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Usability assessment of the electronic health record used in the school clinic of a higher education institution

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Abstract The medical record is an essential tool for monitoring patients during dental care. This study aimed to evaluate the usability of the Electronic Health Record (EHR) used in the Teaching Clinic of the Dentistry Program of a higher education institution. Participants included staff, faculty, and students (n=106) who were EHR users and completed an electronic questionnaire containing questions from a validated assessment tool. The System Usability Scale (SUS) was used to assess the ease of use of the SMART Consultório Médico Pixeon program, according to the specific usability scale. Furthermore, demographic and descriptive characterization of the user profile was performed. The collected data were subjected to statistical analysis for normality of distribution, comparison by ANOVA, and Pearson's correlation, with significance set at p≤0.05. The results demonstrated a neutral overall score, considering average acceptability among all users. The program was considered "Acceptable" by 20.75% of participants, "Neutral" by 44.34%, and "Unacceptable" by 34.91%, according to the SUS scale. There were no statistical differences between professionals and students. Correlations indicate low acceptability among individuals with IT difficulties. The conclusion is that the electronic health record is a useful resource among users, but the study highlights the need for targeted training for specific groups and modifications to the user interface.
Descriptors: Electronic Health Records. User-Centred Design. Medical Informatics. Technology Assessment, Biomedical.

Evaluación de la usabilidad de los registros electrónicos de salud utilizado en el centro dental de una institución de educación superior
Resumen El historial médico es una herramienta esencial para el acompañamiento del paciente en la atención odontológica. El presente estudio tuvo como objetivo evaluar la usabilidad del historial electrónico del paciente (HEP) utilizado en la clínica del Curso de Odontología de una institución de educación superior. La investigación incluyó a 106 colaboradores, profesores y estudiantes que utilizan el HEP y respondieron a un cuestionario electrónico que contenía preguntas de un instrumento de evaluación validado en la literatura. La Escala de Usabilidad del Sistema (SUS) fue el instrumento utilizado para evaluar la facilidad de uso del programa SMART Consultório Médico Pixeon, según la escala de usabilidad específica. Además, se realizó la caracterización demográfica y descriptiva del perfil del usuario. Los datos recopilados se sometieron a análisis estadístico de normalidad de distribución, comparación por ANOVA y correlación de Pearson, considerando p ≤ 0,05 como significancia. Los resultados mostraron una puntuación general neutral, considerando la aceptabilidad media entre todos los usuarios. El programa fue considerado "Aceptable" por el 20,75% de los participantes, "Neutral" por el 44,34% y "No Aceptable" por el 34,91%, según la puntuación de la escala SUS. No se observaron diferencias estadísticas entre docentes y estudiantes. Las correlaciones indican baja aceptabilidad entre personas con dificultades con los recursos informáticos. Se puede concluir que el historial clínico electrónico es un recurso útil para los usuarios, pero el estudio señala la necesidad de capacitación específica para ciertos grupos y modificaciones en la interfaz de usuario.
Descriptores: Registros Electrónicos de Salud. Diseño Centrado en el Usuario. Informática Médica. Evaluación de la Tecnología Biomédica.

Avaliação da usabilidade do Prontuário Eletrônico do Paciente utilizado no centro odontológico de uma instituição de ensino superior
Resumo O prontuário é uma ferramenta essencial para o acompanhamento de um paciente no atendimento odontológico. O presente estudo teve como objetivo avaliar a usabilidade do Prontuário Eletrônico do Paciente (PEP) usado na clínica-escola do Curso de Odontologia de uma instituição de ensino superior. Participaram da pesquisa

106 colaboradores, docentes e alunos usuários do PEP, que responderam a um questionário eletrônico contendo as perguntas de um instrumento de avaliação validado na literatura. O *System Usability Scale* (SUS) foi o instrumento utilizado para avaliar a facilidade de uso do programa SMART Consultório Médico Pixeon, segundo a escala específica de usabilidade. Além disso, foi realizada a caracterização demográfica e descritiva do perfil do usuário. Os dados coletados foram submetidos à análise estatística de normalidade da distribuição, comparação por ANOVA e correlação de Pearson, considerando como significância p≤0,05. Os resultados mostraram um escore geral neutro, considerando a média de aceitabilidade entre todos os usuários. O programa foi considerado "Aceitável" por 20,75% dos participantes, "Neutro" por 44,34% e "Não Aceitável" por 34,91%, segundo o escore da escala SUS. Não houve diferenças estatísticas entre docentes e estudantes. As correlações apontam baixa aceitabilidade entre os indivíduos com dificuldades com os recursos de informática. Pode-se concluir que o prontuário eletrônico do paciente é um recurso útil entre usuários, mas o estudo aponta uma necessidade de treinamento direcionado para determinados grupos e modificações na interface de usuário.
Descritores: Registros Eletrônicos em Saúde. Design Centrado no Usuário. Informática Médica. Avaliação da Tecnologia Biomédica.

INTRODUCTION

Patient medical records are fundamental for the continuity of care, providing unified access to information for all professionals involved in a patient's treatment[1]. With advances in biomedical science and technology, paper-based records have become increasingly inefficient[1,2]. In this context, the Electronic Health Record (EHR) emerged as a practical and efficient tool to replace traditional analog formats[3,4]

According to the Federal Dental Council (CFO), it is the responsibility of every dentist to complete and update medical records, maintaining chronological clinical data necessary for ongoing care[5]. Proper records should include a dental clinical chart identifying the patient and the professional, medical history, treatment plan and its progression, and, when applicable, radiographic, photographic, histopathological, and laboratory records, as well as recommendations, clarifications, impressions, prescriptions, and other legal documents[5,6]. Beyond patient monitoring, medical records serve as legal documents, protecting professionals in potential litigation[6]. Illegible records are considered ethical violations under the Dental Code of Ethics[5,6]. Furthermore, professionals may only provide services after obtaining the patient's signature on a service provision contract and/or an Informed Consent Form (ICF), detailing the procedures to be performed, their advantages and limitations, and authorization for data and image use[7].

With advances in assessment and examination techniques, clinical data has become increasingly heterogeneous, exceeding the capacity of basic information systems. Additionally, physical records are difficult to store and retrieve, especially given regulatory requirements and the expansion of digital dentistry[1,4]. To optimize professionals' time and organize clinical information efficiently, electronic health records were proposed in the 1960s and have since been continuously developed, particularly to support integrated, multidisciplinary patient care[8].

According to NBR 9241-11[9], human-centred products and projects should be developed to achieve substantial economic and social benefits. Usability, in this context, refers to how easily users can achieve their goals using a service or system. In computer programs, usability encompasses the ease with which users operate systems independently and effectively, achieving expected results[10]. A product or system is considered to have adequate usability when it is easy to learn, easy to use, and efficient in meeting users' needs.

In dentistry, usability assessments support the development of products that assist in oral health diagnostics, such as tools for understanding dental trauma concepts[11]. For EHRs, usability is essential to ensure technological efficiency and facilitate healthcare professionals' work. A system with good usability should meet users' needs effectively without compromising patient safety. Moreover, well-designed user interfaces increase efficiency, reduce errors, and streamline clinical processes, including decision-making[12].

Considering the need to adapt health technologies to the complex demands of dental recordkeeping, understanding user acceptability of these resources is crucial. Therefore, this study aimed to evaluate the usability of the electronic health record (EHR) used at a university dental school clinic. As a secondary objective, it assessed the correlation between

usability acceptability and user profile characteristics, such as prior computer training, internet use experience, age, training in using the EHR system, and social media use.

METHODS

This observational, descriptive, cross-sectional study employed both quantitative and qualitative approaches to assess the acceptability of an electronic health record (EHR) system. The study was approved by the Research Ethics Committee of the Escola Bahiana de Medicina e Saúde Pública (EBMSP) under protocol number 6.503.495.

An online sample size calculator, based on the total number of faculty and students, estimated a required sample of 113 students and 39 professionals. After recruitment, 106 participants were included, comprising 32 professionals and 74 Dentistry students. The inclusion criterion was being an active faculty member or student working at the EBMSP dental school clinic. Students enrolled prior to the 5th semester were excluded, as integration with electronic medical records is only established from this stage onwards in their clinical routine.

Data collection was conducted via a survey created on the Microsoft Forms platform, administered between March and April 2024. Faculty and students were invited to participate through direct face-to-face contact and institutional email. All participants signed an Informed Consent Form prior to participation. The survey contained questions regarding individual demographic information and the usability of the EHR system. At the end of the survey, participants could provide suggestions or raise specific questions. The electronic health record evaluated in this study was the Medical Office module of the Pixeon SMART Program.

The demographic variables assessed included participant category (professional or student), age, gender, education level, and length of work or internship at the institution. Computer experience was also assessed, encompassing: number of hours per week using a computer; completion of a basic computer course; location of most frequent computer use; most commonly used computer tool; difficulties using the EHR or the internet; and social media use.

Usability was assessed using the System Usability Scale (SUS)[13], which consists of 10 items evaluating three domains: effectiveness (achievement of user objectives), efficiency (effort required), and user satisfaction. Each item is rated on a five-point Likert scale ranging from strongly disagree (1 point) to strongly agree (5 points). Individual SUS scores were calculated using a standardized formula[14] and categorized based on acceptability thresholds: "unacceptable" (≤50), "neutral" (51–68), and "acceptable" (≥68)[15]. Additionally, SUS results were interpreted using Net Promoter Score (NPS) classifications, adjectives, and grade bands to provide further insights into system usability[15].

Data analysis was conducted using R (version 4.3.3). Descriptive statistics (absolute and relative frequencies, means, and standard deviations) were calculated to characterize the sample. Data normality was assessed using the Shapiro-Wilk test alongside evaluations of symmetry and flattening of the distribution. Comparisons of mean SUS scores between groups were performed using ANOVA, while Pearson's correlation coefficient was applied to assess relationships between variables. The significance level was set at 5% ($p \leq 0.05$).

RESULTS

Table 1 presents the characteristics of the study participants, representing the user sample of the Electronic Health Record (EHR) system at the EBMSP Dental School Clinic. The results showed a significant reduction in usability scores among participants who did not use social media ($p = 0.02$) and among those who reported difficulties using the EHR system ($p \leq 0.01$).

No significant differences in SUS scores were identified between students and professionals. The data indicate that participants' educational level and professional experience did not influence their perception of the EHR system's usability.

Although students in more advanced semesters showed a trend towards higher usability scores, no statistically significant difference was observed across academic semesters ($p = 0.07$) (Table 2). Similarly, professionals with less than 10 years of experience at EBMSP did not differ significantly in their evaluations from those with over 10 years of experience ($p = 0.63$), suggesting no resistance associated with length of professional experience.

Table 3 shows the distribution of SUS scores by acceptability range. Most participants rated the EHR system within the neutral acceptability category (44.34%), followed by unacceptable (34.91%), and acceptable (20.75%). The overall mean SUS score was 53.7 ± 16.7, indicating neutral usability. However, according to the Net Promoter Score (NPS) interpretation, this

average falls within the "detractor" profile. Analysis of Variance with Tukey's post-test demonstrated a statistically significant difference in mean SUS scores among the three acceptability ranges ($p \leq 0.01$).

Table 1. Absolute, relative and mean ± standard deviation (SD) frequencies of SUS scores and p-values by participant characteristics.

Question	Answer	n	Distribution	Score (mean ± SD)	p-value
Are you a student or a dentist?	Student	74	69.8%	51.6±17.2	0.16
	Dentist	32	30.2%	56.9±17.7	
Do you often use a computer or laptop outside of work?	No	6	5.7%	51.3±10.1	0.78
	Yes	100	94.3%	53.3±17.8	
Do you use the internet to communicate?	No	4	3.8%	45.6±9.4	0.38
	Yes	102	96.2%	53.5±17.6	
Do you use the internet to access social media?	No	8	7.5%	39.7±15.2	0.02
	Yes	98	92.5%	54.3±17.2	
Do you use the internet for work/study?	No	3	2.8%	46.7±12.8	0.51
	Yes	103	97.2%	53.4±17.6	
Have you ever taken a computer course?	No	80	75.5%	52.9±17.6	0.73
	Yes	26	24.5%	54.2±17.3	
Do you have difficulty using digital tools?	No	72	67.9%	54.4±19.5	0.29
	Yes	34	32.1%	50.6±12.0	
Do you have difficulty using the EHR?	No	63	59.4%	61.8±14.2	≤0.01
	Yes	43	40.6%	40.6±13.9	
Have you received training on how to use the EHR?	No	32	30.2%	51.6±15.6	0.55
	Yes	74	69.8%	53.9±18.3	

Table 2. Absolute, relative and mean ± standard deviation (SD) frequencies of SUS scores and p-values by student semester and professional recruitment period.

Question	Answer	n	Distribution	Score (mean ± SD)	p-value
Student Semester	Fifth	23	47.4%	47.4±16.4	0.07
	Sixth	8	52.2%	52.2±21.2	
	Seventh	9	51.1%	51.1±15.8	
	Eighth	11	43.0%	43.0±15.3	
	Ninth	18	58.9%	58.9±13.5	
	Tenth	5	64.0%	64.0±23.6	
Professional Recruitment Period	Up to 10 years	19	59.4%	58.2±15.7	0.63
	Over 10 years	13	40.6%	55.0±20.7	

Table 3. Absolute, relative and mean ± standard deviation (SD) frequencies of SUS scores by acceptability range.

Range	Absolute Frequency	Relative Frequency	Score
Unacceptable (≥0; < 50)	37	34.91%	36.7±9.2*
Neutral (≥50; ≤ 68)	47	44.34%	55.3±5.7*
Acceptable (> 68)	22	20.75%	78.0±6.9*
Total	106	100.00%	53.71±16.7

*Statistically significant difference among groups (ANOVA, Tukey's post-test, $p \leq 0.01$)

DISCUSSION

This study evaluated the usability of the electronic health record (EHR) system used at the EBMSP Dental School Clinic through the System Usability Scale (SUS) and characterized the demographic profile of its users. The findings contribute to the development and optimization of health technologies in academic dental clinics, addressing both quantitative metrics and qualitative perceptions, and highlight areas for improvement to increase work efficiency and safety.

The correct completion and storage of patient records are essential components of dental practice. Although records belong to patients, professionals are responsible for maintaining them[5,6]. Law No. 13,787/2018 regulates the digitization, storage, and management of medical records, establishing a minimum storage period of 20 years from the last entry[16]. The CFO recommends dental records be kept for at least 10 years following the last appointment, with indefinite storage preferable to mitigate legal risks[5,6].

Among the numerous benefits of EHRs, indefinite storage is particularly noteworthy. The Ministry of Health identifies additional advantages, including improved accessibility for healthcare professionals, ease of information sharing between departments, data legibility, standardization, organization, planning facilitation, efficient data recovery, and reliable backup creation[3]. These features are critical for the continuity of care in both public and private sectors[4]. However, certain aspects of paper records remain irreplaceable, such as the ability to obtain handwritten signatures for acknowledgments and consent forms.

The SUS is widely recognized for usability evaluation across domains, not only in software development but also for any user-interactive product[17,18]. Its application in this study was justified by its practicality, rapid administration, and open-access availability. Despite being a general usability instrument, it is well-suited for assessing diverse interfaces and products[19]. Complementing SUS scores with Net Promoter Score (NPS) ratings and adjective classifications provides further insight into user perceptions.

The SUS has been validated in multiple studies[17]. Its applications include evaluating voice-command devices[20], diet management apps for nutritional therapy[21], and telerehabilitation tools prescribing and supervising home therapies[22]. The tool has also been used to assess EHR implementation in emergency departments with experienced users, producing reliable results[11,23]. Thus, SUS use in this study ensures confidence in its findings.

It is generally accepted that products with SUS scores below 68 require review and improvement[15]. In this study, the EHR system received an average score within the neutral acceptability category, indicating that while it performs required functions, its usability is neither intuitive nor optimal. When interpreted alongside the NPS, the system was classified within a detractor profile, suggesting users are unlikely to recommend it. This result implies that although the program offers necessary functionalities, its interface and user experience require enhancement.

User experience (UX) encompasses all aspects of user interaction and perception of a system[19]. The user interface (UI) forms the direct interaction environment, comprising input devices (e.g., mouse, keyboard) and output displays (e.g., monitors, printers). Previous studies have evaluated these parameters in hospital intensive care units using EHRs[24]. Although this study did not include a specific UI evaluation, incorporating such analyses in future research could identify critical interface weaknesses.

Self-perception influences comfort with digital tools[25], explaining the lower usability scores reported by participants with difficulties using the EHR. Most participants demonstrated digital affinity, inferred from frequent internet use, computer use outside work, and social media engagement. Notably, users who did not regularly access social media rated the EHR as unacceptable, suggesting personal digital familiarity may affect system usability perceptions. Individuals accustomed to diverse digital platforms may develop transferable skills that facilitate EHR interaction.

Technology implementation must account for individual user needs rather than assuming homogeneity within user groups. Mapping users experiencing difficulties and providing targeted training or tutorials can enhance adoption and reduce frustration. Difficulties with digital tools can contribute to professional burnout[26], underscoring the importance of addressing individual learning curves.

Successful health technology implementation depends on user engagement. Poor usability reduces service efficiency, increases the risk of data entry errors, and may compromise patient safety[27]. Therefore, continuous usability assessments are essential, particularly following workflow changes, user turnover, or system updates, to ensure optimal performance and safe, efficient care.

The benefits of EHRs justify their implementation despite ongoing challenges in aligning ethical and legal considerations. Maximizing their potential requires continuous evaluation and improvement of both technological and human factors. This study demonstrated that the SUS is an effective instrument for assessing usability, and findings suggest targeted attention should be directed towards users experiencing difficulties to optimize system acceptability and performance.

CONCLUSION

The EHR system evaluated in this study demonstrated neutral acceptability, indicating that while it performs required functions, it is not necessarily intuitive or easy to learn. The findings emphasize the importance of targeted training and support for specific user groups experiencing challenges to improve overall usability, user satisfaction, and patient safety.

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