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ORIGINAL RESEARCH

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``Ser Criança''—an oral health literacy program for vulnerable children and families

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Abstract

Background: Oral health literacy and knowledge about primary prevention methods are essential to decrease possible effects of poor oral health on systemic health. This is more evident among the vunerable communities. The objectives of this work consists in the establishment of methods to promote oral health literacy applicable to the participants of the "Ser Criança" program, namely: development of a website—"Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile) and creation of a protocol for remote dental appointment supported by information obtained by intraoral photos, using teledentistry. **Methods**: The work developed was focused on the development of a website for oral health literacy accessed by children of vulnerable communities and the creation of a pilot-protocol for remote dental appointment, by teledentistry, which can offer valuable diagnostic, therapeutic and preventive care online for the children and families involved which may not have easy access to oral health services. **Results**: The "Ser Criança" program is a initiative designed to empower communities with knowledge about oral health and to facilitate the detection and treatment of potential oral pathologies among children. The development of a digital platform for early education represents a strategic approach to improve oral health promotion and disease prevention, particularly among vulnerable communities. **Conclusions**: Promoting oral health literacy and understanding primary prevention methods are essential to reduce the negative impact of poor oral health on systemic conditions. The "Ser Criança" program represents a pioneering effort aimed at empowering communities with oral health knowledge and facilitating early detection and treatment of dental issues in children.

Keywords

Children; Oral health literacy; Digital education; Oral health program

1. Introduction

The integration and participation of oral health into the overall health concept is a process that has been refined over the years. In the 1940s, the World Health Organization (WHO) defined health as "a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity" [1]. Oral diseases and conditions can negatively impact the functional, psychological and social well-being of an individual [2]. As far as preschool children are concerned, the repercussions on quality of life and of oral diseases is notorious and has been reported elsewhere [3]. The high prevalence of some pathologies at these early ages, such as dental caries (most common), trauma and malocclusion, is closely linked to poor quality of life, not only for the child but also for the family [3–5]. Although the literature extensively addresses the topic of oral health promotion, the lack of children specific educational interventions, as well as the application of behavioral strategies, are still currently considered gaps. Current evidence shows that an educational intervention will not be effective if it is solely child-centered, not considering the child's environment, personal and interpersonal relationships [6].

It is also proposed by some authors that an effective intervention in the child's oral health must combine two concepts: education and fun. The ease of learning at preschool and school ages is closely linked to the act of playing. Learning with fun can bring many benefits to children such as: awakening visual alertness, consolidating memory and reasoning strategies, or even increasing the attention span [7, 8]. According to Milteer *et al.* [9], from an early age, playing is considered crucial in a child's cognitive, creative, emotional and physical development. Furthermore, parents who spend more time with their children in building playful activities end up strengthening the primordial family connections. For children in unfavorable households, the "fun" factor often goes unexplored, considerably reducing the child's potential for learning and intellectual development. These circumstances can be overcome in a supportive society where teachers, early childhood educators, and educational assistants' role is valued [9].

The choice of the best educational interventional method continues to be the subject of regular study and analysis. One of the most conventional processes advocated in the literature is a strictly theoretical oral education. This type of childhood instruction rarely generates a positive behavioral change [10]. Currently, the variability of pedagogical alternatives is considered one of the main factors for improving children's oral health [6]. The oral health promotion actions directed to children can be carried out through playful tools that make the learning process more appealing, dynamic, easy to understand, and consequently more effective. Some playful communication strategies adapted to this public are educational games, short plays, songs and exhibitions of dental macro-models. All of these will contribute to increase knowledge, as evidenced by some previously conducted studies [11, 12]. The choice of the activity to be proposed must be made in a coherent and appropriate manner according to the child's degree of cognitive knowledge and maturity. This is the only way the information to be transmitted will be effectively grasped by the children [13–15]. Activities that promote oral health and, consequently, provide a range of possibilities that support children's knowledge are increasingly excellent alternatives for children's cognitive development. Children's growth and resourcefulness will be extensively influenced by their learning years. In parallel, the presence and attitude, of the parents, but also of the educators, will impact positively or negatively to the child's development [16–18].

Today's dentistry is constantly challenged to act in an educational manner in the daily lives of children and young people. As mentioned above, appealing and engaging strategies should be pursued for transmitting concepts of oral pedagogy, strengthening the triad—children, parents and teachers/childcare workers [13].

Educational games are conventionally considered a stimulating and truly dynamic method or educational alternative that reinforces learning at a young age [8]. They are considered attractive options for a generation that lives intensely connected to games.

Play has several benefits in the learning process of individuals in younger age groups. With a diverse range of educational games, those involving strategic planning are highly engaging for children [8, 14]. In this type of game, the youngest are exposed from the start to several options, eventually deciding which is best or worst for the course of the game. Depending on the decision, the outcome may change. This teaching strategy has numerous advantages. Besides encouraging and reinforcing one's identity early on, it also increases knowledge retention through trial-and-error methods [8, 14].

In recent years, we have seen a revolution in the field of technology, which has changed the way we interact with other people and the way we search for and exchange information. Information and communication technologies have the potential to revolutionize the delivery and organization of health care in many ways: improving outcomes, reducing costs, increasing access, especially in disadvantaged and rural areas and low-income countries [14]. Designing and implementing technology-based interventions in any population, but specifically in children, can improve the communication and awareness of the theme. Additionally, for some caretakers and teachers the permanent availability of information without having to consult a specialist in oral health is a valuable asset. However, in certain cases it is important to have a clinical assessment of the conditions and the Ser Criança project included in the website instructions on how to collect essential information to screen oral health problems. This information is essential when communicating with the health professional even if they are not physically close.

Inspite of the fact that direct in-person examination has historically been the most direct way to provide care, technological advances have expanded the options for dentists to communicate with patients. The American Dental Association (ADA) believes that the examinations performed with teledentistry can be an effective way to extend the reach of professionals, increasing access to treatment for a population within a reasonable geographical distance [16]. Nevertheless, it is important to have information on what data needs to be collected and how it should be collected to have sufficient quality to warrant a good diagnosis.

The objective of this work is to establish methods to promote oral health literacy applicable to the participants of the "Ser Criança" program, namely:

• Development of a website—"Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile), through the platform Wix (https://projsc.wixsite.com/projetosercrianca), that connects the program's three target groups: children, parents/caregivers, and teachers.

• Creation of a protocol for remote dental appointment supported by information obtained by intraoral photos, using teledentistry.

2. Materials and methods

A partnership was established between "Reencontro—Associação Social, Educacional e Cultural de Vila Nova de Tazem" (social, educational and cultural association) and the Faculty of Dental Medicine of the Universidade Católica Portuguesa (FDM-UCP). This partnership was destined to fulfill part of the program "Ser Criança" which relates to oral health.

The "Ser Criança" program aims to improve the overall quality of life for socioeconomically vulnerable children belonging to the municipality of Gouveia, Portugal and the types of disturbances by combining health education in the family context. This pioneering program is managed by "Reencontro" Association.

The social problems that "Ser Criança" intends to address include children's social exclusion, consequently poverty and other forms of extreme deprivation faced by children and their families. The presence of a child in a household with significant vulnerabilities substantially hinders their integral development. Early intervention in children's development is crucial to promote equal opportunities in society and breaking the cycle of social exclusion.

The Faculty of Dental Medicine contributes to this program by bringing a component related to the promotion of oral health. Specifically, the role of the dental school team was targeted to achieve the established objectives, a specialized oral health literacy website was developed using the Wix

platform (https://projsc.wixsite.com/projetosercrianca). The initial phase of the project focused on identifying the key topics and determining the types of content, including interactive games, to engage the primary target groups effectively. The website's design was structured to connect and address the needs of the three main audiences: children, parents/caregivers, and teachers.

In addition to developing the website, a pilot protocol for remote dental appointments, using teledentistry, was created. This protocol included a teledentistry component that allows for remote dental appointments, providing diagnostic and preventive care online for the children and families involved. The appointments were conducted using Google Meet through Google Classroom, a platform chosen for its proven effectiveness in digital education and the familiarity of the platform to these users since it is widely used for distance learning in Portugal during the COVID pandemic.

Initially, the Ser Criança program was introduced to participants, outlining its objectives and benefits. Following this introduction, a segment called "Story Time" was presented, which is one of the interactive elements designed to engage children and raise awareness about oral health. After this session, participants' interest and willingness to engage were assessed. Those who expressed a positive response were then provided with a video tutorial to guide them through the teledentistry process. The video tutorial was structured in stepwise instructions on how to perform photographes from the oral cavity as follows: Step 1—Prophylactic Brushing: The child begins by performing a thorough brushing of their teeth; Step 2—Hand Washing: The child washes their hands to prepare for handling their lips; Step 3—Mouth Positioning: The child places their fingers inside their mouth to gently pull apart the mucous membranes and occludes their teeth, Step 4—Mirror Use: The tutorial encourages the use of a small mirror for better visibility; Step 5—Upper Jaw Photography: The child inserts the mirror into their mouth, lifts their chin, and once the mirror is correctly positioned, a photo of the upper jaw is taken; Step 6—Lower Jaw Photography: The child inserts the mirror into their mouth, lifts their chin, and retracts their tongue to facilitate a photo of the lower jaw.

The child must perform a prophylactic brushing. When, through the teledentistry appointment, any situation that required the intervention of the clinic was identified, children were seen at the Clinica Dentária Universitária UCP.

3. Results

The participants in this program were mostly children between 4 and 10 years old and their families, mainly from vulnerable socioeconomic backgrounds. Parents played a key role in imparting daily knowledge and fostering healthy behaviors. Consequently, the program actively encouraged the participation of the parents/caregivers and the teachers. The website was launched during the COVID-19 pandemic, using the distance learning methods employed by schools participating in the "Ser Criança" program (Fig. 1). This included printing coloring pages and mailing them to the parents or caregivers at their respective addresses. Although the use of the digital world was limited, it was a feasible alternative for accessing the website's content. During the post-confinement period, the website was used with guidance from teachers or kindergarten staff. The elements of education, entertainment and fun were carefully balanced to create an effective and enjoyable learning environment. It is worth mentioning that, during the pandemic lockdown, the Portuguese government established guidelines for pre-school and school education that promoted the use of digital resources to support early childhood education. Many of these guidelines emphasized the use of digital tools for stimulating early learning, which significantly facilitated the development of the current program.

The website of the program "Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile) can be accessed via the link: https://projsc.wixsite.com/projetosercrianca. It features six main pages: (1) Home; (2) Who we are; (3) Team; (4) Children; (5) Parents and (6) Educators (Fig. 2). Each page is designed to provide targeted information and resources for children, parents and educators, all of which are supported by oral health information outlined in the literature. The "Home" page expresses an overview of the entire website layout, highlighting the "Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile) logo, also created for the promotion and dissemination of the entire program (Fig. 2).

The "Children" tab is subdivided into three pages: (1) Learning Games; (2) Let's Paint! (3) Challenge yourself. At this stage of construction of website, a very simple and interactive example is already available on the Learning Games subdivision, created by a member of the "Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile team). This game is titled "The toothbrush superhero". The objective of the game is to collect all the brushes and, at the same time, to "escape" from candies (ice cream, candies, and donuts). The longer you stay in contact with the brushes, the more points you accumulate. With each new record achieved, the player has the possibility to register his/her name. This original game from the "Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile) program perfectly intertwines oral health literacy, daily challenges and fun. This section of the website is dynamic and will gradually grow with the addition of challenging games that can be adapted for various age groups. The second subdivision, "Let's paint!", offers a selection of coloring pages that can be printed by parents or teachers for children to use. The final subsection of "Children" tab, "Challenge yourself", features more challenging activities, including crossword puzzles, dot-to-dot games, and word searches. The page dedicated to parents includes two sections: "Story Time" and "More Information". The "Story Time" tab features a story that parents can share with their children, with an emphasis on motivating oral health. In the "More Information" tab, parents can find an informative leaflet created by the FDM-UCP, which uses accessible language appropriate for younger audiences.

Finally, the last section of the page is aimed at kindergarten and elementary school teachers and is composed of three categories: "Classes and Lectures", "Theatre and Music", and "Share Your Opinion!". The role of teachers is vital to children's cognitive development. This section of the website provides information through presentations prepared by the FDM-UCP, tailored to various learning levels and ages, which educators can use as instructional materials. Two dynamic

FIGURE 1. The logo of the "Ser Criança—Aprender a Sorrir" program (To be a Child—Learning to Smile). Source: original from the author.

FIGURE 2. The website homepage of the "Ser Criança—Aprender a Sorrir" program (A Child—Learn to Smile). Source: original from the author.

and engaging methods featured in this section are theater and music. These approaches work together to deliver information in an enjoyable and effective manner. The website includes examples of songs and puppet shows, widely recognized in the dental field, specifically designed for preschool and school-aged children. Both—theatre and music—are referenced on digital platforms available for free on internet. The last subdivision of this third section is titled "Share your opinion!". In this thread, kindergarten educators can share the most effective teaching methods in their daily practice. The aim is to foster a community that supports not only the teachers involved in the "Ser Criança—Aprender a Sorrir" (To be a Child—Learning to Smile) program but also extends to those nationwide who may wish to join. A national network based on knowledge sharing will be actively encouraged and supported.

The program also provided the opportunity to conduct dental appointments using the teledentistry method for the children and families involved, allowing for diagnostic and preventive online consultations. Google Meet, part of Google Classroom, was used due to its established effectiveness as a digital teaching platform. During the initial contact with the participants, the program was introduced, and its objectives were outlined. Following the presentation, "Story Time" was launched, a playful segment designed to increase children's awareness of oral health. At the end of the session, participants' interest and willingness to participate were evaluated, and those who expressed positive responses received the video tutorial.

In addition to the website, a tutorial was developed in collaboration with Trinity College Dublin (TCD)—Department of Public & Child Dental Health. This tutorial aimed to guide caregivers in photographing their children's oral cavity in frontal and occlusal views with lip separation to facilitate diagnosis. The video was culturally adapted into European Portuguese, complementing existing versions in British English and Brazilian Portuguese. Cross-cultural validation is a very useful process because it enables comparisons of data between countries, thus not requiring the creation of new tools for study, and it is possible to later relate data with studies that use the same tutorial. Considering that this process has already been used to adapt the tutorial for other languages and proved to be extremely satisfactory.

The analysis of the intraoral photographs was conducted by first determining whether they met the minimum quality criteria for evaluation. Once this assessment was complete, the oral health evaluation the oral health form was filled out based on the researcher's recommendations, and the child was referred for an online dental appointment. This virtual appointment allowed the caregiver and patient to establish clinical and educational empathy with the dentist, enabling them to discuss their symptoms more openly. This, in turn, facilitated a more accurate diagnosis and a more tailored treatment plan. During the appointment, caregivers and patients were encouraged to expose any concerns, and, when necessary, a brief demonstration on proper oral hygiene was provided, always adjusted to the patient's age, needs and conditions. Based on the observations made and data collected, the treatment plan was formulated, and the child was referred to a dentist as appropriate.

4. Discussion

We live in an increasingly technological and digital era. From young age, there is a natural and almost innate capacity to discover the computer world. Technology has been an excellent ally in the fulfilment of various daily tasks, and these are encompassed in a truly diverse range. The importance of digital choices has been put to the test with the current pandemic situation imposed by COVID-19. For thousands of people worldwide, and because of imposed social distancing, the internet became, very often, the only solution to give continuity to work, but also to allow the communication between teachers and students (online teaching). The education of the youngsters was also ensured through the use of technology, and it is imperative to highlight the role of teachers and kindergarten educators who, in conjunction with parents and/or caregivers, managed to maintain the educational focus during the confinement phase. Thus, and with an entirely changed reality, tens of thousands of children have adapted their learning routines. Although distance learning is not a new concept, it is undeniable to underline its importance throughout this period [19–21]. Dozens of digital platforms, computer applications, and educational resources, mostly free and available in several languages, have facilitated and revolutionized student learning on a large scale [22–24].

Parallel to the importance of the use of digital media, it is crucial to analyse the high discrepancy concerning the lack of access by many families. Witt *et al.* [23] says that, if on the one hand, many have the opportunity to enjoy this electronic alternative, on the other, especially the weakest households, do not have access to this medium, and it is a constant challenge. Virtual connection and outreach to the most disadvantaged communities remains a constant topic that incites interest in vast studies [23].

Our main goal was to enhance oral health literacy through a website and teledentistry while using engaging activities and digital tools for impactful education. The integrated ideas, tools and approaches are supported, as previously discussed. Nevertheless, it is important to note that the website represents an initial version, which will be progressively improved over the coming years, as will the pilot-protocol for the remote dental appointment. Given that this project is planned for development over the next 8 years, it provides the opportunity to improve the website and refine the methods for optimizing communication and information flow between patients and dentist. This extended timeline will also facilitate a thorough evaluation of the medium- and long-term impacts of the program on oral health knowledge among children and families in vulnerable communities residing in rural areas of Portugal's inner regions, but also on an international basis because it is applicable to communities worldwide.

The work of Lev Vygotsky has become the foundation of much research and theory in cognitive development over the past several decades, particularly what has become known as sociocultural theory. Vygotsky's theory comprises concepts such as culture-specific tools, private speech, and the zone of proximal development. The studies developed determined that cognitive development is influenced by cultural and social factors, emphasizing the role of social interaction in the

development of mental abilities such as speech and reasoning in children [19]. The current literature also demonstrates the long-term effectiveness of digital and interactive strategies focused on the improvement of oral health literacy among specific risk groups such as lower income families [14].

In the study by Aparecida *et al.* [20] a didactic game was developed for children between the ages of five and seven. The game is entitled "Doctor Treats Teeth" and is composed of three parameters related to oral health: the cause of oral pathologies; prevention methods; and hygienic procedures. All components were put to the test through association, memory and drawing games. After a detailed analysis by three professionals from different fields (dental medicine, education and psychology), some conclusions were drawn. First, the field of dental medicine was ensured by the correct and concise transmission of all the necessary concepts adapted to the age group. Secondly, the educational question demonstrated that the language used, although extensive, was simple and accessible. Finally, the psychologists revealed that the game consolidated many useful and positive themes for the children. Overall, it was considered an educational, dynamic and interventional approach for the entire study group.

Theatre can also be considered a remarkable interpellation of educational actions in the field of oral health. The creation of stories and their personification are considered excellent alternatives for the transmission of the educational message. Playful teaching, more specifically, theatre can energize the way of learning by stimulating participation and interaction both individually and collectively. Overall, the inter- and intrapersonal development of each child is explored extensively. In addition to the primary goal of conveying knowledge about oral health, theatre also allows for the exploration of characteristics that enhance imagination and vocabulary development. All of this contributes favorably to the overall development of the younger learners [13, 21]. Music is considered a universal language. The transmission of knowledge can be ensured through musical expression. In early childhood education, music provides the dissemination of the pedagogical message in a creative and playful way. Although the lyrics of the songs can be adapted to the various languages, the melody remains, and it is precisely this musical rhythm that makes content retention possible. Unconsciously, our mind memorizes and reproduces the melody very easily [13]. The music or musical interpretation reflects some steps that are intertwined with the hygiene routine, such as brushing the teeth, but also emphasizes the importance of prevention, demystifies transient scenarios about going to the dentist, and consequently circumvents some psychological issues such as anxiety and fear of the dentist [13, 22].

Macro-modelling is a method recognized by multiple dental professionals that is commonly used in the office. Macro models are large-scale three-dimensional representations of the oral cavity (like an enlargement). For children, these models are an extremely educational resource because it allows the dentist to explain various concepts inherent to oral health, such as the correct brushing technique. With this interaction, between patient and dentist, the interest in the area and the treatment itself becomes much more simplified. Contact with the macro models stimulates curiosity and communication among children. If the concepts are well grasped, the children's hygiene routine will improve, as will oral health indicators [21–23].

Anxiety, nervousness, and even fear are very recurrent feelings before and during the visit to the dentist [24]. There are many techniques to circumvent these anxious behaviors. One of the most used methods is the "tell-show-do". As the name implies, this technique aims to explain the procedure, demonstrate, and finally "apply" the treatment in an interactive and harmless way. It is very common to enlist the help of parents or siblings to comfort the child. It is also usual, depending on the outcome of the appointment, to give positive reinforcement [25–27].

5. Conclusions

Promoting oral health literacy and understanding primary prevention methods are essential to reduce the negative impact of poor oral health on systemic conditions. The "Ser Criança" program represents a pioneering effort aimed at empowering communities with oral health knowledge and facilitating early detection and treatment of dental issues in children.

The development of a digital platform for preschool and school education has emerged as a promising strategy for advancing oral health promotion and disease prevention, particularly towards vulnerable communities. The program's interventions have shown that engaging activities, such as storytelling, educational games, painting and songs, effectively convey motivational values.

The extended timeline of our project will allow for a thorough evaluation of the program's medium- and long-term effects on oral health and oral health literacy within this community.

6. Limitations

The work developed presented some limitations in terms of initial technical difficulties in the internal structure of the website. However, all the initial difficulties were solved on time and we were able to finish the website on schedule. The access to some families also was a particular difficulty that we found during the workflow development. However, with the help of the "Reencontro— Associação Social, Educacional e Cultural de Vila Nova de Tazem", we were able to reach the most vulnerable families. The future of this project will pass by applying the strategies developed in this work and reach more communities in the central region of Portugal.

ABBREVIATIONS

WHO, World Health Organization; ADA, American Dental Association; FDM-UCP, Faculty of Dental Medicine of the Universidade Católica Portuguesa; TCD, Trinity College Dublin.

AVAILABILITY OF DATA AND MATERIALS

The data and additional information used to generate and support the protocol established are available from the corre-

sponding author upon request.

AUTHOR CONTRIBUTIONS

NV, MJC, ACMM and ASD—responsible for the conceptualization and design of the project. BD, ACMM, PCou, PCor and MO—responsible for the establishment of the protocols and writing of the manuscript. NV, MJC, ACMM, ASD, PCou, PCL and PCor—drafted the main manuscript and made major contributions to the revising of the manuscript. All authors read and approved the final manuscript submitted.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The research was approved by the Health Ethics Committee of the Universidade Católica Portuguesa (Approval number 30). Informed consent for this study was obtained from all subjects and childrens' guardians.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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