CarieCheck: A Novel mHealth Tool for Caries Risk Monitoring – Usability and Quality Assessment in a Pilot Study

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Article

CarieCheck: A Novel mHealth Tool for Caries Risk Monitoring – Usability and Quality Assessment in a Pilot Study

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Abstract

Background/Objectives: Mobile health (mHealth) technologies have emerged as promising tools to promote preventive oral care and patient self-management. CarieCheck is a Portuguese mobile application designed to in-crease oral health literacy, enable caries risk self-assessment, and encourage behavioral change. However, few oral-health apps have been scientifically validated using standardized instruments. This prospective, observational pilot study evaluated the CarieCheck app using the uMARS-PT version of the Mobile App Rating Scale (MARS). **Methods**: Thirty participants from the academic community of Egas Moniz School of Health and Science (students, staff, and clinicians) tested the app for 30 days and subsequently completed the MARS questionnaire via Qualtrics XM. Descriptive statistics were performed to determine mean scores for each domain: Engagement, Functionality, Aesthetics, Information Quality, Subjective Quality, and Perceived Impact. **Results**: The overall MARS mean score was 4.22, corresponding to excellent perceived quality. The highest ratings were observed for Functionality (4.51), Aesthetics (4.45), and Information Quality (4.22), indicating a clear, intuitive, and visually appealing interface supported by scientifically grounded content. Engagement (3.71) and Subjective Quality (3.05) showed moderate results, typical of early stage mHealth apps still in optimization. The Perceived Impact (3.85) domain revealed that CarieCheck increased users' awareness, knowledge, and motivation to improve oral-health behaviors. **Conclusions**: The CarieCheck app demonstrated high usability, visual appeal, and content quality, confirming the study hypothesis. These findings support its potential as a digital health tool for caries-risk monitoring and preventive education. Larger and longer-term studies are warranted to validate its behavioral impact and integration into clinical and community settings.

Keywords: mHealth; mobile applications; caries risk assessment; preventive dentistry; app usability; digital health; MARS; oral health promotion

1. Introduction

Dental caries remains one of the most prevalent diseases worldwide, affecting approximately 2.3 billion people with permanent teeth [1]. This condition arises from an imbalance in the oral biofilm ecosystem, largely triggered by the frequent consumption of fermentable carbohydrates [2,3]. Fluctuations in pH levels lead to alternating phases of demineralization and remineralization; however, when demineralization predominates, irreversible damage to the tooth structure occurs. If left untreated, the lesion may progress to the dentine–pulp interface, resulting in pain and discomfort. The occurrence of dental caries is strongly associated with a reduced quality of life and poses a significant economic burden on individuals and healthcare systems [4,5]. Without proper

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management, affected individuals may experience difficulties in chewing, tooth loss, pain, delayed speech development in children, and increased school and work absenteeism [6,7].

Given that the progression of dental caries depends on bacterial activity within dental plaque, one of the most effective preventive strategies involves the daily mechanical removal of plaque through toothbrushing, flossing, and mouth rinsing. The accumulation of dental plaque promotes the onset of both caries and periodontal diseases, leading to inflammation of soft and hard oral tissues and accelerating alveolar bone loss, which can culminate in premature tooth loss [8]. Beyond clinical management, the awareness and engagement of individuals in their own oral health play a fundamental role in preventing and managing dental diseases [9]. Behavior changes and adherence to preventive routines often depend on motivation, self-efficacy, and continuous education. In this context, the integration of digital health technologies has emerged as a powerful means to support patients in acquiring and maintaining healthy habits [10,11].

According to the World Health Organization (WHO), eHealth refers to the use of information and communication technologies for health, encompassing tools such as electronic health records, telemedicine, and digital education platforms. Within this domain, mobile health (mHealth) specifically denotes the use of mobile devices—such as smartphones, tablets, and wearable sensors—to deliver health services and information in real time. These tools enable users to monitor their own risk factors, receive personalized feedback, and strengthen their engagement in preventive care [12,13].

Recent evidence suggests that, when properly designed and validated, mobile applications can be valuable tools for reducing oral health disparities, improving access to information, and fostering a user centered, participatory approach to healthcare [14–16].

Building on this digital transition, innovative tools such as mobile applications have gained prominence in supporting self-management and preventive oral care. One such example is CarieCheck, a mobile application developed within the academic environment of the Egas Moniz School of Health and Science, officially registered in the European Patent Bulletin no. 2025/36 under publication number 4 610 990, aimed at promoting oral health awareness, self-assessment, and behavioral change regarding caries prevention. The app provides users with structured questionnaires and educational feedback based on individual risk profiles, seeking to empower them to make informed decisions about their daily oral health routines.

Given the increasing integration of mobile health technologies into preventive oral care, it is essential to assess the scientific quality, usability, and effectiveness of such ap-plications before recommending them to the general population. Despite the growing number of oral health-related apps available in digital stores, only a limited proportion have been evaluated through standardized and validated instruments such as the Mobile App Rating Scale (MARS) [17,18].

Moreover, there is a scarcity of evidence exploring the perception, engagement, and satisfaction of users regarding mobile oral health applications within the Portuguese context.

Accordingly, the present pilot study aims to evaluate the “CarieCheck” mobile ap-plication using the MARS scale, in a sample of users from the academic community of the Egas Moniz School of Health and Science. This evaluation seeks to provide preliminary insights into the app’s quality dimensions — engagement, functionality, aesthetics, and information quality — and to explore its potential as an innovative digital tool to pro-mote preventive oral health behaviors.

It is hypothesized that the “CarieCheck” app will achieve an overall MARS score indicative of acceptable to high quality (≥3.0 on a 5-point scale). Additionally, it is expected that the domains of information and functionality will obtain the highest ratings, reflecting the app’s clarity, reliability, and ease of use. In this sense, the present study aims to answer the following research question: whether the “CarieCheck” app is perceived as attractive, functional, and informationally adequate from the users’ perspective. Based on the existing literature and the parameters established by the Mobile App Rating Scale (MARS), it was assumed that the app would reach an acceptable or higher level of quality (mean score ≥3.0) across the evaluated domains, thus being perceived as an ap-pealing and useful tool for promoting preventive oral health behaviors. Conversely, the null hypothesis

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considered that the "CarieCheck" app would not reach an acceptable quality level (mean score <3.0) in the MARS domains.

2. Materials and Methods

This study adopted a prospective, observational, descriptive and cross-sectional design with a pilot character, aiming to evaluate the mobile application "CarieCheck" using the uMARS-PT, validated for Portuguese [19]. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (1975, revised in 2013) and was approved by the Ethics Committee of Egas Moniz School of Health and Science (ID no. 1462 PT 257/24).

Participation was entirely voluntary, and all participants provided written informed consent prior to inclusion. Anonymity and data confidentiality were ensured throughout the study, in compliance with the General Data Protection Regulation (GDPR).

2.1. Study Setting and Participants

The sample was selected by convenience from the academic community of Egas Moniz School of Health and Science, which includes students, faculty members, administrative staff, and oral health professionals working at the Egas Moniz University Clinic – Caparica. This community was chosen because it allowed the inclusion of diverse population groups within a controlled and familiar environment, and because, at the time of the study, the application was a test version awaiting publication of its patent registration. A total of 30 participants were included in this pilot study, a sample size considered appropriate for feasibility-focused designs. According to current methodological guidelines, pilot studies aiming to test procedures, acceptability, and data collection logistics may adequately operate with samples of around 30 participants, as they are not intended to estimate effect sizes or perform inferential analyses [20,21].

Participants were invited to install and use the test version of the CarieCheck app for a 30-day period. The decision to adopt a 30-day trial window is supported by previous *mHealth* feasibility research, where similar 30-day intervals have been used to assess acceptability, usability, adherence patterns, and behavioral engagement with digital health interventions. This duration provides enough time for repeated interaction and real-world usage, while avoiding excessive participant burden [22]. After the trial period, participants were asked to complete an online questionnaire created using the Qualtrics XM platform, which included the Mobile App Rating Scale for app quality assessment.

App usage was monitored through the administrator dashboard of the CarieCheck test version. This internal panel allowed the research team to verify, in real time, whether participants were completing the in-app questionnaires and interacting with the core features. Although individual usage metrics were not quantitatively analyzed, this monitoring confirmed active engagement throughout the 30-day trial period.

Inclusion criteria were age ≥18 years, affiliation with the Egas Moniz academic community, ownership of a compatible smartphone, and provision of written informed consent.

Exclusion criteria included: age under 18, non-affiliation with the Egas Moniz academic community, lack of a compatible smartphone, or failure to sign the informed con-sent form [20,21].

2.2. CarieCheck App

The CarieCheck mobile application represents an innovative digital tool designed to transform the way dental caries risk is assessed, monitored, and managed. Developed by researchers at Egas Moniz School of Health and Science, the app integrates scientific evidence with an interactive and educational approach aimed at empowering users to identify and understand their individual caries risk through a user-friendly interface that combines behavioral, clinical and lifestyle factors. Its primary goal is to enhance users' oral health literacy and encourage sustained engagement in preventive dental care.

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The system is structured around four core components: (1) a personalized caries risk assessment tool based on scientifically validated parameters; (2) a daily monitoring interface supported by gamification principles to motivate users to adopt and maintain positive oral hygiene habits; (3) a secure communication module that enables remote interaction between patients and oral health professionals; and (4) automatic generation of individualized digital reports summarizing risk levels and tailored recommendations using artificial intelligence. This multidimensional design allows the app to function both as a preventive tool for the public and as a clinical support system for oral health professionals, bridging digital health technology and patient-centered care.

From an innovation standpoint, CarieCheck App (figure n.1) introduces a novel methodological approach to caries risk management, overcoming limitations intrinsic to traditional models such as CAMBRA and Cariogram®. Its framework aligns with the eHealth and mHealth frameworks recommended by the World Health Organization, offering a scalable solution that can be integrated into public health strategies and routine clinical practice. The application is registered in the European Patent Bulletin no. 2025/36 under publication number 4 610 990, underscoring its originality and the potential for technological transfer. Developed in Portugal, CarieCheck holds significant promise for advancing preventive dentistry by merging behavioral science, digital technology and patient engagement within a single accessible platform.

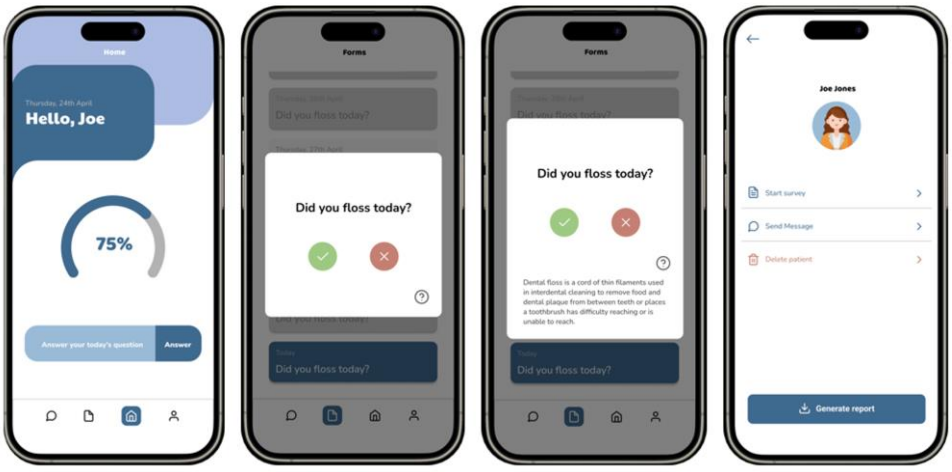

Figure 1. Example of the CarieCheck mobile application interface. The app provides users with daily interactive questions related to oral health habits, such as flossing, and delivers immediate feedback, progress tracking, and personalized communication between patients and dental professionals.

2.3. MARS Questionnaire

The evaluation of the CarieCheck mobile application was conducted using the Mo-bile App Rating Scale, a validated and widely used multidimensional instrument designed to assess the quality of health-related mobile applications. Developed by Stoyanov and colleagues, the original MARS comprises 23 items organized into five domains: Engagement, Functionality, Aesthetics, Information Quality, and Subjective Quality. Each item is rated on a 5-point Likert scale (1 = Inadequate; 2 = Poor; 3 = Acceptable; 4 = Good; 5 = Excellent), with non-applicable (N/A) items excluded from domain analysis [23,24].

For this study, the Portuguese-validated version of the MARS (uMARS-PT) was used [19]. This version includes three additional questions designed to capture user's perceived impact and behavioral intention related to health-promoting practices. Participants completed the online questionnaire via Qualtrics XM after a 30-day trial period using the CarieCheck app. For each domain, mean scores were calculated by averaging the non-missing item values. The overall MARS score was computed as the arithmetic mean of the four objective domains (Engagement, Functionality, Aesthetics, and Information Quality), following the procedure established in the

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validation protocol. The Subjective Quality and additional Perceived Impact domains were analyzed separately to provide further insight into user satisfaction and behavioral influence.

In this context, the term "behavioral impact" does not refer to objectively measured behavior change, but rather to participants' self-reported perceived impact. Specifically, the uMARS-PT items capture whether users felt more aware, motivated, or inclined to adopt healthier oral-health behaviors because of interacting with the app. These items therefore assess perceived influence rather than actual behavioral outcomes. Interpretation followed the standard MARS classification: mean scores ≥ 4.0 indicated excellent perceived quality; 3.0–3.9, acceptable/moderate quality; and < 3.0, poor or unsatisfactory quality.

2.4. Statistical Analysis

Data analysis was performed using IBM SPSS Statistics version 28.0 (IBM Corp., Armonk, NY, USA). A descriptive statistical analysis was conducted to summarize participants' responses to the Mobile App Rating Scale. For each of the four objective MARS domains (Engagement, Functionality, Aesthetics, and Information Quality), mean scores and standard deviations were calculated. The overall MARS score was determined as the arithmetic mean of these four domains, in accordance with the original validation protocol. The Subjective Quality domain was analyzed separately to provide additional insight into user satisfaction and perceived app usability.

No inferential tests were performed, as the study aimed to provide an exploratory, descriptive evaluation of user perceptions in a pilot context.

3. Results

3.1. Participants Inclusion and Characteristics

A total of 30 participants were included in this pilot study, all recruited by convenience from the academic community of Egas Moniz School of Health and Science, which comprises students, faculty members, administrative staff, and oral health professionals. The sample was intentionally diverse to include individuals of different professional roles and genders within a familiar and controlled environment. No participants were excluded from the analysis, as all those enrolled completed the 30-day trial period and submitted valid responses to the MARS questionnaire.

Among the 30 participants, 23 (76.7%) were students — 15 females (65.2%) and 8 males (34.8%). In addition, 2 (6.7%) were male professors, 1 (3.3%) was a male dental intern, 1 (3.3%) was a male Volunteer Dentist in Training, and 3 (10%) were female ad-ministrative staff as shown in Table 1.

Table 1. Participant's demographic and occupational characteristics (n = 30).

Category	n	%	Gender (n/%)	
			Female	Male
Students	23	76.7	15(65.2)	8(34.8)
Professors/ Collaborators	2	6.7	0	2
Dental interns	1	3.3	0	1
Volunteer Dentist in Training	1	3.3	0	1
Administrative Staff	3	10.0	3	0
Total	30	100	18(60)	12(40)

3.2. Descriptive Analysis of MARS Domains

Table 2 presents the descriptive analysis of all items included in the Mobile App Rating Scale, covering the domains of Engagement, Functionality, Aesthetics, Information Quality, Subjective Quality, and Perceived Impact. The mean scores for each item, as well as the minimum, maximum, and standard deviation values, are displayed to illustrate users' overall evaluation of the CarieCheck mobile application.

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Table 2. Descriptive analysis of all domains of the Mobile App Rating Scale (n = 30).

Item	Engagement Domain	n	min	max	Mean	SD
1	Interest: Is the app interesting to use? Does it present information in an engaging way compared with similar apps?	30	1	5	3.9	1.094
2	*Entertainment:* Is the app fun or enjoyable to use? Does it include features that make it more entertaining than similar apps?	30	1	5	3.59	0.983
3	*Customization:* Does the app allow users to personalize settings and preferences (e.g., sound, content, notifications)?	30	1	5	3.03	1.033
4	*Interactivity:* Does the app allow user input, provide feedback, or include prompts (reminders, sharing options, notifications, etc.)?	30	1	5	3.60	0.814
5	*Target Group:* Is the app's content (visuals, language, design) appropriate for the intended target group?	30	3	5	4.43	0.679
	Functionality Domain					
6	*Performance:* How accurately and quickly do the app's features (functions) and components (buttons/menus) operate?	30	3	5	4.57	0.626
7	*Ease of Use:* How easy is it to learn how to use the app? How clear are the menu tabs, icons, and instructions?	30	3	5	4.67	0.547
8	*Navigation:* Is movement between screens logical and consistent? Does the app include all necessary links between sections?	30	1	5	4.27	0.868
9	*Gestural Design:* Do touch, tap, pinch, and scroll gestures make sense? Are they consistent across components and screens?	30	3	5	4.53	0.626
	Aesthetics Domain					
10	*Layout:* Are the arrangement and size of buttons, icons, menus, and on-screen content appropriate?	30	3	5	4.57	0.626
11	*Graphics:* What is the quality and resolution of the graphical elements used for buttons, icons, menus, and content?	30	3	5	4.57	0.690
12	*Visual Appeal:* How visually appealing is the app overall?	30	3	5	4.20	0.664
	Information Quality Domain					
13	*Information Quality:* Is the app content correct, well written, and relevant to the app's purpose/topic?	30	3	5	4.55	0.572
14	*Quantity of Information:* Is the information provided complete and objective?	20	1	5	4.10	1.012
15	*Visual Information:* Are visual explanations of concepts (tables, graphs, images, videos, etc.) clear, logical, and accurate?	30	3	5	4.54	0.637
16	*Credibility:* Does the information appear to come from a reliable and trustworthy source?	30	3	5	4.50	0.638
17	*Recommendation:* Would you recommend this app to people who could benefit from using it?	30	1	5	3.90	1.094
18	*Intended Use:* How often do you think you would use this app over the next 12 months if it were relevant to you?	30	1	5	3.70	1.179
	Subjective Quality Domain					
19	Would you pay for this app?	30	1	5	2.30	1.055
20	What is your overall star rating for the app?	30	2	5	3.80	0.847
	Perceived Impact Domain					
21	*Awareness:* This app increased my awareness of the importance of addressing my health-related habits and behaviors.	30	2	5	4.03	0.718
22	*Knowledge:* This app increased my knowledge or understanding regarding my health-related habits and behaviours.	30	1	5	3.73	0.944
23	*Attitudes:* This app changed my attitudes in a way that improved my health-related habits and behaviours.	30	1	5	3.67	0.922
24	*Intention to Change:* This app increased my intention or motivation to address my health-related habits and behaviours.	30	1	5	3.90	0.885

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25	*Help Seeking:* This app would encourage me to seek additional help to deal with my health-related habits and behaviors (if needed).	30	1	5	3.93	0.868
26	*Behaviour Change:* Using this app will increase or decrease my health-related habits and behaviours.	30	1	5	3.83	0.950

Across the 26 items, the mean scores ranged between 2.30 and 4.67 on a five-point Likert scale. The highest individual mean score corresponded to the Ease-of-Use item (Mean = 4.67 ± 0.55), whereas the lowest score was observed for Disposition to Pay (Mean = 2.30 ± 1.06). Items related to Functionality and Aesthetics domains generally achieved higher mean values compared with other domains. Lower mean values were mainly found in the Engagement and Subjective Quality domains. Overall, the obtained results suggest consistent variability across domains, reflecting different aspects of the users' experience with the CarieCheck application.

Table 3 summarizes the mean scores obtained for each MARS domain and the corresponding qualitative classification.

Table 3. Summary of mean scores by domain and qualitative classification (MARS).

Domain	Items	Mean (domain)	Qualitative Rating
Engagement	1-5	3.71	Acceptable / Moderate Quality
Functionality	6-9	4.51	Excellent Quality
Aesthetics	10-12	4.45	Excellent Quality
Information Quality	13-18	4.22	Excellent Quality
Subjective Quality	19-20	3.05	Acceptable / Moderate Quality
Perceived Impact	21-26	3.85	Acceptable / Moderate Quality
Overall MARS Score	1-18	4.22	Excellent Quality

4. Discussion

This pilot, observational, descriptive, and cross-sectional study aimed to evaluate the perceived quality of the CarieCheck mobile application using the Mobile App Rating Scale (MARS). Conducted among 30 participants from the academic community of Egas Moniz School of Health and Science, the study provided a multidimensional assessment of the app after a 30-day trial period. The overall MARS score was 4.22, indicating excellent perceived quality. The highest domain scores were observed for Functionality (4.51), Aesthetics (4.45), and Information Quality (4.22), suggesting that users recognized the app's technical efficiency, appealing visual design, and accurate, relevant content. In contrast, Engagement (3.71), Perceived Impact (3.85), and particularly Subjective Quality (3.05) obtained lower scores, reflecting limited personalization, moderate perceived behavioral influence, and reduced willingness to pay for or highly recommend the app.

The MARS instrument was selected for this evaluation due to its strong evidence of reliability and validity in assessing mHealth applications. The initial validation of the MARS reported excellent internal consistency (Cronbach's $\alpha \approx 0.90$), supporting its reliability as a measure of global app quality [24]. Subsequent validation work confirmed the four-factor structure of the MARS across 15 international studies involving 1299 health applications, reporting high reliability coefficients (Omega = 0.79–0.93) and strong in-ter-rater agreement (ICC = 0.82). The widespread cross-cultural validation of the scale reinforces its suitability for studies such as the present one, ensuring comparability and methodological rigor [25].

Regarding individual domains, the Engagement domain (Mean = 3.71) indicated that CarieCheck achieved a moderate-to-good capacity to sustain users' attention and interest. Previous studies consistently report this as one of the lowest-performing MARS domains across health apps—mean engagement scores of 2.9 to 3.2 are common [26–28]. Therefore, the CarieCheck result aligns with the general trend, suggesting that engagement features—such as reminders, gamification, or adaptive feedback—could be further strengthened.

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The Functionality domain obtained the highest mean (4.51), highlighting an intuitive interface, smooth navigation, and the absence of major technical issues. These results are comparable to or higher than those reported in similar evaluations of nursing or maternal health apps (means = 4.5–5.0) [26,28].

Similarly, the Aesthetics score (4.45) confirmed the app's strong visual appeal, aligning with evidence that visually coherent and appealing interfaces enhance user satisfaction and experience in mobile applications, including mHealth contexts [29,30].

The Information Quality domain (4.22) also showed a strong performance, suggesting that users perceived the content as clear, reliable, and evidence based. Similar findings have been reported in evaluations of other mHealth applications, particularly in nursing and diabetes management—where well-structured, scientifically supported content was a key determinant of perceived quality [26]. In the context of oral health, this aspect is especially relevant, as previous reviews have highlighted recurring gaps in the accuracy and transparency of app content [16,31].

The Subjective Quality score (3.05) indicated moderate satisfaction, a common outcome in pilot evaluations where users recognize potential but expect further refinement in features and content. Conversely, the Perceived Impact score (3.85) demonstrated that the app succeeded in enhancing awareness and intention to adopt healthier oral-hygiene behaviors. Comparable discrepancies between satisfaction and perceived benefit have been reported in other mHealth assessments, reflecting the learning and optimization stages typical of early-phase digital interventions [27,28].

Despite its encouraging results, the present study has limitations. The small sample size (n = 30), typical of pilot designs, limits generalizability to broader populations. Additionally, the 30-day usage period may have been insufficient to capture long-term behavioral effects or user retention. Future studies should therefore include larger, more diverse samples and extended follow-up periods to validate both the usability and potential clinical impact of CarieCheck.

Finally, based on these findings, future developments of CarieCheck could focus on enhancing personalization, real-time feedback, and motivational components such as adaptive gamification, to increase engagement and user satisfaction. Further validation in educational, clinical, and community contexts—along with integration into electronic health records or preventive programs—could expand its role as a digital tool for promoting oral health and patient self-management.

5. Conclusions

This pilot study found that the CarieCheck mobile application achieved a high overall quality rating (mean = 4.22) on the Mobile App Rating Scale (MARS), indicating strong perceived performance and supporting its potential for further clinical validation. Users consistently rated the app as functional, aesthetically appealing, and informative, with all objective domains exceeding the accepted quality threshold (≥ 3.0). The highest scores were observed in Functionality (4.51), Aesthetics (4.45), and Information Quality (4.22), reflecting a technically robust design, intuitive interface, and evidence-based content.

Engagement (3.71) and Subjective Quality (3.05) were comparatively lower, a profile commonly observed in early stage mHealth tools, where usability and reliability typically develop earlier than sustained user engagement. Notably, the Perceived Impact score (3.85) suggests that CarieCheck may contribute to improved awareness and motivation towards healthier oral-health behaviors, reinforcing its potential value in preventive dentistry.

Overall, the findings position CarieCheck as a promising digital health tool for caries risk monitoring and behavioral reinforcement. Larger longitudinal studies including diverse populations and objective clinical outcomes are needed to confirm its long-term impact and inform integration into routine oral healthcare pathways.

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6. Patents

This work resulted in a patent application recently published in the European Patent Bulletin under the publication number EP 4 610 990.

Author Contributions: Conceptualization, E.G. and G.S.; Methodology, E.G.; Validation, E.G.; Investigation, E.G. and G.S.; Resources, J.J.M. and E.G.; Writing—original draft preparation, E.G., J.J.M., A.C.M and J.B.; Writing—review and editing, E.G., J.J.M. and A.C.M.; Supervision, E.G., A.C.M. and J.J.M.; Project administration, E.G. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of Egas Moniz School of Health and Science (ID no. 1462 PT 257/24).

Informed Consent Statement: Informed consent was obtained from all the subjects involved in the study.

Data Availability Statement: The entirety of the data compiled and examined throughout this study can be found within this document. Any additional queries should be directed towards the author in charge of correspondence.

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Conflicts of Interest: CarieCheck is a mobile application developed within the academic environment of Egas Moniz School of Health and Science and is subject to a patent application published in the European Patent Bulletin (publication number 4 610 990). Authors E.G., A.C.M., and J.J.M. were involved in the conceptual design of the app. The study was conducted independently and received no external funding. The authors declare no other conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

DOAJ	Directory of open access journals
GDPT	General Data Protection Regulation
LD	Linear dichroism
MARS	Mobile App Rating Scale
MDPI	Multidisciplinary Digital Publishing Institute
N/A	non-applicable
TLA	Three letter acronym
WHO	World Health Organization

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