

https://dspace.org/

The Feasibility and Acceptability of a Mobile Application for Oral Health Education Among Adults in Rwanda

Emmanuel Nzabonimana; Yolanda Malele-Kolisa; P Hlongwa

https://hdl.handle.net/10539/43106
SCOPUS

Downloaded from a DSpace repository. https://dspace.org/

Clinical, Cosmetic and Investigational Dentistry

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

The Feasibility and Acceptability of a Mobile Application for Oral Health Education Among Adults in Rwanda

Emmanuel Nzabonimana[1,2], Yolanda Malele-Kolisa[2], Phumzile Hlongwa[3]

[1]Department of Preventive and Community Dentistry, School of Dentistry, University of Rwanda, Kigali, Rwanda; [2]Department of Community Dentistry, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa; [3]Department of Orthodontics, School of Dentistry, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa

Correspondence: Emmanuel Nzabonimana, Email enzabonimana@cartafrica.org

Clinical, Cosmetic and Investigational Dentistry downloaded from https://www.dovepress.com/
For personal use only.

Background: Mobile technology health application (mobile Apps) can assist people manage their health and wellness, encourage healthy lifestyles, and provide valuable information whenever necessary.

Objective: This study aimed to evaluate the feasibility and acceptability of a mobile App for oral health education among adults in Rwanda.

Methods: This was a descriptive cross-sectional study. A total of 111 adult participants evaluated the acceptability and feasibility of the BrushDJ mobile App after using it for three months. At the end of this period, an online survey was conducted using a structured questionnaire consisting of questions on demographics, habitual oral health, assessing acceptability, and assessing the feasibility of the mobile App. Descriptive statistics were performed to analyse demographic characteristics, the feasibility and acceptability of the mobile App. Bivariate analysis using the Chi-square test was performed to detect significant associations amongst the variables.

Results: The response rate was 81% (n=90) of 111 participants who took part in the study, with the majority of participants 44.44% (n=40) aged between 18 and 27 years old. Just over half of the participants were male 51.11% (n=46). The mobile App was found to be highly acceptable (87.78%; n=79) and considered highly feasible (84.44%; n=76) by most of the participants. The differences in acceptability and feasibility across education levels were statistically significant (p=0.000 for acceptability and p=0.038 for feasibility).

Conclusion: The study revealed that the mobile App for oral health education (BrushDJ) was highly acceptable and feasible among the participants. The mobile App had a user-friendly interface and comprehensive guidance on oral hygiene procedures facilitated by its diverse and well-integrated functions.

Keywords: mobile technology application, oral health education, adults, feasibility, acceptability, BrushDJ

Background

Oral health is an essential part of overall well-being. However, many adults lack adequate knowledge and practice for good oral hygiene. Patients have traditionally accessed advice about their oral health from the dental team, but this has limitations such as inequalities and disparities in oral health services, especially to remote and underservice populations as well as lack of affordability to dental care. Mobile health applications that utilise mobile phones and other wireless technologies offer a promising alternative for delivering oral health education in a convenient, accessible, and engaging manner.[1] Mobile Apps have been shown to support education, business enterprise and service delivery. In health using information technology, consultations and self-care can be performed, to promote patients' autonomy and independence.[2]

Mobile Apps for oral health education have been found to promote regular tooth brushing, thus decreasing plaque and gingival index[3] as well as improving and enhancing oral hygiene.[4] Mobile phones are among the tools through which messages can be cascaded, including other electronic media such as emails as well as printed documents; news apers and pamphlets. Patients and healthcare providers can now stay in touch from any location to continue their follow-up, ask questions, collect information, inquire about or provide test results, schedule appointments, send reminders, and renew

Received: 30 July 2024
Accepted: 7 September 2024
Published: 21 September 2024

© 2024 Nzabonimana et al. This work is published and licensed by Dove Medical Press Limited. The full terms of this license are available at https://www.dovepress.com/terms.php and incorporate the Creative Commons Attribution – Non Commercial (unported, v3.0) License (http://creativecommons.org/licenses/by-nc/3.0/). By accessing the work you hereby accept the Terms. Non-commercial uses of the work are permitted without any further permission from Dove Medical Press Limited, provided the work is properly attributed. For permission for commercial use of this work, please see paragraphs 4.2 and 5 of our Terms (https://www.dovepress.com/terms.php).

prescriptions.[5] However, certain demographic factors, such as older age, living alone, having less education, earning a lower salary, and residing in a rural area were found to be linked to low utilisation of eHealth services.[6]

The BrushDJ oral health App is designed to motivate users to brush their teeth effectively to be used for both children and adults. The App provides basic oral health education through videos, text, and pictures tailored for various age groups. Its primary focus is to enhance users' oral hygiene by demonstrating appropriate techniques.[7] The BrushDJ oral health App has been reported to motivate the participants to brush.[8] In a study conducted in Brazil, people who received oral health education from a mobile oral health App have reported to retain the acquired knowledge better than those who received verbal health guidance alone.[9] Mobile oral health Apps can offer oral health education in a fun way, which attracts children and youngsters. While playing, they can learn useful methods to promote their oral health.[10] Therefore, all levels of the population can benefit from oral health education through smartphones, even in remote rural areas, provided there is internet coverage and availability of data to access the mobile App. Parents and caregivers can access information on how to maintain good oral hygiene for their children, thus helping to reduce early childhood caries.[11] Mobile Apps for oral health education have been developed elsewhere, and some studies have shown that they can effectively improve oral health knowledge and practices.[12] Based on the literature findings above, mobile technology has the potential to help the community to maintain their oral health. However, there is scarcity of information regarding mobile oral health App usage in Africa for oral health promotion.

The Government of Rwanda has started to invest more in information communication technology(ICT) to speed up the delivery of online health services.[13] Mobile phone penetration in Rwanda is high, with over 80% of the population owning a mobile phone.[14] Mobile health interventions have been successfully implemented in Rwanda for other health issues, such as maternal and child health.[15,16] Rwanda has adopted online health consultations, allowing patients to receive expert advice from health professionals through phone calls. In addition, Rwanda has started a project called Connect Rwanda, which focuses on bringing one smartphone per family; many citizens have received their smartphones to access online services easily.[17] Despite these encouraging strides, there are still gaps in the delivery of online oral health education and information to the communities. The widespread use of smartphones presents an opportune moment to improve oral health education and promotion interventions.

The aim of the study is to assess the acceptability and feasibility of using the mobile oral health Apps, BrushDJ, to enhance patients' oral self-care at home in Nyarugenge District of Rwanda. The study will contribute new knowledge on the feasibility and acceptability of a mobile oral health App designed to improve oral health. The null hypothesis (HO) is that the mobile application was not acceptable and feasible to use for oral health education. The alternate (HA) is that the mobile application was feasible and acceptable for oral health education. This study formed part of a larger doctoral study titled "Oral Health in Nyarugenge District of Rwanda: The Role of Mobile Applications in Oral Health Education".

Methods

Study Design

This study involved a cross-sectional survey designed to evaluate feasibility and acceptability of mobile App for oral health education. This was done through a survey directed to individuals attending public health facilities in Nyarugenge District, Rwanda.

Setting

Rwanda is one of Africa's 56 countries. It is divided into four provinces and Kigali City, which serves as the capital. The four provinces are subdivided into 27 districts, while Kigali City itself comprises three districts: Gasabo, Kicukiro, and Nyarugenge, according to government data.[18,19] The study took place in July 2022 in the Nyarugenge District of Kigali City, Rwanda.

Study Population and Sampling Strategy

The study participants were recruited from adult patients who are 18 years old and above who met inclusion criteria such as owning a smartphone and being able to understand English or French. These participants have been recruited in our previous study which assessed oral health knowledge, attitudes, and practices (KAP) across three health centres in Rwanda. The KAP study recruited 426 participants, and the sample included only individuals who were 18 years old or older and lived in Nyarugenge District, Rwanda.[20] During sampling for the current study, some participants out of 426 were excluded (n=315)

because either they did not own a smartphone, they did not sign the informed consent, or they were not able to understand English or French. Eventually, 111 participants constituted the total sample size of the current study.

Inclusion Criteria

The included participants were those who agreed to receive the mobile app, signed consent, those who could understand English or French, and owned a smartphone capable to receiving the oral health education App.

Exclusion Criteria

The participants who did not sign the consent form, patients under 18 years, and those having a learning disability.

Measurements

We evaluated the feasibility and acceptability of the BrushDJ mobile App using a structured questionnaire. The questionnaire was adapted from reported studies.[21,22] The adaptations were done to make the questions applicable for users' perceptions of the App's impact on their homecare oral health practices.

Demographic details were collected, with respondents being asked to provide information on their age, gender, and education level as well as their oral health habits. Additional details regarding App usage were also assessed. This included their perceptions, experiences and likeability of the App and its usefulness during the study period. A standard 5-point Likert scale was employed to measure these items, with responses ranging from Strongly disagree (+1) to Strongly agree (+5). The scoring was done on all questions and was analysed by combining all questions to obtain a total, which was converted to a percentage. An arbitrary cut-off points were set, where a score less than 70% was classified as "Less acceptable" /"Less feasible", and a score of 70% and above indicated "Highly acceptable"/ "Highly feasible".[23]

Ten items concerning the App's likability and engagement (its acceptability) were evaluated using the Likert scale. A composite variable was created by summing the scores of these ten items. The reverse scoring was done on five questions, and then acceptability was analysed by combining all questions to obtain a total score of 50 (100%). A score less than 70% was classified as "Less acceptable", and a score of 70% and above indicated "Highly acceptable".

Feasibility was assessed using a standard 5-point Likert scale, with response options ranging from Strongly disagree (+1) to Strongly agree (+5). The analysis was done by combining all questions to calculate a total score of 65 (100%). A score less than 70% was considered "Less feasible", while a score above 70% was considered "Highly feasible".

The items were pilot-tested with ten individuals. This involved having participants complete the entire survey and then discussing each item with them to ensure that the items were clearly written, understandable, and interpreted as intended. The general Cronbach alpha for the entire sample on acceptability variables was 0.712 and 0.961 for feasibility.

Procedure

A total of 111 adult participants received the BrushDJ mobile oral health App and were asked to use the app at home for a period of three months. The BrushDJ oral health App is designed to motivate users to brush their teeth effectively. The App provides basic oral health education through videos, text, and pictures tailored for various age groups. Its primary focus is to enhance users' oral hygiene by demonstrating appropriate techniques. Once BrushDJ is downloaded, it can be used offline without the need for a regular internet connection. However, during installation, participants were given an internet package for three months, even though they could access the App regularly without needing internet. At the end of the three months of using the App, an online structured questionnaire was used to collect data. The group who used WhatsApp received the questionnaire on their smartphone and filled in data in Google form. For those who were not available for the WhatsApp online follow-up data collection, a telephonic interview was conducted.

Data Analysis

Analysis was conducted using Stata software version 16 (StataCorp, College Station, TX). Descriptive statistics, such as frequency and percentage distributions, were employed to assess the feasibility and acceptability of the mobile oral health App. Bivariate analysis using the Chi-square test was performed to measure the level of association between demographic characteristics and the mobile oral health App acceptability and feasibility. The significance level was established at 0.05, with a 95% confidence interval.

Results

Demographic Characteristics of the Participants

The response rate was 81%, with 90 out of 111 participants taking part in the study. The age category 18–27 years was predominant, and over half of the participants were male 51.11% (n=46). Most of the participants 68.89% (n=62) had completed high school level of education (Table 1).

Table 1 Demographic Characteristics of the Participants

Demographics (n=90)	Frequency	Percentage
Age		
18–27 years	40	44.44
28–37 years	28	31.11
38–47 years	13	14.44
48–57 years	7	7.78
58 and above	2	2.22
Gender		
Male	46	51.11
Female	44	48.89
Level of education		
Less than high school	5	5.56
High school	62	68.89
College or university up to bachelor	22	24.44
College or university up to master or PhD	1	1.11

Frequency and Percentage Distribution of Oral Hygiene Behaviour

The majority of the participants brush their teeth twice a day, in the morning and at night, before going to bed (88.89%, n=80). Just over a third of participants use dental floss every day (36.67%, n=33), and most of them thought that regular oral cleaning, brushing teeth, and interdental cleaning are important (95.51%, n=85) (Table 2).

Table 2 Frequency and Percentage Distribution of Oral Hygiene Behaviour

Habitual Variables on Oral Hygiene	Yes n (%)	No n (%)
I brush my teeth when I wake up and before going to bed every day.	80 (88.89)	10 (11.11)
I clean my teeth (brush or rinse with water) after meals.	79 (87.78)	11 (12.22)
I use floss to clean my teeth every day.	33 (36.67)	57 (63.33)
I use an interdental brush to clean my teeth every day.	29 (32.22)	61 (67.78)
I think regular oral cleaning (brushing and interdental cleaning) is important.	85 (95.51)	4 (4.49)
I think I have good oral health.	71 (78.89)	19 (21.11)

Oral Health App Acceptability Among the Participants

Over half of the participants strongly agreed that they liked to use the App frequently, found the App not complex, think that they would not need the support of a technical person to be able to use the App and imagine that most people would learn to use the App very quickly (Table 3).

Table 3 Distribution of Oral Health App Acceptability Among the Participants

Oral Health App Acceptability Assessment (Usability)	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
I think that I would like to use this App frequently.	1 (1.11)	5 (5.56)	1 (1.11)	26 (28.89)	57 (63.33)
I found the App unnecessarily complex.	45 (50)	23 (25.56)	3 (3.33)	11 (12.22)	8 (8.89)
I thought the App was easy to use.	7 (7.78)	6 (6.67)	6 (6.67)	32 (35.56)	39 (43.33)
I think that I would need the support of a technical person to be able to use this App.	46 (51.11)	25 (27.78)	4 (4.44)	7 (7.78)	8 (8.89)
I found the various functions in this App were well integrated.	2 (2.22)	0	9 (10)	38 (42.22)	41 (45.56)
I thought there was too much inconsistency in this App.	36 (40)	35 (38.89)	8 (8.89)	8 (8.89)	3 (3.33)
I imagine that most people would learn to use this App very quickly.	3 (3.33)	7 (7.78)	4 (4.44)	30 (33.33)	46 (51.11)
I found the App very cumbersome to use.	41 (45.56)	33 (36.67)	3 (3.33)	8 (8.89)	5 (5.56)
I felt very confident using the App.	6 (6.67)	2 (2.22)	7 (7.78)	34 (37.78)	41 (45.56)
I needed to learn a lot of things before I could get going with this App.	34 (37.78)	29 (32.22)	4 (4.44)	13 (14.44)	10 (11.11)

Oral Health Mobile App Feasibility Among the Participants

Most of the participants strongly agree that they like the oral care video in the App, which helps them learn more about oral cleaning, and most of the participants confirm that the App is very useful (Table 4).

Table 4 Frequency and Percentage Distribution on the Feasibility of Oral Health App

Oral Health App Feasibility	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
I like the oral care video, which teaches me more about oral cleaning.	0	0	2 (2.22)	34 (37.78)	54 (60)
I like the App pointing out the focal areas in my mouth, which requires extra care.	0	0	5 (5.56)	47 (52.22)	38 (42.22)
I like the App showing the focal areas that require extra cleaning effort in the dental chart.	0	0	7 (7.78)	47 (52.22)	36 (40)
I like the App reminding me to use dental floss and an interdental brush to clean my teeth.	5 (5.56)	1 (1.11)	18 (20)	33 (36.67)	33 (36.67)
I like the App user manual, it makes the App easy to use.	9 (10)	4 (4.44)	23 (25.56)	21 (23.33)	33 (36.67)
I like the App rewarding with applause when achieving a toothbrushing session.	18 (20)	3 (3.33)	9 (10)	33 (36.67)	27 (30)

(*Continued*)

Table 4 (Continued).

Oral Health App Feasibility	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
I like that the App provides important information about oral health.	3 (3.33)	1 (1.11)	6 (6.67)	28 (31.11)	52 (57.78)
I like the App allowing me to set reminders for tooth brushing.	11 (12.22)	2 (2.22)	6 (6.67)	36 (40)	35 (38.89)
I like the App reminding me to brush my teeth according to the time that is set.	11 (12.22)	2 (2.22)	6 (6.67)	31 (34.44)	40 (44.4)
I like the App reminding me to clean my teeth at least twice a day.	10 (11.11)	2 (2.22)	4 (4.44)	33 (36.67)	41 (45.56)
I like the App showing the progress of tooth brushing with an arrow, which directs me to brush my teeth in the same order.	0	0	6 (6.67)	33 (36.67)	51 (56.67)
I like the background music played in the App during the toothbrushing session.	13 (14.44)	5 (5.56)	6 (6.67)	38 (42.22)	28 (31.11)
The App was useful.	1 (1.11)	1 (1.11)	2 (2.22)	23 (25.56)	63 (70)

The Association Between Mobile App Acceptability, Feasibility and Demographic Characteristics

Table 5 shows the association between the App acceptability, feasibility, age group, gender and level of education. In terms of acceptability, the app was found to be highly acceptable by the majority across all age groups, though there were variations. Participants aged 18–27 years showed the highest rate of acceptability (92.5%), whereas those aged 48–57 years had the lowest (71.43%). The differences in acceptability among age groups were not statistically significant (p=0.415). However, the app's feasibility varied more notably by age. Younger participants (18–27 years) reported higher feasibility (82.5%) compared to older participants (48–57 years), who found it less feasible (42.86%), with a statistically significant difference (p=0.013).

Gender did not significantly impact acceptability or feasibility, with both male and female participants showing similar levels of high acceptability and feasibility (p=0.126 for acceptability and p=0.623 for feasibility). Education level significantly influenced both acceptability and feasibility. Participants with less than a high school education found the app less acceptable (20%) and less feasible (40%), compared to those with higher education levels, where acceptability and feasibility rates were notably higher. High school graduates showed an 90.32% acceptance rate, and those with college or university education up to a bachelor's degree had a 95.45% acceptance rate. The differences in acceptability and feasibility across education levels were statistically significant (p=0.000 for acceptability and p=0.038 for feasibility).

Table 5 Oral Health App Overall Acceptability and Feasibility Among the Participants by Demographic Characteristics

	Less Acceptable n (%)	Highly Acceptable n (%)	P value	Less Feasible n (%)	Highly Feasible n (%)	P value
Age group						
18–27 years	3 (7.5)	37 (92.5)	0.415	7 (17.5)	33 (82.5)	0.013
28–37 years	5 (17.86)	23 (82.14)		1 (3.57)	27 (96.43)	
38–47 years	1(7.69)	12 (92.31)		2 (15.38)	11 (84.62)	
48–57 years	2 (28.57)	5 (71.43)		4 (57.14)	3 (42.86)	
58 and above	0	2 (100)		0	2 (100)	
Total	11 (12.22)	79 (87.78)		14 (15.56)	76 (84.44)	

(*Continued*)

Table 5 (Continued).

	Less Acceptable n (%)	Highly Acceptable n (%)	P value	Less Feasible n (%)	Highly Feasible n (%)	P value
Gender						
Male	8 (17.39)	38 (82.61)	0.126	8 (17.39)	38 (82.61)	0.623
Female	3 (6.82)	41 (93.18)		6 (13.64)	38 (86.36)	
Total	11 (12.22)	79 (87.78)		14 (15.56)	76 (84.44)	
Level of education						
Less than high school	4 (80)	1 (20)	0.000	3 (60)	2 (40)	0.038
High school	6 (9.68)	5 (90.32)		9 (14.52)	53 (85.48)	
College or university up to bachelor	1 (4.55)	21 (95.45)		2 (9.09)	20 (90.91)	
College or university up to master or PhD	0	1 (100)		0	1(100)	
Total	11 (12.22%	79 (87.78)		14 (15.56)	76 (84.44)	

Discussion

This study was the first to evaluate the feasibility and acceptability of a mobile App for oral health education among the adult population in Rwanda. The results of our study indicate strong support for the alternate hypothesis (H_a), which posits that the mobile application was both feasible and acceptable for oral health education among adults in Rwanda. This study showed that the acceptability and feasibility of the mobile app were higher among younger participants and were also influenced by education level, with those having less than a high school education reporting lower acceptability and feasibility compared to those with higher education. The predominating age group in our study finding was contrary to Underwood et al,[8] who reported higher participation of 7–12 years age group in their study. The age group differences may be attributed to the sample selection of our study being limited to adults who were 18 years and above. Numerous mobile applications focused on preventing tooth decay primarily emphasize the promotion of effective oral hygiene habits and are tailored towards the young adult population.[24] The younger age group in our study were the 18–27 years old, and different educational attainment measured by levels of education did influence the usage patterns of mobile App. Different results were reported in India, where individuals' education level was not related to the usage of mobile applications for assistance with oral health care.[11] Hedge and colleagues have found that low literacy rates negatively affected the ability to read the information channelled through mobile phones.[5] The study conducted in Kenya revealed findings similar that low literacy rates negatively affected the ability to read the information channelled through mobile phones.[25] Future larger studies are warranted to study how these exposure factors may influence the use of mobile oral health App in this setting, more so that age and gender have been evidence to influence individuals' information processing.[26] The participants in the present study reported good oral hygiene behaviours and positive attitudes, although there is room for improvement on some behaviours, such as use of interdental hygiene aides.

The participants in our study demonstrated a high level of acceptability of the mobile oral health App, which is slightly higher than the 73.7% reported in Boston and 77% reported in Malaysia.[27,28] High acceptability of the mobile App implies intention to use the App as reported by Venkatesh et al[26] thus, our finding signals hope for the App usage. Low acceptability of the mobile App can indicate poor popularity, and has been reported that it can affect the utilization.[29] The high acceptability of the mobile App is commendable as it has resulted in frequent home use of the App in other settings[30] and, therefore, presents hope in oral health education and home care procedures to eliminate oral disease.

The strong agreement with frequent App usage aligns with research in the field of user acceptance of technology, which emphasizes the importance of perceived usefulness as a key determinant of adoption. Studies based on the Technology Acceptance Model have consistently found that users are more likely to adopt a technology if they perceive it as useful.[31] The high proportion of participants expressing a desire for frequent App usage in our study suggests that they perceive the App as valuable and relevant to their needs, which is consistent with Technology Acceptance Model. The finding that participants did not find the App complex and believed they would not need technical support to use it echoes the importance of perceived ease of use in technology adoption. According to Technology Acceptance Model, perceived ease of use influences users' attitudes towards and intentions to use a technology.[31] Research has shown that users are more likely to adopt technologies that are perceived as easy to use.[32] Therefore, the absence of perceived complexity and the belief that technical support would not be necessary by the participants in our study suggests that the App is intuitive and user-friendly, which are critical factors in encouraging adoption.

Participants in our study believed that most people would quickly become adept at using the App, indicating positive perceptions of the App's learnability. This aligns with research emphasizing the importance of perceived ease of learning in technology acceptance.[32] When users believe that a technology is easy to learn, they are more likely to adopt it and perceive it positively. In our study, it was observed that participants expressed a high level of confidence in utilising the mobile oral health App. The participants reported that the various features within the application were seamlessly integrated and user-friendly. Our observations align with the previously reported study, which indicated that individuals utilising oral health applications on their mobile devices exhibit great enthusiasm in endorsing and discussing their experiences.[33] This enthusiasm further extends to encouraging others to utilise the application, primarily due to its user-friendly interface.

Almost 85% of the participants in our study found the mobile App for oral health education to be feasible and usable. These results are commendable because it means the participants were able to navigate the App, understand the contextual meaning of the text and respond to the contents in the App. Feasibility of a programme or project is one of the initial steps necessary before a roll-out of a programme. According to Nicholas and Chinedum in 2017, feasibility determination is important to determine if a proposed programme or, project, service or business will be successful.[34] The high feasibility findings in our study reflect the positive reception of the mobile application among participants, indicating its potential to deliver oral health education effectively. Similar results were observed in a study involving the elderly, where mobile-based video education programs were found to be beneficial and effective. These programs improved patients' knowledge, satisfaction with education, and implementation of the educational content, ultimately enhancing their oral health.[35]

The overwhelming agreement regarding the oral care videos by the participants in our study suggests that the participants found them informative and engaging. This aligns with previous research highlighting the effectiveness of multimedia interventions, such as videos, in promoting health education and behaviour change.[36] The videos likely served as valuable educational tools, providing visual demonstrations of proper oral hygiene practices and enhancing participants' understanding of oral care techniques. Participants in our study reported that they liked the reminders within the App, which prompt them to brush their teeth twice a day and perform interdental cleaning using dental floss or an interdental brush. The App reportedly conveyed valuable oral health information, and this creates hope that it may be a great tool for oral health awareness. Mobile Apps for oral health education are useful for adults, adolescents, and children because it has been shown that the information provided through smartphones by parents positively impacts children's oral health awareness.[11,37] Feasibility determination is needed for the growth of the programme to advocate for its continuance.[34] Since mobile Apps are useful, they should be promoted, and their messages should be designed according to the end users. In addition, the content should be theoretically grounded and empirically validated.[38]

The limitations of our study include its cross-sectional design and the fact that it focused exclusively on a specific group of participants in Rwanda. As a result, the findings may not reflect the broader views of the entire population of Rwanda regarding mobile Apps for oral health education. Therefore, it's essential to consider that some people may be receptive to using mobile Applications, whereas others might opt to maintain with the conventional clinical care offered in dental clinics. Moreover, the sample size and location do not represent the

entire city, which limits the generalizability of the findings. Additionally, the feasibility data were exclusively obtained through the survey questionnaire given to participants who used the BrushDJ App. Future extensive studies should include a more direct evaluation of the preferences of different oral health practitioners regarding the App's features alongside other oral health outcomes experienced by patients receiving the interventions to assess the effectiveness of the App.

Conclusion

Our study found that the acceptability and feasibility of mobile App for oral health education (BrushDJ) was high among the study participants. The mobile App for oral health received positive reviews from the user-friendliness nature. Our study findings have highlighted that the mobile App for oral health (BrushDJ) is a useful tool that might contribute to behaviour change and the adoption of adequate oral health measures. Population groups of all ages and backgrounds, even those in remote areas where the accessibility to dental services is challenging, can use the mobile App for oral health education.

Data Sharing Statement

The data presented in this study are available upon reasonable request from the corresponding author.

Ethical Approval and Consent to Participate

The Human Research Ethics Committee (HREC) (Medical) at the University of the Witwatersrand, Johannesburg, granted ethics approval (M220213) for the research. Approval was also secured from the Rwanda IRB ethical committee (No234/CMHS IRB/2022) and the National Health Research Committee (No NHRC/2022/PROT/26). All participants provided written informed consent. This study complies with the Declaration of Helsinki.

Consent for Publication

This manuscript contains no individual person's data in any form, and consent for publication is not applicable in this section.

Acknowledgment

We appreciate the biostatisticians at the University of the Witwatersrand and the CARTA facilitators' support during the initial data analysis. I acknowledge the community participants who agreed to take part in this study. Additionally, I greatly appreciate the data collectors and dental professionals working at the health facilities for their support during data collection. The included 111 participants for this study was recruited from our previous study which assessed oral health knowledge, attitudes, and practices (KAP) across three health centres in Rwanda.[20]

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This research was supported by the Consortium for Advanced Research Training in Africa (CARTA). CARTA is jointly led by the African Population and Health Research Center and the University of the Witwatersrand and funded by the Carnegie Corporation of New York (Grant No. G-19-57145), Sida (Grant No: 54100113), Uppsala Monitoring Center, Norwegian Agency for Development Cooperation (Norad), and by the Wellcome Trust [reference no. 107768/Z/15/Z] and the UK Foreign, Commonwealth & Development Office, with support from the Developing Excellence in Leadership, Training and Science in Africa (DELTAS Africa) programme. The statements made and views expressed are solely the responsibility of the Fellow.

Disclosure

All authors declared no competing interests in this work.

References

1. Ryu S. Book review: mhealth: new horizons for health through mobile technologies: based on the findings of the second global survey on ehealth. *Healthc Inform Res*. 2012;18(3):231–233. doi:10.4258/hir.2012.18.3.231
2. Abutaleb T. Impact of mobile phone applications in enhancing oral hygiene practices. *Glob J Dent Oral Hyg Comment*. 2022. doi:10.15651/2449-1918.22.9.009
3. Alkadhi OH, Zahid MN, Almanea RS, Althaqeb HK, Alharbi TH, Ajwa NM. The effect of using mobile applications for improving oral hygiene in patients with orthodontic fixed appliances: a randomised controlled trial. *J Orthod*. 2017;44(3):157–163. doi:10.1080/14653125.2017.1346746
4. Scheerman JFM, van Meijel B, van Empelen P, et al. The effect of using a mobile application ("whiteteeth") on improving oral hygiene: a randomized controlled trial. *Int J Dent Hyg*. 2020;18(1):73–83. doi:10.1111/idh.12415
5. Hegde A, Gopikrishna V, Kulkarni S, Bhaskar N, Sourabha K, Jacob J. Recharging smiles: strategies for using mobile phones in dental public health. *J Mob Technol Med*. 2018;7:60–65. doi:10.7309/jmtm.7.2.9
6. Reiners F, Sturm J, Bouw LJW, Wouters EJM. Sociodemographic factors influencing the use of ehealth in people with chronic diseases. *Int J Environ Res Public Health*. 2019;16(4):645. doi:10.3390/ijerph16040645
7. Underwood B. Brush dj mobile app; 2023. Available from: https://apps.apple.com/us/app/brush-dj/id475739913;https://play.google.com/store/apps/details?id=uk.co.appware.brushdj&hl=en&pli=1. Accessed November 21, 2023.
8. Underwood B, Birdsall J, Kay E. The use of a mobile app to motivate evidence-based oral hygiene behaviour. *Br Dent J*. 2015;219(4):E2. doi:10.1038/sj.bdj.2015.660
9. Marchetti G, Fraiz FC, Nascimento WMD, Soares GMS, Assuncao L. Improving adolescents' periodontal health: evaluation of a mobile oral health app associated with conventional educational methods: a cluster randomized trial. *Int J Paediatr Dent*. 2018;28(4):410–419. doi:10.1111/ipd.12371
10. Rasmus K, Toratti A, Karki S, Pesonen P, Laitala ML, Anttonen V. Acceptability of a mobile application in children's oral health promotion-A pilot study. *Int J Environ Res Public Health*. 2021;18(6):3256. doi:10.3390/ijerph18063256
11. Ajay K, Azevedo LB, Haste A, et al. App-based oral health promotion interventions on modifiable risk factors associated with early childhood caries: a systematic review. *Front Oral Health*. 2023;4:1125070. doi:10.3389/froh.2023.1125070
12. Lee KH, Choi YY, Jung ES. Effectiveness of an oral health education programme using a mobile application for older adults: a randomised clinical trial. *Gerodontology*. 2023;40(1):47–55. doi:10.1111/ger.12616
13. Kimanuka O. The role of icts in Rwanda's development. In: *Sub-Saharan Africa's Development Challenges: A Case Study of Rwanda's Post-Genocide Experience*. Palgrave Macmillan US; 2009:87–93.
14. WorldBank. Mobile cellular subscriptions (per 100 people) – Rwanda; 2023. Available from: https://data.worldbank.org/indicator/IT.CEL.SETS.P2?locations=RW. Accessed April 18, 2023.
15. Musabyimana A, Ruton H, Gaju E, et al. Assessing the perspectives of users and beneficiaries of a community health worker mhealth tracking system for mothers and children in Rwanda. *PLoS One*. 2018;13(6):e0198725. doi:10.1371/journal.pone.0198725
16. Ruton H, Musabyimana A, Gaju E, et al. The impact of an mhealth monitoring system on health care utilization by mothers and children: an evaluation using routine health information in Rwanda. *Health Policy Plan*. 2018;33(8):920–927. doi:10.1093/heapol/czy066
17. MINICT. Connectrwanda smartphone distribution continues, targeting one smartphone to one household in every village June 6, 2022. Available from: https://www.minict.gov.rw/news-detail/connectrwanda-smartphone-distribution-continues-targeting-one-smartphone-to-one-household-in-every-village. Accessed June 6, 2022.
18. NISR. District profile nyarugenge district. Available from: http://www.statistics.gov.rw/publication/phc-2012-district-profile-nyarugenge?page=1. Accessed July 04, 2024.
19. Rwanda-Goverment. Country of Rwanda (provinces and districts). Available from: https://www.gov.rw/government/administrative-structure. Accessed July 04, 2024.
20. Nzabonimana E, Malele-Kolisa Y, Hlongwa. P. Oral health knowledge, attitude and oral hygiene practices among adults in Rwanda. *PAMJ Clinical Med*. 2024;14:4. doi:10.11604/pamj-cm.2024.14.4.42461
21. Chang WJ, Lo SY, Kuo CL, Wang YL, Hsiao HC. Development of an intervention tool for precision oral self-care: personalized and evidence-based practice for patients with periodontal disease. *PLoS One*. 2019;14(11):e0225453. doi:10.1371/journal.pone.0225453
22. Brooke J. Sus: a quick and dirty usability scale. *Usability Eval Ind*. 1995;1995:189.
23. Bangor A, Kortum PT, Miller JT. An empirical evaluation of the system usability scale. *Int J Hum-Comput Int*. 2008;24(6):574–594. doi:10.1080/10447310802205776
24. Chen R, Santo K, Wong G, et al. Mobile apps for dental caries prevention: systematic search and quality evaluation. *JMIR Mhealth Uhealth*. 2021;9(1):e19958. doi:10.2196/19958
25. Dev R, Woods NF, Unger JA, et al. Acceptability, feasibility and utility of a mobile health family planning decision aid for postpartum women in Kenya. *Reprod Health*. 2019;16(1):97. doi:10.1186/s12978-019-0767-9
26. Venkatesh V, Thong J, Xu X. Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*. 2012;36:157–178. doi:10.2307/41410412
27. Poort H, Ryan A, MacDougall K, et al. Feasibility and acceptability of a mobile phone app intervention for coping with cancer as a young adult: pilot trial and thematic analysis. *J Med Internet Res*. 2021;23(6):e25069. doi:10.2196/25069
28. Akmal Muhamat N, Hasan R, Saddki N, Mohd Arshad MR, Ahmad M. Development and usability testing of mobile application on diet and oral health. *PLoS One*. 2021;16(9):e0257035. doi:10.1371/journal.pone.0257035
29. Vaid NR, Hansa I, Bichu Y. Smartphone applications used in orthodontics: a scoping review of scholarly literature. *J World Fed Orthod*. 2020;9(3S):S67–S73. doi:10.1016/j.ejwf.2020.08.007
30. Zsegraics DG. Teledentistry with the dental office's mobile application. *J Dent*. 2022;121:104027. doi:10.1016/j.jdent.2022.104027

31. Davis F, Davis F. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*. 1989;13:319. doi:10.2307/249008
32. Venkatesh V, Morris M, Davis G, Davis F. User acceptance of information technology: toward a unified view. *MIS Quarterly*. 2003;27:425–478. doi:10.2307/30036540
33. Nolen SL, Giblin-Scanlon LJ, Boyd LD, Rainchuso L. Development and testing of a smartphone application prototype for oral health promotion. *J Dent Hyg*. 2018;92(2):6–14.
34. Nicholas AI, Chinedum AH. The role of feasibility studies on project and organizational performance. *Int J Res Soc Sci*. 2017;7(5):1.
35. Ki JY, Jo SR, Cho KS, Park JE, Cho JW, Jang JH. Effect of oral health education using a mobile app (ohema) on the oral health and swallowing-related quality of life in community-based integrated care of the elderly: a randomized clinical trial. *Int J Environ Res Public Health*. 2021;18(21):11679. doi:10.3390/ijerph182111679
36. Kuwabara A, Su S, Krauss J. Utilizing digital health technologies for patient education in lifestyle medicine. *Am J Lifestyle Med*. 2020;14 (2):137–142. doi:10.1177/1559827619892547
37. Shirmohammadi M, Razeghi S, Shamshiri AR, Mohebbi SZ. Impact of smartphone application usage by mothers in improving oral health and its determinants in early childhood: a randomised controlled trial in a paediatric dental setting. *Eur Arch Paediatr Dent*. 2022;23(4):629–639. doi:10.1007/s40368-022-00731-9
38. Tiffany B, Blasi P, Catz SL, McClure JB. Mobile apps for oral health promotion: content review and heuristic usability analysis. *JMIR Mhealth Uhealth*. 2018;6(9):e11432. doi:10.2196/11432

Clinical, Cosmetic and Investigational Dentistry Dovepress

Publish your work in this journal

Clinical, Cosmetic and Investigational Dentistry is an international, peer-reviewed, open access, online journal focusing on the latest clinical and experimental research in dentistry with specific emphasis on cosmetic interventions. Innovative developments in dental materials, techniques and devices that improve outcomes and patient satisfaction and preference will be highlighted. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: https://www.dovepress.com/clinical-cosmetic-and-investigational-dentistry-journal