)' (statement 2.11).

3. Positive Attitude Towards the Application (23 of 43 responses, approximately 54 % of all statements)

The majority of users conveyed a generally favorable attitude toward the application. Comments such as *'Gute Umsetzung, intuitiv zu bedienen* (Good implementation, intuitive to use)' (statement 1.9) and *'[...] optisch ansprechend und autodidaktisch gut gelöst!* ([...] visually engaging and autodidactically well solved)' (statement 2.2) reflect a high level of satisfaction with its development. Although many users acknowledge the challenges associated with the app's implementation, they perceive the transition toward digitalization as a positive and necessary step: *'Grundsätzlich ist so eine Umstellung [...] mit einem höheren Zeitaufwand verbunden, [...] aber der Weg "vorwärts in Richtung Digitalisierung" wäre zu begrüßen!* (Basically, such a change [...] is associated with a higher time expenditure, [...] but the path "forward towards digitalization" would be welcomed!)' (statement 2.1).

4. Simplification and Efficiency vs. Concerns (8 of 43 responses, approximately 19 % of all statements)

Despite the overall positive feedback, some users expressed concerns regarding the app's practicality, particularly in time-sensitive situations. One user remarked: *'Sie darf nicht komplexer und langwieriger sein als eine analoge Dokumentation. Meist am Rückflug ausgefüllt mit wenig Zeit [...]* (It should not be more complex and time-consuming than analogue documentation. Usually filled in on the return flight with little time [...])' (statement 1.8). These concerns highlight that the app's efficiency and usability are critical to its acceptance. Additionally, some users feared that the application might be implemented too hastily or could prove impractical in certain circumstances.

The qualitative analysis indicates that users view the introduction of a digital documentation application as a promising tool for the digitalization of medical records. The high level of acceptance is evident in the predominantly positive feedback. Users have distinct expectations regarding the app's functionality, usability, and integration. Automation and seamless integration with existing systems are perceived as essential for the success of such applications. The successful implementation will largely hinge on meeting these expectations and continuously adapting the application to the evolving needs of users.

4. Discussion

This study aimed to assess the usability of an electronic documentation application utilized by the air rescue service, focusing on the perspectives of healthcare professionals. The research employed a comprehensive data collection approach, encompassing both quantitative and qualitative methods, to achieve an in-depth understanding of user experiences and to inform future developments of such systems.

The results from the quantitative assessment, utilizing the System Usability Scale (SUS), were correlated with qualitative feedback. The evaluation of the electronic documentation application yielded an average SUS score of 79.92 from 30 participants, with a median score of 78.75. This score significantly exceeds the commonly referenced benchmark of 68, which is regarded as the threshold for above-average usability [26].

In contrast, a cross-sectional study conducted in the United States reported an average SUS score of only 45.9 (SD $\pm$ 21.9) for electronic health records. In that study, higher SUS scores were linked to lower levels of emotional exhaustion and depersonalization, as well as a reduced frequency of work-related burnout [27]. The elevated SUS score in the current study suggests that the application is user-friendly, even though it may not fully satisfy the requirements of all user groups.

It is important to note that the interpretation of SUS scores can vary across different contexts. A more recent interpretation, based on the Curved Grading Scale (CGS) proposed by Sauro & Lewis [28], assigns a more favorable classification to the same score, categorizing it as “A-,” which corresponds to a percentage score of 85–89 %. This variation illustrates that identical SUS scores can be perceived differently depending on the scoring system employed. In this recent interpretation, the high score indicates a user-friendly application; however, it should not be regarded as definitive proof of optimal usability across all dimensions.

A critical aspect of the analysis is the variation in SUS scores relative to individual user characteristics. Participants with greater experience and higher digital competence tended to provide more favorable usability ratings. This contrasts with findings from another study, which indicated that older physicians rated electronic health records as less user-friendly compared to their younger counterparts [27]. The specific involvement of Austrian HEMS crew members in the app's development may have resulted in a tailored application primarily suited for experienced and digitally adept users. It may be beneficial to create specific adaptations of the app for users with less experience or digital proficiency.

An examination of the 7 participants (23.33 % of 30) whose SUS scores fell below the benchmark of 68 revealed that individuals in the 25–39 age group (23.57 % of the 7 participants) provided a less favorable evaluation of the application. This finding supports the notion that the app may not adequately address the needs of younger users.

Interestingly, some experienced users with strong digital skills also rated usability poorly, indicating possible inconsistencies in the feedback. Such discrepancies may stem from misunderstandings in interpreting the SUS statements, a concern echoed by participants who reported difficulties in comprehending the statements.

Qualitative data analysis indicates that while the majority of users generally rate the application positively, they express clear requirements for technical integration and process automation. Notably, 30 % of the comments highlighted the necessity for seamless integration with existing systems, such as Leonardo, as well as the automation of data collection. These requirements are deemed essential for the application's acceptance and usability. Literature supports the notion that inadequate software integration and insufficient automation can lead to low acceptance rates [29], as the application may otherwise be perceived as an additional burden.

Furthermore, qualitative analysis reveals that users expect the application to be both easy and intuitive to use while simultaneously demanding a robust and well-integrated solution. This expectation presents a challenge for future development, necessitating a balance between the required technical complexity and usability. This critical issue warrants further investigation, particularly concerning implementation in high-stakes environments such as air rescue services.

The high acceptance of the application, coupled with the favorable SUS score, reflects a generally positive attitude among users towards digital documentation systems. However, the findings from both qualitative and quantitative evaluations underscore the ongoing need to enhance the application and adapt it to the evolving needs of users, thereby facilitating its full integration into daily workflows and further increasing acceptance.

Strengths and Limitations

The methodological approach of this study presents several strengths and limitations, which are elaborated upon below.

A notable strength of this study is the utilization of a QR code for distributing the questionnaire and conducting data collection on participants' mobile devices. This approach enhances accessibility to the survey and increases the likelihood that participants can complete the questionnaire in its entirety without encountering technical barriers.

The combination of convenience and purposive sampling allows for efficient participant recruitment and the fulfilment of specific inclusion criteria. However, this sampling strategy introduces potential bias. Convenience sampling may lead to an overrepresentation of certain demographic groups while underrepresenting others that are relevant. Additionally, purposive sampling carries the risk that the sample may not fully represent the target population, which could limit the generalizability of the findings, particularly concerning the experiences and perspectives of Austrian HEMS professionals.

The absence of a power calculation and the reliance on previous studies for sample size estimation raise concerns that the sample may be insufficiently sized to yield statistically significant results. This limitation may impact the power of the findings and diminish the ability to detect differences or associations, especially when analyzing subgroups.

Participant recruitment was primarily focused on two HEMS bases (Klagenfurt am Wörthersee and Lienz in East Tyrol) and individuals participating in one supra-regional air rescue training program. Despite efforts to enhance sample diversity through supra-regional training, this regional concentration may have constrained the variety within the sample. Consequently, regional differences in working conditions, culture, or technical access may not be adequately represented, potentially affecting the transferability of the findings to other regions in Austria.

While the use of the System Usability Scale (SUS) for assessing usability is advantageous due to its widespread recognition, it also has limitations. The SUS is relatively general and may not fully capture the specific aspects of usability pertinent to highly specialized applications such as emergency medicine. The careful selection and implementation of a systematically validated German translation of the SUS reflect the author's commitment to ensuring methodological rigor and scientific integrity. However, the "unnatural choice of words" in the German version may have influenced participants' interpretations of the statements, thereby affecting the validity of the results.

The inclusion of a qualitative component through open-ended questions complements the quantitative SUS results, offering deeper insights into user experience. This approach enhances the understanding of the nuances and complexities of user perceptions, thereby improving the quality and validity of the findings. However, the intended supplementary qualitative method, the think-aloud, could not be executed due to the inability to recruit participants. This represents a significant limitation, as this method would have yielded valuable insights into users' cognitive processes during their interaction with the application. The absence of this qualitative component limits the study's ability to provide a deeper, contextualized understanding of the user experience, which is challenging to capture through quantitative methods alone.

Theoretical and Practical Implications

Based on the findings of this study, several recommendations can be proposed for future research and practical applications.

The results indicate that usability assessments vary according to users' digital competence and work experience. It is advisable to tailor the user interface of the electronic documentation application to meet the specific needs of diverse user groups. A significant barrier to the acceptance of the application is its

lack of integration with existing systems, such as Leonardo. Therefore, prioritizing seamless integration and automation of documentation processes is essential to reduce user workload and enhance the application's usability.

The observed discrepancies in usability ratings among different age and experience groups warrant further investigation. Future research should focus on systematically analyzing these variations and identifying their underlying causes.

The inconsistencies in the System Usability Scale (SUS) ratings suggest possible misunderstandings in interpreting the statements. Future studies should explore the extent to which these discrepancies arise from cultural or linguistic differences. Given that the SUS may be interpreted differently across languages and cultural contexts, comparative studies on its international application would be beneficial. Such research could enhance our understanding of the SUS's validity in various contexts and, if necessary, lead to the development of adapted versions of the instrument.

Considering the specific circumstances of the Austrian air rescue service, it is recommended that pilot tests of the electronic documentation application be conducted at regional CFV bases. This approach would facilitate the collection of site-specific feedback, ensuring that the application is tailored to the varying operational conditions across Austria. Acknowledging regional differences in work processes will help optimize the application's usability in diverse operational scenarios.

5. Conclusion

This study examined the usability of an electronic documentation application for Austrian Helicopter Emergency Medical Services from the perspective of healthcare professionals. The findings indicate that the application demonstrates good overall usability, as evidenced by an average SUS score of 79.92, reflecting a high level of user acceptance and satisfaction.

However, the detailed analysis reveals variations in usability perception: experienced and digitally competent users tended to provide more favorable ratings, while less experienced and younger users exhibited lower satisfaction levels. This discrepancy suggests that the application may not be equally effective for all user groups.

Qualitative analysis indicates that users desire improved integration of the application with existing IT systems and enhanced process automation. Users' willingness to adopt the application is closely linked to their perceptions of its efficiency and usability.

Overall, the results of this study emphasize the importance of continuously adapting and enhancing digital health applications to align closely with the needs of end users. The high acceptance level of the application, combined with the identified areas for improvement, suggests that it can offer valuable support to HEMS, provided that the noted shortcomings are addressed. Consequently, future developments should focus not only on enhancing technical functionalities but also on optimizing the user experience to ensure sustained acceptance.

Addressing the research question provides insights into how digital systems can be optimized to enhance user acceptance and satisfaction, ultimately contributing to improved patient care in high-stress emergency situations.

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Conflicts of Interest Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

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