Development of a mobile application for caregivers on oral hygiene in dementia and dysphagia

Francelise Pivetta Roque[1]
0000-0002-0998-8014

Mariana de Lima Goulart Pecly[1]
0009-0000-2963-6035

Lorran Soares Duarte Terra[2]
0009-0004-8054-8179

Angela Scarparo[2]
0000-0002-4415-1893

Claudio Pinheiro Fernandes[2]
0000-0002-3286-6250

[1]Curso de Fonoaudiologia, Instituto de Saúde de Nova Friburgo da Universidade Federal Fluminense (ISNF/UFF), Nova Friburgo, Rio de Janeiro, Brasil.
[2]Curso de Odontologia, Instituto de Saúde de Nova Friburgo da Universidade Federal Fluminense (ISNF/UFF), Nova Friburgo, Rio de Janeiro, Brasil.

Correspondence:
Francelise Pivetta Roque
E-mail: franceliseroque@id.uff.br

Abstract The authors report the experience of developing the prototype of an application on oral hygiene for elderly individuals with dementia, with special attention to those with dysphagia, aimed at guiding their caregivers. The purpose was also to describe the role of this experience as a strategy for interprofessional education and social innovation for dentistry and speech-language pathology students. A qualitative study of the experience was conducted, gathering information from verbal narratives and written and iconographic records of the researchers, as well as written reports from two reviewers of the application prototype—both experts in Gerontology. The website SeuApp.com website was used for the prototype, which required no programming, generating an application format and a website for desktop and mobile. The product was developed in three phases, successfully completed, and positively evaluated by the reviewers. Its content included written and iconographic information, static and dynamic, regarding the importance and step-by-step process of oral hygiene, its relationships with health and dysphagia, and specific care in the face of the latter, along with an "App Guide" and "Feedback." The reported experience demonstrated that the application's construction was successful and positively evaluated by reviewers, thus achieving the intended social contribution. Dentistry and speech-language pathology students and faculty involved expanded their skills in innovation and interprofessional competencies. Given its expanding presence in the market and significant contribution to the ongoing education of healthcare professionals, further studies on innovation in health education are required.
Descriptors: Oral Hygiene. Dementia. Medical Informatics. Caregivers.

Desarrollo de aplicación móvil para cuidadores sobre higiene bucal en demencia y disfagia

Resumen Los autores relatan la experiencia del proceso de desarrollo del prototipo de una aplicación sobre higiene bucal para personas mayores con demencia, con especial atención a aquellas con disfagia, con el objetivo de orientar a sus cuidadores. También tuvo como objetivo describir el papel de esta experiencia como estrategia de enseñanza interprofesional e innovación social para estudiantes de Odontología y Logopedia. Se realizó un estudio cualitativo del tipo relato de experiencia, con informaciones provenientes de relatos verbales y registros escritos e iconográficos de los autores de esta investigación, así como relatos escritos de dos revisores del prototipo de la aplicación, ambos especialistas en Gerontología. Para el prototipo se utilizó el sitio web SeuApp.com, sin necesidad de programación, generando un formato de aplicación y sitio web para escritorio y celular. El producto fue desarrollado en tres fases, completado con éxito y evaluado positivamente por los revisores. Su contenido incluía información escrita e iconográfica, estática y dinámica, referente a la importancia y el "paso a paso" de la higiene bucal, sus relaciones con la salud y la disfagia, y los cuidados específicos ante esta, además de una "Guía de Aplicación" y "Comentarios". La experiencia relatada demostró que la construcción de la aplicación fue exitosa y fue evaluada positivamente por los revisores, con la contribución social deseada. Los estudiantes y profesores de Odontología y Logopedia involucrados ampliaron sus habilidades en innovación y competencias interprofesionales. Se requiere más estudios en innovación en la graduación en salud, ya que es un área en expansión en el mercado, con un gran aporte para la actualización de los profesionales de la salud.
Descriptores: Higiene Bucal. Demencia. Informática Médica. Cuidadores.

Desenvolvimento de aplicativo móvel para cuidadores sobre higiene bucal em demência e disfagia

Resumo Os autores relatam a experiência do processo de desenvolvimento do protótipo de um aplicativo sobre higiene bucal de idosos com demência, com atenção especial aos que apresentam disfagia, voltado à orientação dos seus cuidadores. Objetivou, também, descrever o papel desta experiência como estratégia de ensino interprofissional e de inovação social a estudantes de Odontologia e Fonoaudiologia. Realizou-se estudo qualitativo do tipo relato de experiência, com informações originadas de narrativas verbais e registro escrito e iconográfico dos autores dessa pesquisa, bem como de relatos escritos de duas revisoras do protótipo do aplicativo – ambas especialistas em Gerontologia. Para o protótipo, utilizou-se o site SeuApp.com, sem necessidade de programação, gerando formato de aplicativo e site para desktop e celular. O produto foi desenvolvido em três fases, concluído com êxito, e avaliado positivamente pelas pareceristas. Seu conteúdo incluiu informações escritas e iconográficas, estáticas e dinâmicas, referentes à importância e "passo a passo" da higiene bucal, suas relações com saúde e disfagia, e cuidados específicos diante dessa, além de um "Guia do Aplicativo" e "Feedback". A experiência relatada demonstrou que a construção do aplicativo se deu com êxito e avaliação positiva por pareceristas, com contribuição social almejada. Os discentes e docentes de Odontologia e de Fonoaudiologia envolvidos ampliaram suas habilidades na inovação e nas competências interprofissionais. Mais estudos sobre a inovação na graduação em saúde são requeridos, por se tratar de uma área em expansão no mercado, tendo grande contribuição para atualização dos profissionais da saúde.

Descritores: Higiene Bucal. Demência. Informática Médica. Cuidadores.

INTRODUCTION

Population aging poses one of the main challenges in the quest for improving care provided to elderly individuals with dementia, a common progressive disease that renders them entirely dependent on caregivers[1].

Dementia is linked to poor oral hygiene conditions[2], which are associated with mortality in the elderly. Caregiver guidance improves oral hygiene in elderly individuals with dementia[3], potentially reducing pneumonia by up to 40%[4]. This disease often leads to death due to oropharyngeal dysphagia, an alteration in the oral and/or pharyngeal phases of swallowing[5].

One tool to address the improvement of this situation is the use of applications for caregiver guidance, known as Mobile Health (mHealth), which is currently expanding worldwide[6]. Brazilian data from 2016 reveal significant internet access proportions, even in less privileged classes: 61% of the general population, 66% in class C, and 35% in classes D/E, with 93% of overall users accessing via mobile phones, 92% in class C, and 94% in classes D/E[7].

Some recent studies included in the review focused on health applications[8], both for professional training and for caregiving support[9-11], but none were similar to the topic of the this study.

These pieces of information motivated the development of the prototype of an application on oral hygiene for elderly individuals with dementia, targeting their caregivers, with special attention to oropharyngeal dysphagia, named *"Saúde bucal em demência e disfagia"* [Oral Health in Dementia and Dysphagia], the description of which is the topic of this study. The application was developed in the context of undergraduate studies in Speech-Language Pathology and Dentistry, with the goal of interprofessional training for future healthcare professionals and innovation.

EXPERIENCE REPORT

This is a qualitative study of the experience report type, and its research protocol was approved by the Research Ethics Committee (under the CAAE *[Certificate of Presentation for Ethical Consideration]* No. 67842416.3.0000.5626), Decision No. 2,063,509.

The information contained in this report originated from verbal narratives and written and iconographic records of the authors of this research, with expertise and interest areas related to the theme.

Written reports from two reviewers were also used – a speech-language pathologist (Reviewer A) and a dentist (Reviewer B), both specialists in Gerontology and Ph.D. holders in Sciences, faculty members at higher education institutions in São Paulo, with extensive practical experience in assisting elderly individuals with dementia and their caregivers.

The development of the application was part of an undergraduate thesis for a Speech-Language Pathology student and an initiation into Innovation for a Dentistry student with institutional scholarship, with joint academic guidance from faculty members of Speech-Language Pathology and Dentistry. Therefore, the process also aimed at interprofessional training and innovation in future healthcare professionals. The evaluation of the process and teaching products was carried out through critical-reflexive analysis grounded in the authors' literature. The process was described retrospectively, narrating facts, feelings, and perceptions derived from the experience, listing positive aspects, and areas to be improved, with the aim of replicating the experience in other curricular components of professional health education.

The chosen website for application development was SeuApp.com, with the selection of the promotional plan, thus incurring no financial costs. The platform allows for the creation of applications in a simple and intuitive manner, which can be made available for Android, iPhone, Windows, and HTML5, without the need for programming, also providing a website in versions for mobile and desktop. Submission to the App Stores is carried out by the author, subject to a fee.

Figure 1 shows the phases and stages of prototype development, which were successfully completed. Based on the literature[6,12-15,18] used during Phase 1, the prototype was divided into "App Guide," "Why Clean the Mouth," "Health Relationships," "When to Clean the Mouth," "Proper Position," "Who Does What," "Materials Needed," "How to Clean the Mouth," "Golden Tips," "Videos," and "Feedback," partially illustrated in Figure 2.

Tables 1 and 2 show that the reviewers' evaluation was favorable to the application prototype.

Phase 1	Planning	- guiding questions outlined by the researchers based on their expertise - research on models of other free applications on health guidance - literature review (PubMed, Scielo, Lilacs, educational institution websites) based on the expertise of the researchers
	Building the Application Prototype	- development of the written content of the application in "intermediate" language for accessibility (intended for nursing technicians, using technical and colloquial language) - simplification of the written language of a portion of this content to generate a "sample" for the prototype, inserted for review by the reviewers (next stage) - customization of the design (choice of colors, modules, and navigation style) - production and insertion of photos and recording of explanatory videos into the prototype
	Review by Reviewers	- submission of written content and the prototype to reviewers in digital format - written evaluation of content and prototype by reviewers
Phase 2	Content Adjustments	- Appreciation of the analysis and contributions made by reviewers - Adjustment of the prototype and content according to the relevance of the analysis
Phase 3	Final Planning	- planning actions to transform the prototype into version 1.1 of the application: - transformation of technical language into colloquial language for all remaining content. - production of photos, videos, and other illustrative images for the material - publication of the application (Google Play) - evaluation of the application by users – an ongoing process

Figure 1. Phases and stages of development of the "Oral Hygiene in Dementia and Dysphagia" application prototype.
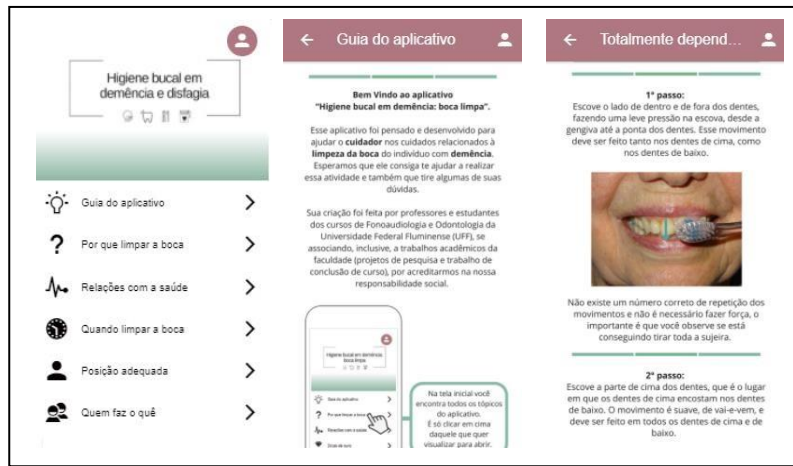
Figure 2. Illustrations of screens from the "Oral Hygiene in Dementia and Dysphagia" application prototype.

Table 1. Evaluation, by the reviewers, of the prototype* of the "Oral Hygiene in Dementia and Dysphagia" application.

Questions	Reviewer A		Reviewer B	
	Score**	Notes	Score**	Notes
a. content: is it sufficient to understand the reasons for oral hygiene?	10	-	10	-
b. content: is it sufficient to understand how to perform oral hygiene?	10	"Emphasize that it is necessary to remove the water volume from the brush for patients with dysphagia so that the patient does not choke."	10	"I think it should be divided into dementia stages because each stage requires a specific approach."
c. content: Is it coherent with the literature?	10	-	10	-
d. content: Is it coherent with the needs of caregivers?	10	-	10	"Important information about fixed and removable dentures (...)."
e. strengths of the content	10	"The content and the step-by-step guide greatly assist in performing the procedure."	10	"The information, the relationship of oral health to overall health."
f. adequacy of redundancy (non-repetitive content)	10	"No, but perhaps it could be even more simplified so that the caregiver doesn't feel lazy to read."	10	"Repetition is favorable for understanding."
g. weaknesses of the content	-	-	-	-
Contributions made by the reviewers directly in the text submitted				
Categories of contributions made by the reviewers directly in the drafting of the text	Suggestions and additions		Corrections, suggestions, and additions	

* prototype: the version of the application containing the sample of written content, videos, and photos, as well as module titles, user evaluation, and information about the use of the application. ** evaluation of each aspect (question) by each reviewer, on a continuous scale from zero (0) ("very bad") to ten (10) ("very good").

Table 2. Evaluation, by the reviewers, of the prototype* of the "Oral Hygiene in Dementia and Dysphagia" application.

Aspect evaluated	Opinion of Reviewer A	Opinion of Reviewer B
Usefulness	5	5
Ease of use	5	5
Clear language	5	5
Quality of videos	5	3 ("very low volume, couldn't hear")
Quality of figures and photos	5	5

* prototype: the version of the application containing the sample of written content, videos, and photos, as well as module titles, user evaluation, and information about the use of the application. ** evaluation of each aspect (question) by each reviewer, on a Likert scale from zero (0) ("very bad") to five (5) ("very good").

The speech-language pathology student reported, as final considerations for her undergraduate thesis on this topic, that "the development of this work provided me with a unique experience, contributing to the expansion of my interest in the field of technology, as well as clarifying the strong relationship that exists between Speech-Language Pathology and Dentistry." The Dentistry student, who participated in the project as a research initiation scholarship holder, included in the acknowledgments of his undergraduate thesis, which was on another topic and supervised by other faculty members: "To the teachers I had throughout my life, from literacy to undergraduate degree, especially Eloá who taught me to read and had all the patience with that restless child without ever giving up on me, and Francelise [speech-language pathologist teacher] who welcomed me into her projects, believed in my abilities, and taught me to be a professional who treats patients with respect and dignity." These reports allow us to see that the objectives of interprofessional education and innovation were achieved.

The information aimed at guiding the caregiver of elderly individuals with dementia, with special attention to oropharyngeal dysphagia, constitutes, in this prototype, unprecedented content and format, well-evaluated by experts in the field, and of expected contribution, both in terms of applicability and scientific aspects, encouraging other professionals to take similar actions[1,3,4,6-13,16,18].

Given the lack of unanimous information about the most effective methods of oral hygiene in this population[16], and the barriers and facilitators of oral hygiene[17], one limitation of this application is the potential criticism to the information included.

Another limitation is that this application has not been tested on caregivers due to the difficulty in obtaining a sufficient number in this phase of the research. It should be noted, however, that the planning phase of the prototype ensures testing of the next version by this audience.

The fact that the funding for this research came solely from personal resources resulted in limitations in the available resources for its creation (including obtaining and editing images), fewer layout options, and the absence of a programmer. Examples of this include the limited quality of the video and images; the videos illustrating oral hygiene procedures cannot be inserted into the topic whose content is related, with all the videos in a separate topic (videos); the videos need to be loaded from YouTube; there is no auditory narration of the written content.

It is also emphasized that, with the goal of innovation, the development of this application ideally should have involved the target audience (caregivers of elderly individuals with dementia), which was unfeasible in the context of the reality in which the project was developed (even though it was planned and ethically approved). The development of the application prototype and its description were successfully completed.

FINAL CONSIDERATIONS

The development of the application prototype and its description were successfully completed. All the theoretical foundation contents, along with the contributions from the professionals involved in this work, contributed to a positive evaluation of the content by the reviewers. Dentistry and speech-language pathology students and faculty involved expanded their skills in innovation and interprofessional competencies.

Further studies focusing on the description of application development are required, as it is an expanding area in the market, making a significant contribution to the updating of healthcare professionals.

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