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RESEARCH

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MOBILE APPLICATIONS ON HIV/AIDS: A TECHNOLOGICAL PROSPECTION

Aplicativos móveis sobre o HIV/aids: uma prospecção tecnológica

Aplicaciones móviles sobre VIH/sida: una prospección tecnológica

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ABSTRACT

Objective: to identify applications, available for brazilian culture, that promote knowledge or information about HIV/AIDS. **Method:** technological prospecting study carried out through documentary research with a qualitative approach. The search for applications was carried out through access to the Apple Store and Google Play virtual stores in January 2019. The search strategy used the terms: HIV and AIDS. The organization of the data was carried out from a list with the applications and their characteristics. **Results:** 19 applications were identified in the Apple Store and 13 in Google Play. In both virtual stores, applications were identified aimed at the population using health systems, health professionals and the general population, which promote access to information related to the HIV / AIDS theme. **Conclusion:** the applications have the potential to contribute to the control of HIV / AIDS in the country through the combined prevention approach.

DESCRIPTORS: Biomedical technology; Mobile application; Software; Acquired immunodeficiency syndrome; Health education.

RESUMO

Objetivo: identificar aplicativos, disponíveis para a cultura brasileira, que promovam conhecimentos ou informações acerca do HIV/Aids. **Método:** prospecção tecnológica realizada através de pesquisa documental com abordagem qualitativa. Foi realizada a busca por aplicativos através de acesso as lojas virtuais Apple Store e Google Play em janeiro de 2019. Na estratégia de busca utilizou-se os termos: HIV e aids. A organização dos dados foi realizada a partir de uma listagem com os aplicativos e suas características. **Resultados:** foram

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identificados 19 aplicativos na loja virtual *Apple Store* e 13 na *Google Play*. Em ambas as lojas virtuais foram identificados aplicativos voltados a população usuária dos sistemas de saúde, profissionais da saúde e população em geral, que promovem o acesso as informações relacionadas ao tema HIV/Aids. **Conclusão:** os aplicativos apresentam potencial para contribuir no controle no HIV/aids no país através da abordagem a prevenção combinada.

DESCRITORES: Tecnologia biomédica; Aplicativos móveis; Software; Síndrome de imunodeficiência adquirida; Educação em saúde.

RESUMEN

Objetivo: identificar aplicaciones, disponibles para la cultura brasileña, que promuevan el conocimiento o la información sobre el VIH / SIDA. **Método:** estudio de prospección tecnológica realizado mediante investigación documental con enfoque cualitativo. La búsqueda de aplicaciones se realizó a través del acceso a las tiendas virtuales *Apple Store* y *Google Play* en enero de 2019. La estrategia de búsqueda utilizó los términos: VIH y SIDA. La organización de los datos se realizó a partir de una lista con las aplicaciones y sus características. **Resultados:** se identificaron 19 aplicaciones en *Apple Store* y 13 en *Google Play*. En ambas tiendas virtuales, se identificaron aplicaciones dirigidas a la población utilizando sistemas de salud, profesionales de la salud y la población en general, que promueven el acceso a la información relacionada con el tema del VIH / SIDA. **Conclusão:** las aplicaciones tienen el potencial de contribuir al control del VIH / SIDA en el país a través del enfoque de prevención combinada.

DESCRIPTORES: Tecnología biomédica; Aplicaciones móviles; Programas informáticos; Síndrome de inmunodeficiencia adquirida; Educación em salud.

INTRODUCTION

Health care institutions have implemented initiatives to identify and provide quality care to people living with HIV (PLHIV), as well as to achieve disease control. These efforts are meeting the 90-90-90 target, which states that by 2020, 90% of people will know their HIV status; 90% of these people will be on treatment; and 90% of people on treatment will reach the undetectable viral load.¹ Brazil supports the fulfillment of these goals, and the Ministry of Health (MH) has developed protocols to assist PLHIV and several actions focused on prevention and treatment.

It is estimated that by the end of 2018, there were approximately 900,000 PLHIV in the country, of which 85% were diagnosed, of which 77% were using antiretroviral therapy (ART), and among these, 95% were with suppression of the viral load,² which demonstrates the need to invest in health care technologies that promote HIV prevention, serologic testing, diagnosis of the disease and its treatment.

The use of mobile telephony and the Internet is growing in people's daily lives and provides tools for engaging in health. As for treatment adherence, for example, several information and communication technologies based on mobile devices have been used by PVHIV: short message service (SMS),³ smartphone applications,⁴ real-time electronic adherence monitoring devices,⁵ among others.

In this scenario, there is a need for technological prospecting studies, since they allow: guiding the development of technologies; incorporating information into the

technological management process in an attempt to predict possible future states of technology or conditions that affect its contribution to society; and providing subsidies to expand the anticipation capacity and stimulate the organization of innovation systems in the business and academic spheres, by seeking to understand the forces that guide the future, aiming at building and mapping the knowledge production chain.⁶

To predict the construction of future technologies in the area of HIV/AIDS care in Brazil and, by identifying mobile applications as a technology used by health system professionals and users to build health knowledge, the object of this study was defined as mobile applications that foster HIV/AIDS control in society. Given the above, this study aims to identify mobile applications, available for Brazilian culture, that promote knowledge or information about HIV/AIDS.

METHOD

Technological prospecting carried out through documentary research with a qualitative approach. The technological prospecting followed four phases: 1) preparatory: definition of the objective, scope, approach and methodology; 2) pre-prospective: details of the methodology and survey of the data source; 3) prospective: collection, treatment and analysis of the data; and 4) post-prospective: communication of the results.

The technological prospecting is a study that allows the identification and evaluation of the state of the art regarding the current technologies and uses the documental research as a method for the explanation of primary documents (in this case, the mobile applications), formation of a panorama on the subject and, then, help in the decision process regarding the technologies to be produced.⁸

The data was collected in January 2019. The search for applications was made through access to *Apple Store* virtual stores, on January 12, 2019, and *Google Play*, on January 17, 2019, chosen for the diversity of platform features, and for being prevalent in smartphone availability. The applications were captured by each virtual store, on an individual basis, with no store being pre-defined to start and/or end.

The inclusion criteria were: applications that address the theme of HIV/AIDS with a focus on its treatment and control, either through health education for professionals or patients, clinical simulation, virtual patients, nurses or virtual doctors, serious games, self-monitoring of medication, among others; and applications in the Portuguese language. Exclusion criteria: applications on scientific events aimed at professionals, which did not report in their description that would bring the availability of the scientific publications of the event; guidelines and clinical protocols not Brazilian. The keywords used in the search strategy were: HIV and AIDS.

After the search terms were applied: a) *Google Play*: HIV (250 results) and AIDS (249 results); b) *Apple Store*: HIV (658 results) and AIDS (1536 results). The inclusion and exclusion criteria were then applied. Thus, 13 applications were captured in *Google Play* and 19 applications in the *Apple Store*.

The data was organized from a list with the applications and their attributes. The information collected were: name; category; compatibility; acquisition (paid/free); characteristics; developer; evaluation (scale of virtual stores from 1 to 5 points); and comments from users. The critical evaluation of the applications was based on and discussed with primary studies and available literature, based on the information relevant to the subject in its study context. A comparative qualitative analysis was performed, identifying the functions developed in the applications, their scope, and potential for use.

This study did not require the evaluation of the Research Ethics Committee, as it was performed from freely available data.

RESULTS

The Apple Store has identified applications aimed at healthcare users, healthcare professionals, and the general population. Targeting healthcare professionals, the following applications were identified, all of which are available free of charge, along with the specification: 1. Adult PCDT: provides the Clinical Protocol and Therapeutic Guidelines (PCDT), produced by the Ministry of Health, in the whole and via platform, which establishes the recommendations for the management and care of PLHIV; 2. PCDT TV: provides the Vertical Transmission PCDT, produced by the Ministry of Health, in a practical platform, simple and easy to consult; 3. TV-SP: directed to Primary Health Care (PHC) professionals and maternity hospitals in São Paulo, aims to provide technical information on the vertical transmission of HIV, syphilis and viral hepatitis to support decision-making from prenatal to puerperium; 4. PEP-tec: assists health care professionals in assisting people who have experienced potential risk of HIV infection; 5. PCDT prep: provides a document produced by the MH that establishes recommendations for the use of pre-exposure prophylaxis (PREP); and 6. EoHIV: assists in the treatment of occupational exposure to HIV. It targets health care professionals and aims to provide information for workers to increase their self-care capacity and improve antiretroviral adherence during post-exposure prophylaxis (PEP).

As for applications targeting the health system population, there have been applications that address PLHIV and those that may be at risk for sexually transmitted infections (STI's). The following applications were identified, along with their specification: 1. Hzone: community for singles and gay men living with HIV/AIDS; 2. Hive - friends of life: a platform for relationships, seeking the democratization of access to information and the promotion of forms of acceptance; 3. Viva Bem: allows the registration of drug reminders, tests and vaccines, view details of drugs and schemes, access test results, view graphs of treatment evolution, information and news on the subject; and 4. Take good care of yourself: help people with HIV and Hepatitis C to administer their routine with medications and tests. It offers tips on rights, agendas, alerts and treatment follow-up. Among the four applications, "Live Well" and "Take Good Care" are available for free, "Hzone"

has a paid version and another free and "Hive- friends of life" is available only through payment.

With regard to applications aimed at people who may be at risk for STI's, the following were detected: 1. it is in hand: it presents a questionnaire with simple questions and, at the end, it is possible to analyze the degree of risk and obtain information on STI's, HIV/AIDS, location and addresses of health services in the city of São Paulo, where condoms, tests and PEP can be obtained; 2. it is in hand: it presents a questionnaire with simple questions and, at the end, it is possible to analyze the degree of risk and obtain information on STI's, HIV/AIDS, location and addresses of health services in the city of São Paulo, where condoms, tests and PEP can be obtained; 3. it is possible to obtain information on the STI's, the STI's, the STI's, the STI's and the STI's. The time is now: it offers men who have sex with men, adults, residents of Curitiba/PR the possibility to know their HIV serological status (user can request a free HIV self-test kit, which is delivered by mail to any address in the city or generate a code to pick up the kit at a counseling and orientation center or know in which health units the test is performed). It informs about STI and AIDS prevention and allows the user to calculate the risk of HIV infection associated with their sexual practices; 3. PEP: presents SUS users with the sites and health equipment they should use for the immediate initiation of PEP; and 4. Here is a condom: focuses on HIV/AIDS and STI prevention, aims to bring the population closer to condoms and other combined prevention and public health services, and assist municipal and state health departments in their prevention campaigns. The four applications mentioned are available free of charge.

Applications aimed at the general population include: 1. HIV & AIDS researcher: global research on HIV & AIDS trends; 2. HIV/AIDS virus, and 3. HIV/AIDS Info and 4. HIV/AIDS Guide: these last three bring photo collection and information about the HIV/AIDS virus; and 5. The positive Project: fighting HIV stigma and promoting information about the virus. Only the last mentioned application is available for free.

As for the category, they were classified in: social networks (Hzone and Hive - friends of life), medicine (PCDT Adult, Viva Bem, A hora é agora, Cuide-se bem, TV-SP, PEP-tec, EoHIV, PCDT Prep and PCDT TV), health and fitness (Tá na mão, PEP, Aqui tem condom, HIV/AIDS Guide), reference (HIV & AIDS Researcher), education (HIV/AIDS Vírus), utilities (HIV/AIDS Info) and lifestyle (The positive project).

As for compatibility, four were compatible with IOS 6.0 or later, one with IOS 7.0 or later, five with IOS 8.0 or later, eight with IOS 9.0 or later, and one with IOS 10.3 or later. Regarding the form of acquisition, it was noted that one application had a free version and another for subscribers (paid), five are paid and 13 are free.

Of the applications, 15 received no evaluation. The evaluations are quantified from 1 (lowest score) to 5.0 (best score). The application "Hzone" received an evaluation score of 3.0, the "Live well" 3.5, the "Adult PCDT" and "PCDT prep" score of 5.0.

Of the applications evaluated, three received opinions from users: 1. "Hzone": restrictions for non-subscribers,

exorbitant value for subscribers (comments in 2017 and 2018); people from different states, making face-to-face meetings difficult (2017); 2. “Live Well”: When removing a medicine from the list, it continues every day announcing the time of taking it (2016); practical and useful (2016); every day there are alarms, warnings, and thus, considering that HIV patients can make use of prophylactics for a period of time, it meant that when the prophylaxis is suspended, the alarms continue (2016); there are no test results (SUS) and no drug dispensations (2019); when the medication is excluded, reminders continue to appear on the cell phone and the warning about the end of the medication does not work (2019); and 3. “Adult PCDT”: “bugado”, concertar logo (2015); complete and didactic material (2015); MS shows its capacity to disseminate knowledge related to the management of patients in SUS by bringing to IOS the entire PCDT booklet (2017).

Of the 13 applications captured in Google Play, applications were also identified that target the population that uses health systems, health professionals and the general population. Among the applications aimed at health professionals, four are the same ones already mentioned at the Apple Store (PCDT Adult, PCDT Prep, PCDT TV and TV-SP), but developed for the Android model. In addition, the “HIV App” application, developed based on the PCDT for the management of HIV infection in adults, was found to help physicians in the care of patients with HIV diagnosis. All applications are available for free.

In applications targeting the population using health systems, the availability of applications addressing PLHIV and those that may be at risk for STIs was again verified. The applications targeting PLWHA, along with their specification, were: 1. Hive: same specification as the “Hive - friends of life” available at the Apple Store; 2. HIV/TARV: dissemination of content and awareness of the importance of antiretroviral treatment; 3. Take Good Care of Yourself: an initiative of the STI/AIDS-SP Reference and Training Center, helps people with HIV and Hepatitis C to administer their routine with medications, tests, in addition to providing welfare tips and information about rights; works as a diary, with alerts and reminders, with space to record side effects and follow the step by step treatment itself. All three applications are available free of charge.

About the applications aimed at people who may be at risk for STIs, the “You’re in the Hand”, “The Time is Now” and “PEP-tec” applications were detected, all with the same specification as those of the same name available at the Apple Store and free.

With regard to applications aimed at the general population, the free Educ@aims application was identified, which seeks to inform the population about HIV. It contains a concept about the virus and its difference from AIDS, the stages of exposure and risk until the disease occurs, transmission routes, existing forms of prevention for each lifestyle, information about the importance of adherence to treatment, myths and taboos on the subject and places of support and assistance in the State of Piauí. One of the applications, named AIDSApp, also free of charge, brings

information about the disease, the importance of treatment and of knowing the serological status of the disease early, as well as the importance of condom use. It does not make clear what its purpose and the tools it provides.

As for the category, they were classified in: medicine (HIV App, AIDSApp, PCDT Adult, TV-SP, Take Good Care, PCDT Prep, PCDT TV), health and fitness (Tá na mão, HIV/TARV, A hora é agora, Educ@aims, PEP tec), entertainment (Hive). Regarding compatibility, one was compatible with Android 2.1 or higher, one with Android 4.0 or higher, one with Android 4.0.3 or higher, six with Android 4.1 or higher, three with Android 4.4 or higher and one with Android in which version varies according to the device.

Of these applications, nine received evaluation: a) 5.0: HIV App, AIDSApp, Hive, PEP tec; b) 4.9: TV-SP; c) 4.5: Ta in hand; d) 4.4: The Time is now; e) and 3.9: PCDT Adult.

The following opinions were expressed: 1. the HIV app: the technology is objective and clear, facilitates day-to-day consultation, and helps health professionals and patients (2018); 2. AIDSApp: the app is informative, practical and effective (carried out between 2014 and 2017); 3. it is in hand: users congratulate São Paulo for the initiative and the information provided (2015 and 2018); the app could also map the metropolitan region (2017); the description of people with the highest rate of STDs and AIDS is not reliable (2015); 4. Adult PCDT: users report that the texts are cohesive and useful for people living with HIV/AIDS, all citizens and family members, but some users report, in 2015, problems with the screen, scrolling the text and the presentation of tables; in 2017, users report that the problem in scrolling the text was corrected, but there is a complaint of difficulty in installing the application and the report persists that the screen was all blank.

DISCUSSION

The present study identified the use of mobile applications in order to provide quick and easy access to protocols and guidelines (most of which are authored by the MH) that collaborate for clinical decision making.

Protocols and guidelines are built through evidence-based clinical practice and make it possible to optimize health care by implementing valid recommendations for specific conditions that meet the health needs of the population, which contributes to patient safety.⁹⁻¹⁰

The Clinical Protocol and Therapeutic Guidelines for the Management of HIV Infection in Adults (PCDT) was an initiative in 2013 in which Brazil became the first developing country and the third in the world to recommend immediate initiation of antiretroviral treatment (ART) for all PLWHA, regardless of the CD4 count.¹¹ With the advances in the care of PLWHA since 2014, the management of HIV infection in PHC is encouraged, considering the complexity of the actions and the need for referral to the specialized care service (SAE) when necessary.¹² From this PCDT, others were implemented by the MH, collaborating with the goal 90-90-90.

Healthcare professionals who work in PHC and who are in the process of professional qualification and continuing

education in service in order to offer assistance, find in these applications the necessary clinical protocols and guidelines to support their conduct. When providing health care to PLWHA, professionals can access the Adult PCDT via mobile phone, for example, to help define drug and non-drug treatment, as well as request pertinent tests and schedule returns to health services.

Treatment control applications have also been identified. Some studies demonstrate that PLWHA evaluate these technologies in a positive way in involving health care,⁴ as well as enabling self-monitoring of treatment¹³⁻¹⁴ and health education for greater understanding of HIV and treatment.¹⁵ There is still the possibility to address beyond adherence to these technologies, such as mental health,¹⁶⁻¹⁷ substance use and risky sexual behaviours.¹⁶ These applications generally seek to enhance higher levels of adherence to ART, which will have an impact on reducing the viral load.

In short, the applications addressed combined prevention, which consists of the implementation of different prevention actions based on different categories of interventions: a) biomedical: aimed at reducing the risk of exposure, such as: distribution of male and female condoms; provision of testing; ART for all PLWHA; PEP; PrEP; and treatment of STIs. All of the examples cited have been addressed by some of the applications, contributing to people's access to such forms of prevention; b) behavioural: strategies that contribute to increasing information and risk perception about exposure to HIV and its consequent reduction through incentives for behavioural changes in the individual and the community; c) structural: strategies to address sociocultural factors and conditions that directly influence the vulnerability of individuals or specific social groups to HIV, such as any form of alienation from fundamental rights and guarantees to human dignity.¹⁸ In the meantime, the applications that addressed legal issues are highlighted, as well as the socialization among peers with a focus on debureaucratization of access to information and acceptance.

Brazilian data points out that treatment adherence is the goal 90-90 which is less than desired.² Qualification and professional support contribute to assertive behaviors that may have a positive impact on treatment adherence. It is interesting to note that few applications focus on IVP HIV, and even fewer those focused on ART adherence.

Regarding the rating of the applications, it was scored that those available on the Google Play platform, even when they had a version in the Apple Store, had more ratings and opinions, which suggests greater use of the applications available in Google Play. This reality can be explained by the high value of iOS devices in Brazil, when compared to the Android operating system.

As for users' comments regarding the applications available at the Apple Store, sometimes some applications have had negative opinions regarding the same problems in different years, which supposes that the operating system is not updated in order to solve issues related to user experience and usability of the technology. The applications "Live Well" in the Apple Store and the "Adult PCDT" in Google Play, both developed by MS, despite having been well evaluated in most of the

comments, some received criticism due to difficulties in the scrollbar and screen viewing, as well as for functions that were triggered by the application in a way inappropriate to the reality of its user. In both situations, the problems negatively impact the user experience and the usability of the technology.

It is considered relevant the absence of applications that use gamification to interact with their users. Gamification consists of the use of game-related elements for the development of applications in order to motivate individuals to take action, assist in problem solving and promote learning.¹⁹ It presupposes the use of: a feedback system, a reward system, cooperation, competition, objectives, clear rules, levels, trial and error, fun, interaction, among others.²⁰ This technique has the potential to encourage the adoption of desirable behaviors in the context of real life, however, due to the lack of studies on gambling in the health area, it is necessary to create e-Health solutions through well founded theories that explore the central experience and psychological effects of game mechanics.²¹

It is important to compare the data from this study with recently published research that identified applications with HIV in the world context, available on Google Play and iTunes platforms in all languages, from August to September 2017, which identified 21 applications available in the Portuguese language on Google Play and 14 applications available in the Portuguese language on iTunes, of which 15 were produced in Brazil.²² In the present study, which had its data collection carried out in January 2019, it calls attention to the fact that there was no significant increase in applications available in the Portuguese language, nor in those produced in Brazil, although some applications previously available are not currently found in these online stores.

CONCLUSION

This study identified the applications available for Brazilian culture that promote knowledge or information about HIV/AIDS. It was found that these technologies are targeted at health professionals, PLWHA, people at risk for STIs and the general population, as well as meeting combined prevention strategies in their three categories of interventions (biomedical, behavioral and structural), with the potential to cooperate in achieving the goal 90-90-90. It is recommended to produce application-type technologies for mobile devices that are made available free of charge for use by PLHIV and that will collaborate with treatment adherence. It is also necessary that the developers of the technologies perform updates according to the needs pointed out by the users in the sense of enabling better user experience and usability of the product.

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