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Interest, uptake, and feasibility trial of a real-life digital health intervention to improve lifestyle in Brazil

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Abstract

Objective: Promoting healthy lifestyle behaviors is essential for preventing and managing chronic and mental health conditions. This study aims to present a digital health platform accessible via PC or smartphone, *VIVA!*, designed to foster lifestyle change among the Brazilian population. It evaluates interest, uptake, acceptability, usability, adherence, and retention over 12 weeks.

Methods: A fully online feasibility trial was conducted from April to December 2023. Participants were adults who lived in Rio de Janeiro and reported using the Brazilian Public Health System. Interest in *VIVA!* and uptake were assessed via recruitment metrics. Acceptability and usability were measured using the Mobile App Rating Scale (MARS). Adherence was calculated as the percentage of completed challenges over 12 weeks, and retention was tracked at 4, 8, and 12 weeks.

Results: Of 3812 individuals reached, 27.2% expressed interest in the app, with an uptake rate of 65.4%. A total of 401 participants were enrolled, predominantly women (73.3%) with higher education (61.6%). MARS acceptability scores were 2.9 for quality and 3.5 for specificity. Usability scores averaged around 3, with aesthetics rated the highest. Retention at 12 weeks was 4.5%, and the average adherence rate was 11.2%.

Conclusion: The *VIVA!* attracted women and highly-educated individuals, but its effectiveness was constrained by high attrition. These findings highlight key challenges in DHI implementation, including the need for robust outreach, iterative improvements, and strategies to sustain engagement. Addressing digital access, literacy inequities, and strengthening regulations are critical for the future success and equity of DHIs in public health systems.

Trial registration: The trial was registered at the Brazilian Clinical Trials Registry (Registro Brasileiro de Ensaios Clínicos -REBEC)—number RBR-2ssyb6q.

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Introduction

Non-communicable diseases and mental health disorders are significant contributors to the global burden of disease, which could be substantially reduced by addressing unhealthy behaviors,[1] such as physical inactivity and substance use. However, promoting healthier behaviors is a complex challenge that requires both population- and individual-level interventions. At the individual level, lifestyle medicine presents a promising, evidence-based approach that incorporates various behavioral change theories and techniques to promote physical activity, healthy diets, restorative sleep, social support, stress management, and reduced substance use.[2]

A recent meta-meta-analysis of 47 meta-analyses, which included 507 randomized controlled trials (RCTs), demonstrated that digital health interventions (DHIs) are effective in promoting healthier lifestyles, particularly in improving physical activity, diet, and sleep.[3] DHIs are increasingly recognized as valuable tools for enhancing health outcomes due to their scalability and potential to improve health access. The World Health Organization (WHO) has advocated for the implementation of DHIs to reduce health inequalities.[4]

Over the last decade, the number of smartphone-based DHIs has increased dramatically, with thousands of apps now available to improve lifestyle and mental health.[5] This growth is partly driven by the expanded access to the Internet and smartphones globally. For instance, in Brazil, 84% of individuals aged 10 years and older reported using the Internet in the past 3 months, with 99% of them accessing it via mobile phones.[6] Because most individuals own smartphones and carry them throughout the day, apps offer a unique opportunity for users to consistently practice key skills needed to prevent or manage symptoms.[7]

Most DHIs are developed in high-income countries and may not be culturally suitable for low- and middle-income countries (LMICs). Furthermore, populations in different regions may have varying levels of digital literacy. Given that sociodemographic and cultural factors, as well as literacy levels, can influence the acceptability, usability, and retention of DHIs,[8] it is crucial to design and evaluate these interventions in LMICs.

Evaluating DHIs presents several challenges. Common issues include low usability, acceptability, and user retention over sufficient timeframes to observe sustained behavior change.[9,10] These limitations may hinder the accurate evaluation of the effectiveness and large-scale implementation of DHIs. Notably, few available apps for lifestyle improvement have undergone rigorous scientific evaluation, and many existing studies are preliminary or underpowered.[11,12]

In Brazil, the seven leading risk factors contributing to death and disability are metabolic (high body mass index, high fasting plasma glucose, high blood pressure) or behavioral (tobacco use, dietary risks, malnutrition, and excessive alcohol consumption).[13] All of these risk factors can be mitigated through behavior change, and many related diseases can be treated using lifestyle interventions. Fortunately, Brazil has one of the largest public health systems in the world—the Unified Health System (SUS)—which provides comprehensive healthcare to all citizens.[14]

The SUS is currently undergoing a rapid digital transformation, integrating multiple innovations into healthcare services.[15] This transformation presents a significant opportunity to incorporate user-centered apps designed to improve lifestyle, which could be made freely available to the entire population. However, to date, no Brazilian apps have demonstrated sufficient scientific evidence of their effectiveness in improving lifestyle behaviors at a population level or to SUS users. Additionally, there are no established guidelines for designing clinical trials to evaluate such apps on a national scale. Thus, feasibility studies are essential for estimating the parameters needed to conduct clinical trials and are a critical step in implementation science.[16] Conducting feasibility studies prior to deploying DHIs is crucial for assessing acceptability and retention rates, thereby saving valuable resources by refining study designs or determining whether further investment in the intervention is warranted.

This manuscript aims to describe a DHI designed to promote healthy lifestyle behaviors among the Brazilian population. Specifically, it assesses individuals' interest in, uptake of, acceptability, usability, adherence to, and retention with the intervention over a 12-week period.

Methods

Design

This is a non-randomized, single-group, feasibility trial. Individuals were recruited between April 2023 and September 2023 and followed for 12 weeks. The project was a partnership between the Oswaldo Cruz Foundation (FIOCRUZ) and the Rio de Janeiro Municipality Health Department (SMS/Rio). There were three major changes in the design during the study conduction: the sample size was increased (see below), the recruitment strategy was broadened through the partnership with SMS/Rio, and the design of the app was changed to improve user experience (Supplemental Material 1).

Participants and recruitment

Men and women who lived in Rio de Janeiro (RJ), aged 18 or over, self-reported SUS users, who had a PC or smartphone with a data plan for Internet access, and who accepted to participate in the study were eligible. Individuals who reported restrictions or clinical conditions that contraindicate the practice of physical exercise and/or use diets prescribed by health professionals due to clinical conditions were excluded.

Recruitment was carried out through advertising on social media (institutional and project Instagram® and Facebook® pages: @icict_fiocruz, @saude_rio, and @appviva_rio) and through promotional material distributed in a primary health unit in the city of Rio de Janeiro (Basic Health Unit Maria do Socorro). For instance, @icict_fiocruz has 15,800 followers, and @saude_rio has 388,000 followers. The publications on institutional pages were unpaid, and the publications on the project's social media were both paid and unpaid. The publications on the project's social media were boosted using keywords targeting lifestyle behaviors and the inclusion criteria.

The enrollment was completely remote. Individuals interested in participating should access the VIVA! app via a QR code or through the link www.appviva.com.br. In the first access, the potential participant was asked to provide an e-mail or telephone number, through which the informed consent form (ICF) would be received. After agreeing to participate, individuals were enabled to create a login and a password and answered questions regarding inclusion criteria, and, if they met them, they had access to the app's functionalities.

Intervention

A digital health platform accessible via PC or smartphone, VIVA!, was developed with the aim of promoting a healthy lifestyle into the following seven domains: diet, physical activity, restorative sleep, stress management, use of psychoactive substances, social support, and environmental exposures (screen time and contact with nature). The domains were based on the Short Multidimensional Inventory on Lifestyle Evaluation (SMILE), a validated questionnaire for multidimensional lifestyle evaluation.[17–21] The VIVA! was developed by the research team, which includes three psychiatrists and one physical educator with experience in cognitive behavioral therapy and motivational interview, one psychologist, one public health nurse, one GP, and one app developer with UX experience. After the first version was launched, the users' feedback and analysis of the data were incorporated to improve the app. Three behavioral change techniques were used to promote healthy behaviors in each lifestyle domain: feedback, goal-setting, and self-monitoring.[22] These techniques were chosen following the literature[5,24,25,9,23] and the clinical experience of the research team.

Individuals with access to the app functionalities completed the SMILE and received one of the possible types of feedback: "Your lifestyle is healthier than that of most VIVA! users. Stay here, accept the challenges, and overcome yourself next month" if the score was higher than the mean score of users, or "Your lifestyle is not as healthy as that of most VIVA! users. Don't give up, accept the challenges, and overcome yourself next month" if the score was lower than the mean.

Afterwards, the app randomly displayed a goal (named "Challenge"). The challenges were weekly proposals of activities promoting healthy behaviors, such as "In the next 7 days, I will walk 15 min at least 3 days." Participants could select one of the three options: "I already have this habit," "Maybe in a next opportunity," or "Accept." If options 1 or 2 were selected, another challenge was proposed until one was accepted by the user. One week later, individuals received an e-mail/WhatsApp message asking for their subjective feedback regarding performance (the options were "I was able to complete the challenge," "I was partially able to complete the challenge," or "I was not able to complete the challenge"). In addition, they were asked to select another challenge for the following week. Participants could choose one challenge each week, completing a total of 12 challenges throughout the study. No additional prompts were provided until the end of each week. The challenges varied in difficulty, allowing participants to select those that matched their abilities. The challenges were designed based on the researchers' clinical experience, a bibliographic review of the literature, and a review of commercial apps available for lifestyle changes—the complete list of challenges is available in Supplemental Material 2.

Regarding self-monitoring, individuals could check the challenges they were able or not to complete, and once a month (for 3 consecutive months), they would complete the SMILE again to verify their improvement. Finally, aiming to improve users' health literacy, every week the app displayed the "Health Tip of the Week"—Supplemental Material 3. These were brief texts providing

information regarding preventive strategies recommended by recognized health organizations, such as the WHO and the Brazilian Ministry of Health. The tips were also advertised on the project's social media (@appviva.rio). Although individuals could reach the research team by e-mail, in case they presented questions and doubts, the entire process of recruitment, intervention, and evaluation was remote and anonymous.

Technical design

The programming language used to develop the VIVA! app backend was a hypertext preprocessor (PHP). PHP is a scripting language that is open-source and cross-platform, enabling the creation of websites and web applications integrated with various types of databases. To store the data, the chosen database management system was MySQL. MySQL is one of the most popular databases in the world, used in e-commerce sites, social media platforms, and applications.

Outcomes

The primary outcomes were the app's interest, uptake, acceptability, and usability, as well as participants' adherence and retention after 12 weeks:

- Interest was evaluated by the proportion of individuals reached by the recruitment strategies who created a VIVA! account.
- Uptake was defined as the proportion of individuals who created a VIVA! account filling eligibility criteria who were included in the study.

Acceptability was measured by Sections E and F of the Mobile Application Rating Scale (MARS). The MARS is a validated multidimensional scale for evaluating apps. It comprises 23 items in four objective dimensions (A, engagement; B, functionality; C, aesthetics; and D, information quality) and one subjective dimension (E). It also presents six additional questions (Section F) to evaluate the perceived effect of the app "on the user's knowledge, attitudes, intentions to change as well as the likelihood of actual change in the target health behavior." Responses are provided through a five-item Likert scale, and scores are calculated based on the mean of the subscale scores (i.e., each subscale score ranges from 1 to 5) and the overall score.[26] Participants could answer Section E at any time in the app, but Section F was available only in Week 12.

- Usability was evaluated by Sections A, B, and C of the MARS.
- Retention in Weeks 4, 8, and 12 was evaluated by the proportion of users providing feedback on the challenges in Weeks 3, 7, and 11.
- Adherence was calculated by the number of challenges accepted for 12 weeks divided by 12 and multiplied by 100.

The secondary outcome was the evaluation of lifestyle before and after the intervention, as measured by the difference in SMILE total scores between Weeks 1 and 12.

Sample size

The initial sample size was estimated at 60 participants, who would be monitored by the application over a period of 3 months. Although feasibility studies do not necessarily have to provide a sample size calculation,[16] this size calculation would allow us to find a 10% difference in the SMILE scores between Weeks 1 and 12 (secondary outcome). However, three challenges emerged during the study conduction: (1) the recruitment strategy was not effective (it took 6 months to include 60 participants); (2) participant demographics were not representative of users from SUS (most participants had post-graduation and additionally to use the SUS had private health insurance); (3) only 6 participants (10%) were retained in Week 12. Such challenges led to the changes mentioned above and the increase in sample size to 600 participants, expecting a 10% retention rate in Week 12.

Covariates

To evaluate the characteristics of individuals who could be interested in a DHI to improve their lifestyle, the following variables were assessed on the app first access: sex, age, having private health insurance, education, work status, previous diagnosis of COVID-19, COVID-19 vaccination status, self-rated health,[27] 12-month infectious, cardiovascular and mental health diseases, screenings for anxiety (seven-item Generalized Anxiety Disorder (GAD-7), cutoff $\geq$10)[28] and depression (Patient Health Questionnaire-2 (PHQ-2, cutoff $\geq$3[29]) and body mass index (BMI, calculated through self-reported weight and height and categorized as underweight/normal (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obesity (>30 kg/m²)).

Statistical analysis

Descriptive analysis is presented for all the primary outcomes. Covariates obtained during the initial access were compared between individuals who participated in the study and those who did not, using proportions for categorical variables and median and interquartile range for continuous variables. The chi-square test for homogeneity and the Mann–Whitney test were used accordingly, with a significance level of 5%.

Ethical aspects

The project was approved by the Institutional Review Board of the Pesquisa da Escola Politécnica Joaquim

Venancio (CAAE 50634321.3.0000.5241) and by the Secretaria Municipal de Saúde do Rio de Janeiro (CAAE 50634321.3.3001.5279). The clinical trial was registered in the Brazilian Clinical Trial Registry (Registro Brasileiro de Ensaios Clínicos (REBEC)) (#RBR-2ssyb6q).

The only identifying information collected during the study was an e-mail address or a cell phone number, which was used to send WhatsApp messages. No other identifying details—such as the participant's name, address, IP address, or backend data—were collected. These measures adhered to IRB requirements to ensure participant confidentiality.

When individuals interested in the app first accessed the QR code or the link www.appviva.com.br—promoted on social media and in materials distributed at a primary health unit—they were asked to provide either an e-mail address or a cell phone number.

The informed consent form (ICF) was sent to the provided e-mail or WhatsApp number. At the end of the form, a single-use link valid for 2 h was included. Individuals needed to click this link to confirm their understanding of the study and express their interest in participating.

After providing consent, individuals were directed to the app, where they could create an account using only the same e-mail or phone number they had provided. This was verified to ensure it matched the contact information to which the ICF was sent. Participants also created a password to complete their account setup, allowing them access to the app's features and participation in the study.

If the link was not clicked within 2 h, or if unmatched login information was provided, the e-mail address or phone number was deleted from the database.

The app is hosted on a secure ICICT/Fiocruz server with a digital certificate that guarantees encryption in traffic and data storage.

Results

Between April 2023 and September 2023, the project's social media had 2012 followers, and 1800 leaflets were distributed in the Basic Health Unit. Of these individuals ($n = 3812$), 1037 created an account on VIVA!, 613 fulfilled inclusion criteria, and 401 filled the SMILE at baseline (i.e., were considered as participants; Figure 1).

Overall, 27.2% ($n = 1037/3812$) of the individuals reached were interested in the app, and the study uptake was 65.4% ($n = 401/613$). Table 1 compares the characteristics of eligible individuals who participated or did not in the study. Individuals who did not participate were older, had lower education, worse self-rated health, and more frequently reported a diagnosis of chronic disease ($p < 0.05$).

The study participants were mostly women (74.6%), did not have private health insurance (55.6%), had graduated or more (61.6%), and reported very good/good health (49.4%). Additionally, most of them presented a positive screening for depression (62.8%) and/or anxiety (64.6%).

Of the 401 participants, only 9 (2.24%) provided feedback in Week 12. Table 2 shows the MARS mean scores. Acceptability scores were 2.9 for Section E (quality) and 3.5 for Section F (specificity), i.e., just above average. Participants were likely to believe that the app content was targeting lifestyle and could help improve it, but rated the quality of the app slightly lower and would not pay for using it.

Regarding usability, the MARS scores were also around average, but lower than for acceptability. Best scores were provided for the app aesthetics, and worst scores were provided for engagement—mainly, the app was not considered to be fun/amusing (Table 2).

The results regarding retention and adherence are shown in Table 3. User retention in Week 12 was 4.5%, and the average adherence to the challenges was 11.2%.

The secondary outcome was the evaluation of lifestyle before and after the intervention, as measured by the difference in SMILE total scores between Weeks 1 and 12. Considering none of the users provided feedback on the SMILE at Week 12, it was not possible to evaluate this outcome.

Discussion

In this real-world, fully online feasibility trial, 27.2% of the reached individuals expressed interest in using the VIVA! app, and the study uptake rate was 65.4%. While the app content was deemed appropriate for addressing lifestyle behaviors, participants indicated that they would not be willing to pay for its use. Acceptability and usability scores were average, and the app's aesthetic design was considered satisfactory, but it was not perceived as engaging or enjoyable. Retention at 12 weeks was 4.5%, with an average adherence rate of 11.2%.

Understanding interest and uptake are critical first steps when implementing DHIs on a large scale, as they help estimate the effort and costs required to increase awareness and usage of the intervention. However, few studies report on the general population's interest in and attitudes toward DHIs. Participation rates in digital mental health intervention programs offered in primary care settings, for example, have been reported to be as low as 3%–25%.[5] Given that VIVA! was not tailored to any specific clinical or demographic group, one might expect lower interest rates, yet our findings suggest otherwise. A study evaluating DHI interest indicated that trust in the organization delivering the intervention was a key factor influencing participation.[30] In our case, the involvement of reputable governmental institutions such as Fiocruz and the SMS/Rio likely fostered trust, encouraging individuals to try the app. Moreover, Xiong et al. highlighted in their systematic review that political commitment, community mobilization, and integration with existing healthcare systems are essential for improving DHI uptake in LMICs.[31] Political commitment provides advocacy, financial

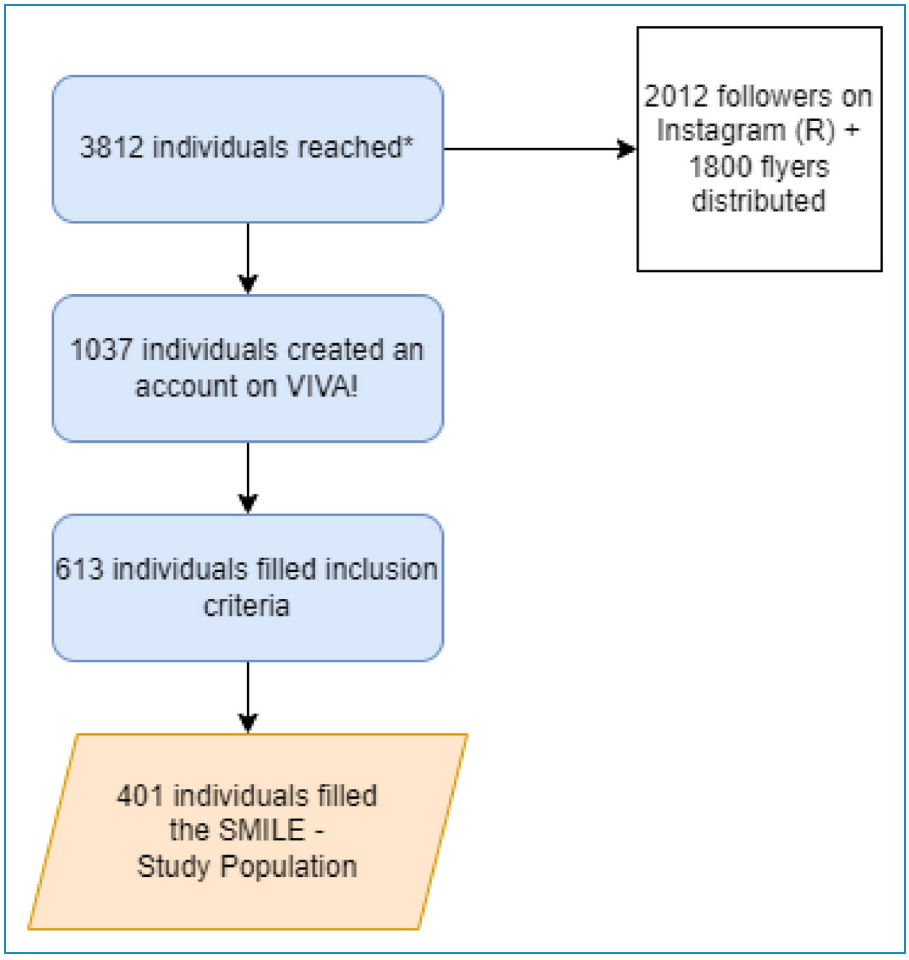

Figure 1. Study flowchart. App VIVA!, Rio de Janeiro, 2023.
*This number is likely to be underestimated because it does not include other possible dissemination (such as sending the link to their contacts). SMILE: Short Multidimensional Inventory on Lifestyle Evaluation.

backing, and stakeholder engagement, while community mobilization and capacity-building support the adoption of digital health tools.

In remote, fully digital DHIs like ours, recruitment poses additional challenges, particularly in determining the most effective methods for reaching potential users. In this study, advertising the app on the app social media was the most efficient recruitment strategy, compared to posting on institutional pages or distributing printed materials. This aligns with findings from a remote RCT evaluating an app for reducing alcohol consumption.[32] Our recruitment strategy primarily attracted women, middle-aged individuals, and those with higher education levels. Women generally engage more in health-promoting behaviors and utilize healthcare services more frequently than men.[33] Additionally, higher education levels and age likely reflect greater digital literacy and more reliable access to broadband Internet, which are necessary for interacting with social networks used in app promotion.

Further research is needed to understand the preferences of younger individuals and men, as these groups were underrepresented in our sample. Furthermore, caution must be exercised to avoid exacerbating health inequities by focusing exclusively on populations with high digital literacy or consistent Internet access. Digital access is increasingly considered a "super determinant of health,"[34] and a "digital health paradox" has been described, where those most in need of DHIs are often those with the least access.[35] In countries presenting huge social disparities, such as Brazil, this must be considered when developing and implementing DHIs at the public health level.

Few participants provided feedback using the Mobile App Rating Scale (MARS), likely because this assessment was only requested in Week 12, where retention was low. The average MARS score for VIVA! was (2.9), similar to those reported in other studies evaluating lifestyle apps, which tend to fall within the moderate range.[36] For example, a study for lifestyle behavior change apps in Australia reported an average MARS score of 2.93, indicating low-to-moderate functionality. However, MARS scores varied depending on the specific lifestyle behaviors

Table 1. Characteristics of eligible individuals who participated or not in the study (n = 613). App VIVA!, Rio de Janeiro, 2023.

Variables		Participated in the study				*p*-value
		Yes		No		
		n = 401	%	*n* = 212	%	
Sex at birth	Female	299	74.6%	161	75.9%	0.707
	Male	102	25.4%	51	24.1%	
Gender	Female	294	73.3%	161	75.9%	-
	Male	103	25.7%	51	24.1%	
	Non-binary	4	1.0%	0	0.0%	
Age	mean (SD)	**401**	**41(19)**	**212**	**50(16)**	**< 0.001**
Private Health insurance	No	223	55.6%	126	59.4%	0.363
	Yes	178	44.4%	86	40.6%	
Educational level	Primary school	3	.7%	8	3.8%	**0.024**
	High School	97	24.2%	61	28.8%	
	Technical	54	13.5%	24	11.3%	
	≥Graduation	**247**	**61.6%**	**119**	**56.1%**	
Self-rated health	**Very good/good**	**198**	**49.4%**	**80**	**37.7%**	**0.022**
	Regular	161	40.1%	103	48.6%	
	Bad/very bad	42	10.5%	29	13.7%	
Employed	No	112	27.9%	66	31.1%	0.696
	Yes	276	68.8%	140	66.0%	
	Lost job at pandemic	13	3.2%	6	2.8%	
Diagnosed/treated for chronic diseases in the last 12 months	No	394	98.3%	56	26.4%	**<0.001**
	Yes	**7**	**1.7%**	**156**	**73.6%**	
Diagnosed/treated for mental disorders in the last 12 months	No	255	63.6%	136	64.2%	0.891
	Yes	146	36.4%	76	35.8%	
Diagnosed/treated for infectious diseases in the last 12 months	No	358	89.3%	194	91.5%	0.380
	Yes	43	10.7%	18	8.5%	

(continued)

Table 1. Continued.

Variables		Participated in the study: Yes n = 401	%	No n = 212	%	p-value
Screening for depression	Negative	149	37.2%	91	42.9%	0.164
	Positive	252	62.8%	121	57.1%	
Screening for anxiety	Negative	142	35.4%	71	33.5%	0.635
	Positive	259	64.6%	141	66.5%	
Diagnosed with COVID-19 in the last 12 months	No	164	40.9%	104	49.1%	0.053
	Yes	237	59.1%	108	50.9%	

Bold indicates $p < 0.05$.

targeted, with apps focused on mental health receiving higher scores (average 3.26), and those targeting healthy diets receiving lower scores (average 2.71).[5]

A review of 121 European stress management apps reported an average MARS score of 3.59, but only 9% of these apps demonstrated scientific evidence, and 38% were no longer available after two years.[37] Among the five apps with the highest MARS scores in that review, none were developed by public institutions, but all emphasized their development by experts or researchers, three had been included in RCTs, and all five were still available two years after the original screening. These findings suggest that while acceptability and usability are necessary for an app's use, they are insufficient on their own. The digital health market is vast and competitive, with companies like Google (through its acquisition of Fitbit) and phone manufacturers such as Samsung and Apple heavily investing in health apps. Developing, evaluating, and continuously updating such apps require substantial resources, and the presumed low cost of DHIs should be carefully quantified to better inform public investments.

The low retention rate observed in this study is not unique to VIVA!. Two meta-analyses of clinical trials evaluating mental health and mindfulness apps reported weighted average attrition rates of 24% and 24.7%, respectively.[38,39] However, attrition rates were much higher in studies with characteristics similar to ours. For instance, large trials with over 200 participants had attrition rates of up to 50%, and studies targeting the general population reported dropout rates of up to 49%. Attrition was also higher in trials that did not offer monetary compensation or involved fully remote enrollment.[39] Another meta-analysis showed that studies involving human feedback had significantly lower dropout rates (11.7%) compared to those without such feedback (34%).[40] Retention rates tend to be even lower in implementation studies. A review found that completion rates or sustained app usage ranged from 0.5% to 28.6%, highlighting the need for better reporting of implementation data.[41]

Several challenges remain in advancing the research and implementation of DHIs. One critical issue is the need for clearer regulations. Thousands of health-related apps are available for download, but few have undergone scientific evaluation.[42] While many apps claim to be based on scientific principles, these claims are often unsupported by robust evidence. The rapid expansion of the mobile health app market presents a challenge for validation. Most apps are not classified as medical devices and therefore do not require efficacy testing, resulting in a marketplace flooded with apps of questionable quality.[43] Ongoing efforts aim to improve the validation of health apps through initiatives such as developing evidence standards frameworks and creating curated app libraries. However, these efforts face challenges, including the need for consensus among stakeholders and the complexity of evaluating diverse digital health interventions.[44] As the field evolves, balancing innovation with rigorous validation will be essential to ensure that health apps can be trusted by healthcare providers and users alike.

Limitations of the present study include the non-probabilistic sample, which may limit the generalizability of the results. Additionally, retention was low, and we were unable to assess changes in lifestyle behaviors over time. Nevertheless, our findings provide valuable insights for the development and implementation of DHIs within public health systems. First, developers must recognize the large

Table 2. VIVA!'s acceptability and usability measured by the MARS ($n = 9$). App VIVA!, Rio de Janeiro, 2023.

		Mean	SD
Section A—engagement	Entertainment: Is the app fun/amusing to use? Does it use any strategy to increase engagement through entertainment (e.g., through gamification)?	2.0	1.2
	Interest: Is the app interesting to use? Does it use any strategy to increase engagement, presenting its content in an interesting way?	2.7	1.3
	Personalization: The app provides/keeps the necessary settings/preferences for app resources (e.g., sound, content, and notifications)?	2.8	1.5
	Interactivity: Does the app allow user participation, provide feedback, and contain prompts (reminders, sharing options, notifications, etc.)? Note: To be perfect, these functions need to be customizable and not overwhelming.	2.7	1.2
	Target audience: Was the application content (visual information, language, design, etc.) appropriate for you?	3.2	1.3
	Overall engagement score	2.7	1.1
Section B—functionality	Performance: How accurately/fast do the app features (functions) and components (buttons/menus) work?	2.8	1.3
	Ease of use: How simple it is to learn how to use the app; clarity of menu labels/icons and instructions?	2.6	1.6
	Navigation: It is the movimentation through screens in a logical/precise/adequate/uninterrupted way; all buttons/links are present and work?	2.9	1.4
	Gestural design: Are the interactions (switch/slide/pinch/scroll) consistent and intuitive in all components/screens?	3.2	1.4
	Overall functionality score	2.8	1.2
Section C—aesthetic	Layout: Are the arrangements and the buttons/icons/menus/content size appropriate or with zoom, if necessary?	3.0	1.3
	Graphs: What is the quality/resolution of graphics used for buttons/icons/menus/content?	3.1	1.4
	Visual appeal: What does the app look like?	3.0	1.3
	Overall aesthetic score	3.0	1.3
Section E—quality	Would you recommend this app to people who could benefit from it?	3,1	1.6
	How many times do you think you would use this app in the next 12 months if it was relevant to you?	3.0	1.4
	Would you pay for this app?	2.2	1.6
	What is your overall star rating for this app?	3.1	1.1
	Overall quality score	2.9	1.3
Section F—specificity	Awareness: This app will likely raise awareness of the importance of addressing a healthy lifestyle.	3.4	1.4

(continued)

Table 2. Continued.

		Mean	SD
	Knowledge: This app will likely increase knowledge/understanding about healthy lifestyle	3.6	1.5
	Attitudes: This app will likely change attitudes toward lifestyle improvement	3.6	1.5
	Intent to change: This app will likely increase intentions/motivation to change lifestyle	3.6	1.5
	Help search: Using this app will likely encourage more help in your quest for a healthy lifestyle.	3.4	1.4
	Behavior change: Using this app will likely improve users' lifestyle.	3.6	1.5
	Overall specificity score	3.5	1.5

The MARS responses for each question are obtained through a five-point Likert scale ranging from 1 to 5. The Section score is calculated by summing up the answers and dividing by the number of questions in the respective section.

Table 3. Retention and adherence. App VIVA!, Rio de Janeiro, 2023.

Retention			
Week	Feedbacks	*N* in the week[a]	Retention (%)
4	4	63	6.3
8	3	39	7.7
12	1	22	4.5
Week	**Mean accepted challenges**		**Adherence**
12	**1.3**		**11.2%**

aNumber of participants at Weeks 4, 8, and 12.

number of individuals that need to be reached to achieve meaningful adoption of DHIs. Second, apps must undergo continuous evaluation and updates, which require sustained resources. Third, interventions without a specific target population are more likely to attract women and middle-aged individuals. Fourth, most users are likely to stop using the apps after a few weeks. Finally, stronger regulations are needed to prevent the proliferation of ineffective or misleading apps, which is particularly important given the ongoing issue of misinformation in today's society.

Conclusion

The findings underscore critical challenges and valuable insights for the future development and implementation of DHIs within public health systems, especially in countries with significant social disparities. Moving forward, it is crucial to address digital access inequities and strengthen regulations to ensure the effectiveness and equitable impact of such interventions.

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Informed consent: Individuals accessing the app were asked to provide an e-mail or telephone number, through which the informed consent form (ICF) would be received. The ICF contained an individual access link, which was valid for two hours. By clicking on the link, the user expressed their understanding and confirmed their interest in participating.

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