ARQUIVOS EM ODONTOLOGIA

Interest of dental professionals and students in a mobile app for calculating dosages of medicines for use in pediatric dentistry

Mariana Ramos Coimbra[1] [iD] **| Isabela Cristina Vital Amaral[1]** [iD] **| Túlio Silva Pereira[1]** [iD] **| Luna Chagas Clementino[1]** [iD] **| Juliana Freire-Maia[1]** [iD] **| Paulo Antônio Martins-Júnior[1]** [iD]

[1] Department of Child and Adolescent Oral Health, School of Dentistry, Federal University of Minas Gerais – UFMG, Belo Horizonte, Minas Gerais, Brazil

Aim: This study aimed to assess the interest of dental students, clinicians and professors in a mobile app for calculating dosages of medicines for use in Pediatric Dentistry.

Methods: The cross-sectional survey involved a random sample of undergraduate and postgraduate pediatric dental students, clinical pediatric dentists and professors. Initially, participants watched a video about an early version of the app. They then answered a questionnaire about their clinical experience, calculation routine, and interest in the app. Descriptive analyses were carried out.

Results: Of the 41 participants (20 students, 10 clinicians and 11 professors), 87.8% recognized the need to adjust doses of medicines used in pediatric dentistry, but only 56.1% felt confident in doing so. Almost a fifth of participants (19.5%) admitted errors in prescribing medicines for pediatric dental patients. After seeing the app's functionalities, 92.7% considered it relevant, and 87.8% were interested in the full version.

Conclusion: The app is deemed relevant, necessary, and of significant interest to the target audience, indicating potential for investment and full development.

Uniterms: Pediatric dentistry. Pharmacology. Mobile application. Inventions.

INTRODUCTION

Pediatric patients are recognized as a special population for drug therapy because the constant physiological and anatomical changes during childhood iact the pharmacokinetics and dynamics of compounds[1]. Health professionals providing care to children and adolescents must understand that drug therapy for this population needs to be individualized[2].

Generally, the dose of a drug administered to pediatric patients is adjusted to ensure safe pharmacodynamic effects[3]. However, errors in dose calculations, administration intervals, and/or timing, coupled with dental surgeons' lack of knowledge about pharmacology and dosage adjustment, result in incorrect drug prescriptions and the failure of pharmacotherapeutics in the pediatric population[4,5].

Pediatric patients experience three times more prescription errors compared to adult patients[6]. Interventions mediated by electronic devices can offer an alternative to traditional methods of disseminating oral health information to children's caregivers[7]. In this context, Mobile Health (*m-Health*) is a term that utilizes smartphones and wireless communication technologies to promote health. This technology is associated with telemedicine, clinical and sociodemographic data collection and treatment

Corresponding author
Paulo Antônio Martins-Júnior
Avenida Antônio Carlos 6627, Belo Horizonte, Minas Gerais. CEP: 31.270-901. Telefone: +55 31 3409 2405.
E-mail: pauloa-martinsjunior@ufmg.br

decision-making[8,9]. Additionally, it provides simple access, promotes rapid response, helps control the patient's condition, and reduces errors in health procedures[10].

Mobile apps can assist dental surgeons by providing and facilitating access to information about medications used in the pediatric dental clinic. They can also personalize the calculation of medication dosages safely, optimizing care and treatment response. This aligns with literature suggesting how undergraduate and postgraduate students and teachers use their mobile devices to obtain health information[11,12].

The aim of this study was to assess the interest of dental students, clinicians and professors in using a mobile app for calculating dosages of medicines for use in Pediatric Dentistry.

MATERIALS AND METHODS

This study was conducted following the principles of the STROBE Statement (Strengthening the Reporting of Observational Studies in Epidemiology)[13]. The Human Research Ethics Committee of the Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil, approved the study (CAAE protocol 52939321.1.0000.5149). All participants read and signed an informed consent form.

STUDY DESIGN AND SAMPLE COMPOSITION

The study population in this cross-sectional study comprised a convenience sample (n=41) of undergraduate dental students, pediatric dentists, *lato sensu* postgraduate students in Pediatric Dentistry, *stricto sensu* postgraduate students and Pediatric Dentistry professors from Belo Horizonte, Brazil. Belo Horizonte has a territorial area of 331,401 km^2, an estimated population of 2.53 million[14], and a Human Development Index of 0.810 (very high)[15].

DEFINITION OF BASIC INFORMATION AND FUNCTIONALITIES

In this stage, a literature search identified the medicines used in the clinical routine of pediatric dentistry, for care and prescriptions. The following information was defined: classes of drugs used in Pediatric Dentistry (analgesics, anesthetics, antibiotics, anti-inflammatories, etc.), concentrations, dosage, posology, forms of presentation, indications, contraindications,

undesirable effects, drug interactions, etc. A literature review also identified oral conditions and emergencies in Pediatric Dentistry requiring medication prescriptions, as well as information relevant to Pediatric Dentistry. Additionally, a search for similar apps in app stores (Android and iOS) was conducted to identify existing basic functionalities.

ELIGIBILITY CRITERIA

Participants linked to the UFMG School of Dentistry (undergraduates, postgraduate students and professors) and the Brazilian Association of Pediatric Dentistry - Minas Gerais Region (ABOPED-MG) (clinical pediatric dentists) were included.

DATA COLLECTION

The participants were invited to watch a demonstration video, characterized as the Minimum Viable Product (MVP), based on the Theory of Ries[16], presenting the basic functionalities envisioned for an application of this nature.

After watching the video, participants were invited to answer a questionnaire presented through the Google for Education platform (Google Forms). Only one answer per participant was accepted. The survey instrument consisted of 16 objective questions and 4 essay questions related to the participant's level of education, routine drug prescribing, and interest in the mobile app.

STATISTICAL ANALYSIS

The data were compiled and analyzed using with Google Forms' own analysis tool, presenting results in the form of percentages.

RESULTS

A total of 41 participants responded the questionnaire. The age of the sample ranged from 22 to 66 years old, with most prevalent age being 25 years old (5 participants; 12.2%), followed by 26 years old (4 participants; 9.8%) and 50 years old (3 participants; 7.3%).

Regarding the level of activity of the 40 participants, 27.5% were professors, 27.5% were *stricto sensu* postgraduate students, 22.5% were clinicians, 17.5% were undergraduate students and 5% were *lato sensu* postgraduate students. Concerning their training, 24.4% of the participants had a Master's degree, 17.1% were

undergraduates, 14.6% had completed their undergraduate degree, 14.6% were studying specialization, 14.6% were pursuing a PhD, and 14.6% were *Post-Doc*. Regarding the length of time they had been working in Pediatric Dentistry, 40% of the respondents had been working for more than 10 years. 32.5% had been working for between 01 and 03 years, 10% between 04 and 05 years, 10% more than 05 years and up to 10 years and 7.5% for less than 01 year.

During pediatric dental care, dental surgeons may need to use drug therapy, for example, in cases of inflammation, bacterial infections, or painful symptoms. Considering the importance of pharmacology knowledge in this area, the next question on the questionnaire addressed whether the participants prescribed medication for pediatric dental patients. The majority of participants (87.8%) answered yes, and 12.2% answered no. When asked if the participants calculated the dosage of these drugs (including local anesthetics) for pediatric dental patients, 87.8% answered that they did make calculations. When asked if they felt confident in carrying out these calculations to adjust dosages, 43.9% felt insecure. They were then asked why they felt insecure, and the reasons are outlined in Table 1.

Table 1. Reasons for insecurity when calculating drug dosages.

"I always have to consult the ideal weight x dose relationship for that specific drug"
"Insecurity"
"I'm always in doubt as to whether my calculation is really right"
"Because I can't memorize the formulas and always have to resort to books"
"Difficulty remembering the maximum and recommended doses and concentrations of drugs"
"I always feel like I've miscalculated"
"Insecurity with dosages"
"Too many details about each medicine"
"Lack of knowledge"
"Fear of overdose"
"Lack of experience"
"Possibility of error. I always find it necessary to check"
"I do the calculations, but I don't feel comfortable. Usually pediatricians use higher dosages than indicated on the package leaflet"
"Although I have experience in the pediatric dentistry clinic at UFMG, I haven't had any cases where it was necessary to prescribe medication or use anesthesia. So I have no experience in this matter"
"Because I don't remember the rules"
"I lack information"
"Not remembering the correct calculation formulas"

Thus, it is evident that almost half of the professionals interviewed feel insecure about medication dosages. Moreover, there were similar justifications for their insecurity in many cases, such as a lack of information and difficulty in dealing with calculations. Considering that errors in prescriptions can cause serious harm to the patient, as well as negative repercussions for the responsible professional, the next question inquired whether the participants had ever made a mistake when calculating the dosage of medication for dental patients. Nineteen point five percent (19.5%) of respondents indicated they had. They were then asked about the consequences for the patient, and the answers are outlined in Table 2.

Table 2. Consequences for the patient due to drug dosage miscalculation.

"None, since I was able to replace the prescription"
"None, small error"
Two participants answered "None"
"The mother returned to the office for a new prescription since the pharmacist hadn't accepted the prescription"
"Insufficient analgesic effect"
"I saw in time that the dosage was lower than necessary and changed it"
"I made a mistake... it was an antibiotic"

Following the questionnaire, the participants were asked how they currently calculate the dosage of medication for dental patients. Almost half of them (43.9%) answered that they use a calculator, 39% use paper, 7.3% calculate mentally, 4.9% don't calculate, and the remaining 4.9% were divided between the alternatives: calculate using apps and calculate mentally/using paper/using a calculator. The respondents were then asked if they knew of and/or had tried any apps for calculating drug/anesthetic dosages for pediatric dental patients, and 24.4% answered that they had never tried such an app.

Bearing in mind that before starting to fill in the questionnaires the participants watched an explanatory video, they were asked to rate the relevance of the app in question on a scale of 0-3 (where 0 means "not at all relevant" and 3 means "very relevant"), according to the video. The vast majority (92.7%) rated it as 3 (very relevant), and 7.3% as 2 (fairly relevant).

Subsequently, respondents were asked whether they would be willing to pay for the full version of the app if it met their expectations, and 85.4% said yes. They were then asked what the fairest way of charging would be. The results were varied: 39% believe it should be a one-off charge, 29.3% believe it should be freemium (free to test and paid to use), 24.4% believe it should be an annual subscription (annual updates), and the remaining 7.3% were divided into one-off charge and charge only when there is an update; I think the app should be free; no charge. Finally, participants were asked if they would like to register to be one of the first to test the application in its full version, and 87.8% said they would.

DISCUSSION

This study aimed to evaluate the interest of dental professionals and students in using a mobile app to calculate the dosage of frequently commonly used medicines in pediatric dentistry. m-Health apps provide convenient access to relevant information at any time and place[17]. However, less common are apps that directly assist the healthcare professionals in prescribing, offering a suggested course of action or specific information for the patient[18,19]. Smartphones combine conventional functions with advanced computing, enabling users to access software, commonly known as apps[20], providing accessibility, low cost, mobility, multimedia capacity, geolocation and information exchange[21]. This technology has proven to be a facilitator in the development of healthcare systems, promoting access to care, increasing service coverage, and enhancing the quality of healthcare interventions[22].

Safe use requires prescriptions to be written clearly, with a conscious choice of medication to prevent dispensing and administration errors[23]. However, medication use is not without risks, being a common source of treatment incidents, including irregularities in the medication use process such as adverse reactions, which can occur at any stage, including prescribing, transcribing, dispensing, and administration[24].

Optimizing pharmacotherapy, especially in the pediatric population, has become a primary need[25]. The dynamic process of maturation, leading to substantial changes in body proportion and composition, differentiates the pediatric from the adult population, influencing the efficacy, toxicity, and dosage regimens of medications used in children[26]. Reducing medication errors is an ongoing process, requiring continuous improvement and timely evaluation by specialists to acquire information and adopt criteria favoring the correct delivery of child treatments[1,27].

Approximately 87% of participants in this study reported the need to adjust medications in

daily clinical practice, but only 56% felt confident with dosage adjustment procedures across different age groups of children. Medication errors have a significnt impact on children and their families, compromising patient trust in the healthcare system[28]. Healthcare professionals share a responsibility to identify factors contributing to medication errors and use this information to further reduce their occurrence[29]. Similar results from Zhang et al.[30] showed that health apps received positive reviews from dentists who wich to obtain more medical information through apps in the future and would recommend these apps to peers. These apps allow dentists to access information more quickly in their clinical practices.

Among the participants, 19.5% admitted to making mistakes when prescribing medication in pediatric dentistry. Medication errors are a common cause of iatrogenic adverse events[29], and many errors are preventable through effective control measures[31]. Decision support systems, are developed to be used by healthcare professionals as support in decision-making, acting directly to reduce the occurrence of errors, with a view to patient safety[32].

Positive responses were obtained regarding the relevance of an app to help calculate medication dosage in pediatric dentistry, with 92.4% indicating that the app was very relevant, and 87.8% expressing interest in downloading the full version for use in clinical practice. Mobile health apps have become integral tools on the smartphones of billions of consumers offering the possibility of greater self-knowledge, self-help, connection, and community[33]. It is crucial to ensure that health technologies are appropriately designed and targeted to meet user needs in health interventions[34].

The main limitation of this study was the use of a convenience sample, providing non-representative answers and limiting the possibility of extrapolating the results. Despite this limitation, the findings suggest future directions based on participants' demonstrated interest and the app's potential development. The researchers plan to conduct additional tests to resolve design and functionality issues with the aim of making the app available on the market and for public institutions.

It was observed that the currently available information sources do not adequately meet clinical practice needs, emphasizing the need for improvements and the development of new tools with greater effectiveness and reliability[18]. The results obtained from using the app developed by the researchers are promising, showing greater speed and safety compared to other sources, as found in the study by Santos et al.[18]. Notably, there is a high level of satisfaction with free access to the app, its ease of use, and the way information is offered, demonstrating clarity of content, practical guidance, and time savings[35,36].

CONCLUSION

The introduction of a new app for drug dosage in clinical procedures in pediatric dentistry has generated interest and relevance among dental students and professionals. The app's applicability, safety, and potential for error prevention during pediatric dentistry care support its potential use and learning about full versions of the app.

FUNDING INFORMATION

AUTHOR CONTRIBUTION

Mariana Ramos Coimbra: Investigation, Data curation, Visualization, Writing & original draft. Isabela Cristina Vital Amaral: Investigation, Data curation, Visualization, Writing & original draft. Túlio Silva Pereira: Data curation, Visualization, Writing e original draft, Writing e review & editing. Luna Chagas Clementino: Data curation, Visualization, Writing e original draft, Writing e review & editing. Juliana Freire-Maia: Data curation, Visualization, Writing e original draft, Writing e review & editing. Paulo Antônio Martins-Júnior: Project administration, Conceptualization, Investigation, Data curation, Supervision, Writing, review & editing.

CONFLICT OF INTERESTS

The mobile app is under development by the authors of this manuscript.

AUTHOR'S ORCID

Mariana Ramos Coimbra https://orcid.org/0009-0009-4960-874X

Isabela Cristina Vital Amaral https://orcid.org/0009-0003-3104-7864

Túlio Silva Pereira https://orcid.org/0000-0002-3243-6242

Luna Chagas Clementino https://orcid.org/0000-0001-9904-9418

Juliana Freire-Maia https://orcid.org/0009-0002-6479-4930

Paulo Antônio Martins-Júnior https://orcid.org/0000-0002-1575-5364

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Interesse de profissionais e estudantes de odontologia em um aplicativo móvel para cálculo de dosagens de medicamentos para uso em odontopediatria

Objetivo: Este estudo buscou avaliar o interesse de estudantes de odontologia, clínicos e professores em um aplicativo móvel para calcular dosagens de medicamentos para uso em Odontopediatria.

Métodos: A pesquisa transversal envolveu uma amostra aleatória de estudantes de odontologia pediátrica de graduação e pós-graduação, odontopediatras clínicos e professores. Inicialmente, os participantes assistiram a um vídeo sobre uma versão inicial do aplicativo. Em seguida, eles responderam a um questionário sobre sua experiência clínica, rotina de cálculos e interesse no aplicativo. Análises descritivas foram realizadas.

Resultados: Dos 41 participantes (20 estudantes, 10 clínicos e 11 professores), 87,8% reconheceram a necessidade de ajustar as doses de medicamentos usados em Odontopediatria, mas apenas 56,1% se sentiam confiantes para fazê-lo. Quase um quinto dos participantes (19,5%) admitiu erros na prescrição de medicamentos para pacientes odontopediátricos. Após verem as funcionalidades do aplicativo, 92,7% o consideraram relevante, e 87,8% demonstraram interesse na versão completa.

Conclusão: A conclusão é que o aplicativo é relevante, necessário e de interesse para o público-alvo, indicando potencial para investimento e desenvolvimento completo.

Unitermos: Odontopediatria. Farmacologia. Aplicativo móvel. Invenções.