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Effect of mobile application use on knowledge about human immunodeficiency virus among university students

Efeito do uso de aplicativo móvel no conhecimento sobre vírus da imunodeficiência humana entre universitários

Efecto del uso de aplicaciones móviles en el conocimiento sobre el virus de la inmunodeficiencia humana en estudiantes universitarios

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ABSTRACT

Objective: To evaluate the effect of using a mobile application on knowledge about human immunodeficiency virus among university students.

Method: A before-and-after intervention study, with 196 university students, from August to December 2018. The intervention consisted of using the educ@aids mobile application for 15 days. Univariate analyzes were performed using simple descriptive statistics and the McNemar test was used to compare knowledge before and after the intervention.

Results: There was an improvement in knowledge after using educ@aids in the variables related to knowledge about the transmission of the virus; knowledge about treatment, cure and prevention; knowledge of other information about human immunodeficiency virus.

Conclusion: The use of educ@aids increased knowledge about the human immunodeficiency virus among health university students.

Keywords: Acquired immunodeficiency syndrome. Knowledge. Mobile applications. Smartphone. Students. Information technology.

RESUMO

Objetivo: Avaliar o efeito do uso de aplicativo móvel no conhecimento sobre vírus da imunodeficiência humana entre universitários.

Método: Estudo de intervenção do tipo antes e depois, com 196 universitários, no período de agosto a dezembro de 2018. A intervenção consistiu no uso do aplicativo móvel educ@aids por 15 dias. Foram realizadas análises univariadas, por meio de estatísticas descritivas simples e para comparação do conhecimento antes e após intervenção foi utilizado o Teste de McNemar.

Resultados: Houve melhora no conhecimento após uso do educ@aids nas variáveis relacionadas ao conhecimento acerca da transmissão do vírus; conhecimento acerca do tratamento, cura e prevenção; conhecimento de outras informações sobre o vírus da imunodeficiência humana.

Conclusão: O uso do educ@aids aumentou o conhecimento sobre o vírus da imunodeficiência humana entre os universitários da saúde.

Palavras-chave: Síndrome de imunodeficiência adquirida. Conhecimento. Aplicativos móveis. Smartphone. Estudantes. Tecnologia da informação.

RESUMEN

Objetivo: Evaluar el efecto del uso de una aplicación móvil en el conocimiento sobre el virus de la inmunodeficiencia humana entre estudiantes universitarios.

Método: Estudio de intervención antes y después, con 196 estudiantes universitarios, de agosto a diciembre de 2018. La intervención consistió en utilizar la aplicación móvil educ@aids durante 15 días. Se realizaron análisis univariados mediante estadística descriptiva simple y se utilizó la prueba de McNemar para comparar conocimientos antes y después de la intervención.

Resultados: Hubo una mejora en el conocimiento después de usar educ@aids en las variables relacionadas con el conocimiento sobre la transmisión del virus; conocimiento sobre tratamiento, cura y prevención; conocimiento de otra información sobre el virus de la inmunodeficiencia humana.

Conclusión: El uso de educ@aids incrementó el conocimiento sobre el virus de la inmunodeficiencia humana entre estudiantes universitarios de la salud.

Palabras clave: Síndrome de inmunodeficiencia adquirida. Conocimiento. Aplicaciones móviles. Teléfono inteligente. Estudiantes. Tecnología de la información.

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INTRODUCTION

There is a downward trend in the incidence of Human Immunodeficiency Virus (HIV) infection, both in Brazil and in other countries, in the general population. On the other hand, some social segments have higher rates of infection, revealing a concentrated and rising epidemic, especially in key populations. Moreover, there is a concern with priority populations, as their susceptibility makes them vulnerable to HIV, such as young people, blacks, indigenous people and homeless individuals[1].

Among the priority populations, young people account for a significant percentage in the number of cases of infection. It is noteworthy that the age group of 25-39 years has the highest concentration of cases of Acquired Immunodeficiency Syndrome (AIDS) in Brazil, corresponding to 52.1% of male cases and 48.1% of female cases. There was also an increase in the infection detection rate in young people aged 15-19 years (64.9%) and 20-24 years (74.8%) in the last 10 years[2].

As university students are mostly young individuals, aged between 15 and 29 years, as defined by the Youth Statute, health actions targeted to this particular group are necessary. Although university students in the health area have more knowledge about HIV/AIDS compared to students of other areas, there are still substantial deficits in their knowledge on the subject[3].

Therefore, mobile health technologies (mHealth) have been used to support HIV/AIDS prevention as they are considered innovative strategies, which effectively promote adherence to health promotion strategies, especially for risk reduction and control of HIV/AIDS in a key and priority population[4]. Thus, given that smartphone use is more common among young people, the incorporation of educational technologies, especially in mobile health, can be used as a tool for health education of this population[5–6].

In this regard, the use of mobile applications has been increasingly used to promote health education, as it is a strategy more attractive to young people[5] However, few studies have investigated the effect of the use of these applications with a focus on HIV/AIDS prevention among university students, especially in Brazil. Thus, the present study can contribute to the improvement of more effective strategies for the prevention of HIV/AIDS among young people, providing knowledge about innovative resources available on the subject and encouraging their use, as they are more accepted by this population.

This study may also support other studies and the elaboration of HIV/AIDS prevention plans, in order to assist managers, health and education professionals, in the elaboration of more effective methodologies and tools aimed at health promotion and disease prevention among the target population.

Thus, the following research question emerged: "What is the effect of using a mobile application on knowledge about the human immunodeficiency virus among university students?"The aim of the study was, therefore, to evaluate the effect of using a mobile application on knowledge about the human immunodeficiency virus among university students.

METHOD

A before-and-after intervention study, with a single group of university students, which consists of the description of an action and evaluation of the effects after its implementation[7]. It was conducted in a public university located in the city of Teresina, state of Piauí, Brazil. It is the largest campus in Piauí, concentrating a large proportion of students enrolled.

The population consisted of 1,275 university students in the health area enrolled in Nursing, Pharmacy, Medicine and Dentistry courses. Students from the referred courses were selected because they are more familiar with HIV-related issues, and thus need scientifically accurate knowledge, for their use and also for the assisted population.

To calculate the minimum required sample of students, proportional stratified probability sampling was used[8]. Initially, the number of students enrolled in the Coordination of Evaluation and Statistics of the institution was calculated, based on the population of 1,275 students enrolled in the four undergraduate courses selected for the study. The significance level =0.05, $1-\beta$=0.90 was considered in sample size calculation. It was assumed that 1% of the participants would not have gained knowledge and 10% would have gained knowledge after the intervention, resulting in 113 participants. A rate of 11% was applied to recompose the sample, assuming that 10% of the sample would be lost during the research and, due to the effect of the sample design, the design effect (DEFF) =1.4 was applied. Thus, the minimum final sample size was 176 participants (41 students from the nursing course (2 classes), 33 from the pharmacy course (2 classes), 66 from the medicine course (3 classes) and 36 from the dentistry course (2 classes).

The distribution of students by course was proportional and the classes of each course were randomly selected, using the R software version 3.4.0. Thus, based on the fact that each class has an average of 22 students, all university students from each selected class who were willing to participate were included, resulting in a final sample of 196 participants.

The following inclusion criteria were adopted in the study: health university student regularly enrolled in the academic year who possesses a mobile device with an Android platform

with internet access. The exclusion criterion was individuals under 18 years old, taking a course related to infectious diseases at the time of the study, and the discontinuity criterion was students not present at all stages of the study.

Data was collected from August to December 2018. Visits were made to the departments of the relevant courses, to inform the coordinators/professors of the courses and the classes chosen in a draw about the research, as well as for inviting the students to participate and discussing aspects related to the logistics of data collection, which took place on previously scheduled days and times, in order to guarantee equal opportunities for participation to the students in the classes. Anonymity and confidentiality of the information provided were guaranteed.

Data collection was divided into three stages: pre-intervention, educational intervention and post-intervention. In the first stage, called pre-intervention, a pre-test questionnaire to characterize sociodemographic, behavioral, sexual practices and knowledge about HIV was administered in person to the students who agreed to participate in the study, after the signing of the Free Informed Consent Form. Participants were instructed to answer the questionnaire based only on their own knowledge. Consulting publications on the topic was not permitted. The average time for filling out the questionnaire by university students was thirty minutes.

The data collection instrument was a questionnaire adapted from a study entitled: "Knowledge about HIV/AIDS among men who have sex with men in 10 Brazilian cities"[9]. Knowledge about HIV was the dependent variable chosen, measured from 15 items contained in the questionnaire, which have three response options: yes (agree), no (disagree) and don't know. Thus, the items include questions related to knowledge about the transmission of the HIV virus; knowledge about the treatment, cure and prevention of HIV/AIDS; knowledge of other information about HIV/AIDS. Correct answers received a score of "one" and incorrect answers and don't know, "zero". Thus, the global assessment of knowledge about HIV/AIDS was obtained with the sum of all items (minimum possible value 0, maximum possible value 15).

Classification of knowledge was established as follows: "Low level of knowledge" (lower 25 percentile), "medium level of knowledge" (≥ 25th to ≤ 75th percentile) and "high level of knowledge" (> 75th percentile). That is, for the 15-item questionnaire, a rate of up to 3 correct questions indicates low level, 4 to 11 correct answers – medium level, and 12 to 15 correct answers – high level[9].

Independent variables were aspects related to sociodemographic characteristics and other personal information, namely: age, gender, marital status, race, family income, internet access, frequency of internet access, internet access content, conversation about sex or sexuality with the parents, conversation about sex and HIV prevention with friends/colleagues, sexual intercourse, first intercourse, HIV test, HIV testing site, diagnosis of sexually transmitted infection (STI) in life, purchase of condoms, sources of information, HIV prevention strategy, HIV vulnerability.

To optimize data collection time and avoid sample loss, participants were trained and familiarized with the use of the application. Pamphlets with the tutorial and guidelines for downloading and browsing "educ@aids" were also handed to them. Thus, the university students accessed the Android platform in the virtual store "Play Store", searched for the "educ@aids" application and downloaded the application.

The second stage consisted of the educational intervention, that is, the use of the educ@aids mobile application for 15 days. Students were told to search for HIV information only on the app during the survey. A minimum time for accessing the application was not established, and participants were instructed to explore all the information contained in the application through spontaneous demand during the intervention period. The Educ@aids mobile application consists of a software validated in 2018 for quality and usability by 10 judges, of which five were infectious disease physicians and five were IT professionals that were systems analysts with experience in software programming[10].

The purpose of Educ@aids is to promote health education regarding HIV/AIDS and improve knowledge about this infection. In this regard, it addresses concepts and makes a distinction between HIV and AIDS, presents the stages of exposure and risk until the onset of the disease, the transmission routes, the existing forms of prevention according to each lifestyle, reports on the importance of adherence to the treatment, myths and taboos surrounding this theme and services that provide support and assistance in the State of Piauí[10].

In the third stage, called post-intervention, the participants answered the questionnaire again so that changes in their knowledge could be identified after the intervention. The questionnaire was completed individually, in the classroom, and consulting information on the topic was not permitted. Anonymity and confidentiality of the information provided was guaranteed. After completing the questionnaire, the participant placed the document in a box.

Data were double entered into Excel, imported and analyzed using the Statistical Package for Social Science (SPSS) version 20.0 software. Absolute (n) and relative (%) frequencies, measures of position (mean, minimum and maximum) and dispersion (standard deviation) for the data from the sociodemographic characterization and intervention instrument were calculated. In the evaluation of the efficiency

of the application, McNemar test was performed to verify if there were changes in the classification of knowledge before and after the intervention. Statistically significant differences (p-values ≤ 0.05) were considered.

The project was approved by the Research Ethics Committee (CEP) of Universidade Federal do Piauí under Protocol no 2504918 and CAAE: 82401918.8.0000.5214. All participants were informed about the benefits and risks of the research and signed the informed consent in two copies: one was delivered to the participant and the other was kept by the researcher.

RESULTS

In the first stage of data collection there were 224 university students. Of these, three were excluded because they reported losing their smartphone during the intervention period and 25 were excluded because they were absent from the classroom in the second stage of data collection when the post-test questionnaire was applied. Thus, 196 students completed all stages of the study, as follows: 59 students from the nursing course, 33 from the pharmacy course, 67 from the medical course and 37 from the dentistry course.

Regarding the characterization of the students, 53.6% (105) university students in the sample were female, mean age of 21.4 (±3.5) years, minimum age of 18 years and maximum of 38 years, 92.9% (182) were single, 62.2% (122) of mixed race, with a mean family income of BRL 3,814.55, standard deviation of BRL 4,342.26. It was found that 55.6% (109) access the internet for more than five hours a day, 84.2% (165) access the internet via cell phone and 81.6% (160) access social networks.

As for the effects of using the Educ@aids application, there was a significant change (p<0.05) in the knowledge of the items: "a person can get HIV if they use public restrooms", with 80.1% correct answers in the pre-test and 94.9% in the post-test; "a person can get HIV if they share cutlery, glasses, or meals", with 92.3% in the pre-test and 99.5% in the post-test and the anal route is the main route of HIV transmission, with 34 .2% accuracy in the pre-test and 55.6% in the post-test, as shown in Table 1.

Regarding knowledge about the treatment and cure for HIV/AIDS, there was a significant difference in the items: "an HIV-infected person who is taking AIDS medication has

Table 1 – Knowledge of university students about the transmission of the HIV virus before and after the intervention. (n=196). Teresina, Piauí, Brazil, 2019

Variables	Pre-test n (%)	Post-test n (%)	Total n (%)	p* value
A person can get HIV if they use public restrooms.				
Hit	157 (80.1)	186 (94.9)	343 (87.5)	<0.001
Miss	39 (19.9)	10 (5.1)	49 (12.5)	
A person can get HIV if they share cuttlery, glasses or meals.				
Hit	181 (92.3)	195 (99.5)	376 (95.9)	0.001
Miss	15 (7.7)	1 (0.5)	16 (4.1)	
A person can get HIV if they share instruments for drug use.				
Hit	190 (96.9)	195 (99.5)	385 (98.2)	0.125
Miss	6 (3.1)	1 (0.5)	7 (1.8)	
A person can get HIV if they are bitten by an insect.				
Hit	165 (84.2)	181 (92.3)	346 (88.3)	0.02
Miss	31 (15.8)	15 (7.7)	46 (11.7)	
A person can get HIV if they don't use condoms during sex.				
Hit	194 (99)	193 (98.5)	387 (98.7)	1
Miss	2 (1)	3 (1.5)	5 (1.3)	

Table 1 – Cont.

Variables	Pre-test n (%)	Post-test n (%)	Total n (%)	p* value
The anal route is the main route of sexual exposure for transmission of the virus.				
Hit	67 (34.2)	109 (55.6)	176 (44.9)	<0.001
Miss	129 (65.8)	87 (44.4)	216 (55.1)	

Source: Research database, 2019.
* McNemar test

a lower risk of transmitting the virus to another person" (p<0.001) with a total percentage of 50% of correct answers in the pre-test and 75% in the post-test; there are medicines for HIV-negative people to take before having sex with other people to prevent HIV infection" (p<0.001), with 19.9% of correct answers in the pre-test and 57.1% in the post-test according to the Table 2.

Table 3 shows that there was a significant difference in the items: "condoms are not the only way to prevent HIV through sexual transmission" (p<0.001) with a total percentage of 37.8% of correct answers in the pre-test and 61 .7% in the post-test; "People with STIs are more likely to get HIV" (p<0.001) with a total percentage of 57.1% of correct answers in the pre-test and 80.1% in the post-test.

Table 2 – Knowledge of university students about the treatment, cure and prevention of HIV/AIDS before and after intervention. (n=196). Teresina, Piauí, Brazil, 2019

Variables	Pre-test n (%)	Post-test n (%)	Total n (%)	p* value
HIV-infected pregnant women treated during prenatal care and delivery are less likely to transmit the infection to the baby.				
Hit	167 (85.2)	177 (90.3)	344 (87.8)	0.110
Miss	29 (14.8)	19 (9.7)	48 (12.2)	
There is a cure for AIDS.				
Hit	176 (89.8)	187 (95.4)	363 (92.6)	0.052
Miss	20 (10.2)	9 (4.6)	29 (7.4)	
An HIV-infected person undergoing treatment has a lower risk of transmitting the virus.				
Hit	98 (50)	147 (75)	245 (62.5)	<0.001
Miss	98 (50)	49 (25)	147 (37.5)	
There are drugs for the treatment of HIV/AIDS to be used after a situation of risk of infection.				
Hit	160 (81.6)	147 (75)	307 (78.3)	0.184
Miss	36 (18.4)	49 (25)	85 (21.7)	
There are medications for HIV-negative people to take before having sex with others to prevent HIV infection.				
Hit	39 (19.9)	112 (57.1)	151 (38.5)	<0.001
Miss	157 (80.1)	84 (42.9)	241 (61.5)	

Source: Research database, 2019.
* McNemar test.

Table 3 – Knowledge of university students about other information about HIV/AIDS before and after the intervention. Teresina, Piauí, Brazil, 2019. (n=196)

Variables	Pre-test n (%)	Post-test n (%)	Total n (%)	p* value
A healthy-looking person may be infected with HIV.				
Hit	193 (98.5)	195 (99.5)	388 (99)	0.625
Miss	3 (1.5)	1 (0.5)	4 (1)	
If a person has sex only with a faithful, uninfected partner, the risk of catching the virus is lower.				
Hit	181 (92.3)	183 (93.4)	364 (92.9)	0.851
Miss	15 (7.7)	13 (6.6)	28 (7.1)	
Condoms are not the only way to prevent HIV through sexual transmission.				
Hit	74 (37.8)	121 (61.7)	195 (49.7)	<0.001
Miss	122 (62.2)	75 (38.3)	197 (50.3)	
People with STDs are more likely to get HIV.				
Hit	112 (57.1)	157 (80.1)	269 (68.6)	<0.001
Miss	84 (42.9)	39 (19.9)	123 (31.4)	

Source: Research database, 2019.
* McNemar test.

In the classification of the level of knowledge about HIV/AIDS, there was a significant increase in the proportion of high level of knowledge post-intervention (72.4% in the post-test compared to 36.2% in the pre-test (p<0.001). Therefore, regarding the medium level of knowledge, there was a reduction, with 63.8% in the pre-test and 27.6% in the post-test. No student had knowledge rated as low.

DISCUSSION

The characterization of the participants of the present study was similar to that of other research with students in the health area, with a predominance of females and young age group[6,11].

Regarding aspects related to the use of the internet by university students, the most commonly used means of access is the cell phone, with an average access time between 3 and 5 hours, similar to findings from other studies[12–13]. Thus, it was found that the cell phone is widely used by young people and is a potential tool to reach this audience, as it is necessary to adapt health actions to the target population so that they are more effective.

As for the knowledge of university students about the theme, initially most had medium knowledge and at the end of the intervention they had high knowledge, thanks to the use of the mobile application. University students must have knowledge on the subject, both for their own benefit and for the benefit of others. Although these students have better access to information on HIV prevention, their knowledge and behaviors related to the topic are still insufficient. A study carried out in China showed concern about knowledge on sex education in the face of HIV, especially related to the means of transmission[14].

A study with 2,432 male university students in which a percentage of correct answers of less than 80% was verified for questions regarding HIV transmission, especially in relation

to transmission through mosquito bites and through kissing, with percentages of correct answers of 75.3 and 69.7%, respectively[15] is consistent with this finding.

A study conducted in Minas Gerais obtained results similar to those of the present study, as it reported that the forms of transmission cited by university students were sharing soap (86%), towels (88%), toilet seats (75%) and through kissing. (60%)[3].

Thus, health actions must be effectively coordinated with higher education institutions, as there is still a misunderstanding of aspects involving HIV/AIDS. However, educational actions aimed at preventing and detecting HIV are more targeted to young people with a low level of education. Therefore, university students who have a higher educational level are often not included in educational activities, although they are in a more vulnerable age group, because it is believed that they have sufficient knowledge about HIV.

The present study also revealed lack of knowledge in the pre-intervention phase about the HIV prevention mechanism, as the university students stated that condoms were the only form of sexual prevention. The Ministry of Health contemplates several HIV prevention methods, including condom use, regular testing for HIV and other STDs, pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP), preventing mother-to-child transmission, treating all people living with HIV/AIDS, harm reduction, immunization against hepatitis B and Human Papillomavirus (HPV), diagnosing and treating people with STDs and HIV[1].

It should be noted that, after using Educ@aids, university students had a significant improvement in their knowledge on the subject, in aspects related to transmission, treatment and prevention, especially regarding the new PrEp and PEP technologies. Therefore, the application can be considered effective as an educational intervention aimed at this audience, since the participants acquired a high degree of knowledge about HIV.

In this regard, mobile applications are increasingly being incorporated as a health education tool. However, there are few apps available related to the prevention of HI/AIDS, especially targeted to university students. A randomized clinical trial that used a cell phone program called Guy2Guy with 302 young people for HIV prevention also showed the potential of the strategy adopted for reaching young people and also improved their sexual behavior, demonstrating that the technology used was accepted by the participants, with a retention rate above 80% and improved condom use among young people[16].

The present study is also corroborated by an intervention with a similar methodology using a smartphone application called "Health Mindr" based on social cognitive theory, with the objective of evaluating the usability and acceptability of a theory-based Android mobile application for HIV prevention among men who have sex with men (MSM). Its main results were satisfactory usability, purchase of condoms and HIV kits by more than half of the participants through the application. In addition, 9% of MSM eligible for PrEP started using this method during the four-month period and the vast majority reported that the application influenced their decision to start using this method[17].

In China, a study with MSM that used the mHealth strategy called Wechat, which consisted of a library of messages to provide information, motivation and behavioral recommendations about the need for regular HIV testing and condom use, increased HIV testing during six months of follow-up compared to the control group[18].

Regarding the improvement in university students' knowledge about HIV/AIDS, after using the mobile application, this improvement was significantly greater among women compared to men. A study shows that women seek more information about health than men. Also, they are more concerned about diseases and develop more actions in the scope of prevention and care[19]. However, a study with adolescents and young adults at a university in Ghana showed that men are more likely to use cell phones for STI education and prevention purposes than women[5].

In this context, the use of smartphones technology for health promotion aimed to improve the knowledge of individuals and help prevent diseases and injuries has been growing in recent years. Cell phones are widely used by young people. Therefore, this mobile technology has good potential for reaching the referred population, which is usually not easily reached by health services[20].

The use of mHealth proved to be an efficient strategy for HIV/AIDS prevention among university students, considering the increase in knowledge obtained in the present study, showing that the mobile application may have attracted young people and had good acceptance among them. A study with university students in Ghana showed that the vast majority of the participants believed that adolescents and young adults would be interested in using cell phones for STD education and prevention, and about 40% of the respondents recommended mobile applications for this purpose[5].

Thus, mobile phones are being used in activities related to the prevention and care of STDs, with a focus on reducing risk behaviors, increasing care retention, medication adherence and clinical follow-up[4,16].

CONCLUSION

It is concluded that the educ@aids mobile application had a positive effect on the knowledge of university students in the health area about the human immunodeficiency virus. There were statistically significant changes in knowledge about transmission, drugs and prevention of the human immunodeficiency virus, which made it possible to increase the level of knowledge from medium to high after the use of the application.

Information biases regarding self-reported answers that addressed aspects related to the health and sexual behavior of young people can be considered a limitation of this study. Moreover, the 15-day interval between the pre- and post-test may have caused testing bias, since university students may have memorized the questions in the instrument.

It is understood that monitoring students' knowledge about the human immunodeficiency virus, with the use of new educational technologies, can minimize their vulnerabilities in relation to the infection. Thus, the contribution of the present study to nursing is the knowledge about an alternative tool for the development of preventive actions, which enables the planning of effective actions to improve health care and face the epidemic with a focus on prevention, especially in populations with difficult access to health services.

Thus, the results of this study point to the need for educational institutions to reexamine their curricula in order to address issues related to sexuality and sexually transmitted infections in the early stages of the course, in order to provide adequate knowledge and, therefore, improve their attitudes and practices. This study suggests the incorporation of actions to prevent sexually transmitted infections among university students, on a regular basis, as well as carrying out testing campaigns in this population, given the low level of knowledge of this population.

It is believed that the use of the educ@aids application can improve human immunodeficiency virus prevention strategies, especially for young people, and should be expanded to university students from all areas of knowledge, as well as to other audiences, as its content is easy to understand and use. It is hoped that the present study can support further research related to the context of mHealth and prevention of the human immunodeficiency virus, as well as knowledge retention after the use of the mobile application and changes in sexual behavior.

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