

Teleconsultation in sexual and reproductive health for young adults through mobile devices: Experience in Colombia

Original Paper

Catalina Lopez¹, MD, MSc; Jose Ignacio Valenzuela^{1 2}, MD, MSc; Daniel Ramirez¹, MD; Arturo Argüello¹, MD, EdM; Juan Pablo Saenz², MSc; Dario Correal², PhD; Roosevelt Fajardo¹, MD, MBA.

1. Center for Innovation and Health Education. Fundacion Santa Fe de Bogota.
2. School of Medicine and Health Sciences. Universidad del Rosario.
3. Systems and Computing Engineering Department. School of Engineering. Universidad de Los Andes.

Corresponding Author:

Catalina Lopez, MD, MSc

Center for Innovation and Health Education. Fundacion Santa Fe de Bogota.

Carrera 7B No. 123-90

Bogota

Colombia

Phone: +571 6030303 ext 5721

Fax: +5712146668

Email: catalina.lopez@fsfb.edu.co

ABSTRACT

Background: Sexual risk behaviors associated with poor information on sexuality have contributed to major public health problems in the area of sexual and reproductive health in teenagers and young adults in Colombia.

Objective: To measure the perception of changes in sexual and reproductive risk behavior after the use of a teleconsultation service via mobile devices in a sample of young adults.

Methods: A before and after observational study was designed, where a mobile application to inquire about sexual and reproductive health was developed. The perception of changes in sexual and reproductive health risk behaviors in a sample of young adults after the use of the application was measured using the validated survey "Family Health International (FHI) – Behavioral Surveillance Survey (BSS) – Survey for Adults between 15 to 40 Years". Non-probabilistic convenience recruitment was undertaken through the study's web page. Participants answered the survey online before and after the use of the mobile application for a six month period (intervention). For the inferential analysis, data was divided into three groups (dichotomous data, discrete quantitative data, and ordinal data), to compare the results of the questions between the first and the second survey. For all tests, a confidence interval of 95% was established. For dichotomous data, the Chi-squared test was used. For quantitative data, we used the Student's t-test, and for ordinal data, the Mann-Whitney-Wilcoxon test.

Results: A total of 257 subjects were registered in the study and met the selection criteria. The pre-intervention survey was answered by 232 subjects, and 127 completely answered the post-intervention survey, of which 54.3% did not use the application, leaving an effective population of 58 subjects for analysis. 53% (n=31) were female, and 47% (n=27) were male. The mean age was 21 years, ranging between 18 and 40 years. The differences between the answers on the first and the second survey were not statistically significant. The main risk behaviors identified in the population were homosexual relations, non-use of condoms, sexual relations with non-regular and commercial partners, the use of psychoactive substances, and ignorance about the symptoms of sexually transmitted diseases and HIV transmission.

Conclusions: Although there were no differences between the pre- and post-intervention results, the study revealed different risk behaviors among the participating subjects. These findings highlight the importance of promoting educational strategies on this matter and the importance of providing patients with easily accessible tools with reliable health information.

KEYWORDS

Mobile health; youth and adolescents; sexual health; telemedicine; remote consultation; Colombia; Latin America.

INTRODUCTION

Sexual risk behaviors associated with poor information on sexuality, such as the early onset of sexual relations and a high number of sexual partners, contribute to the status of sexual and reproductive health in teenagers and young adults as a public health problem (1).

In Latin America, almost 5% of teenage girls are single mothers. In Colombia, the pregnancy rate was estimated to be 2.4 children per woman in 2002-2005, which is equivalent to 20 births per 1000 women. In teenagers, the pregnancy rate is estimated at 90 births per 1000 women (79 per 1000 in urban communities and 128 per 1000 in rural populations) [1, 2]. This rate is one of the highest compared with the rest of Latin America and the United States. According to a study conducted by Profamilia, a Colombian organization with expertise in sexual and reproductive health, 20% of Colombian teenagers have been pregnant at least once, and 12.9% have children [2]. The above observations position early and unwanted pregnancy among the main causes of school dropouts and abortion [3].

Various strategies of education for prevention have been explored, but their impact has not been as great as expected. From 2007, the Colombian Ministry of Health and Social Protection has been implementing the national adoption of the WHO Adolescent Friendly Health Services (AFHS) model. The model aims to facilitate the access and essential attention of young people and teenagers to sexual and reproductive health, in the context of the rights of health [4]. On the other hand, the United Nations Fund for Population Activities (UNFPA Colombia) promotes favorable conditions for the informed and protected exercise of sexuality in several cities of the country (not including Bogota). This goal is achieved through the promotion of comprehensive sexual and reproductive health services. The UNFPA also promotes the improvement of the socio-economic determinants that contribute to HIV vulnerability [5]. Moreover, Bogota's District Health Department has a School Health program that seeks to ensure the integrity of the fundamental rights of children and youngsters in the city with respect to topics such as sexual and reproductive health [6]. Nonetheless, teenage pregnancy rates are now similar to that of 30 years ago in Colombia [2, 7].

This situation has motivated the search for innovative programs through the use of emerging information technologies. These programs promise benefits in the diffusion

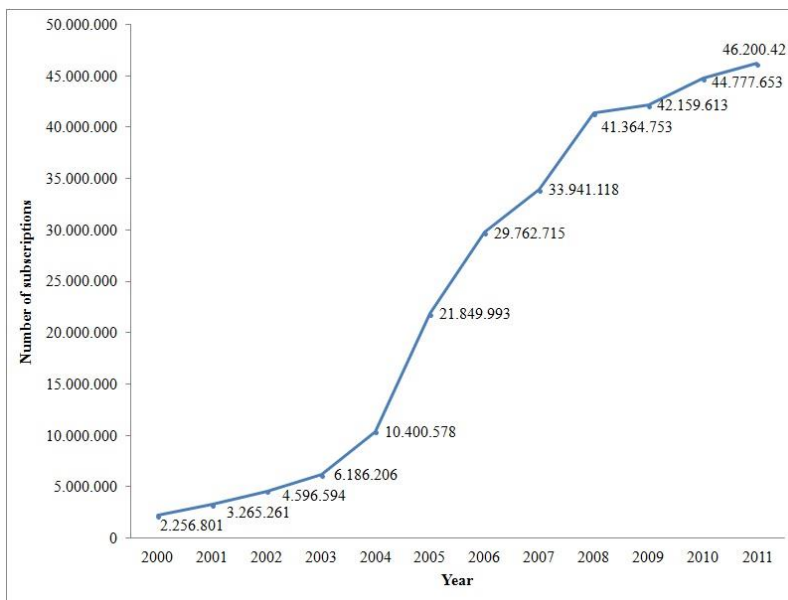
of information and guidance towards prevention. However, their potential and impact have not been studied sufficiently in Latin America.

Specifically in the field of sexual health in teenagers, literature on the applicability of computer technologies is limited. In 1999, Humphreys wrote a newsletter that cited the existence of two websites with content focused on teenagers. These websites allowed users to pose questions, but their impact was never measured [8, 9]. In 2005, Gilbert evaluated the behavior of a website designed for teenagers. The most frequent topic of interest was sexual expression, followed by information on teenage sexuality, virginity, sex, contraception, and STDs, with some variations according to the user's age and gender [10]. Lou, in 2006, concluded that "providing sexual education to students in Shanghai over the internet is feasible and effective". His statements suggested that web-based sexual education programs increased the students' knowledge of reproductive health and led to significant changes in their attitudes toward sexuality, particularly on issues related to sexual freedom. The author concluded that the Internet offers significant potential to provide sexual education to students and teenagers in China [11]. Furthermore, a study conducted by Hagley and Carne found that almost 50% of teenagers prefer consulting the Internet to obtain information on sexual and reproductive health [12].

In September 2006, our research group started a virtual medical counseling program service called "Doctor Chat". The program is a free-access space for medical consulting in Spanish through the web. As previously reported [13, 14], most queries were related to sexual health and reproduction in the youth population. Teleconsultation in Colombia proved to be an innovative, low-cost, and effective method to address the health information needs of users. The program also allowed the unrestricted open discussion on sensitive topics such as sexual and reproductive health. Therefore, it was concluded that the expansion of the service could optimize the potential of the tool and positively impact key economic indicators in Colombia, such as the rate of teen pregnancy, through education for the sake of health prevention and promotion. The authors concluded that *"taking into account the rapid growth and the high prevalence of cellular phones in Colombia, making use of this resource could positively impact health care information delivery in the short term"*. Therefore, we undertook the task of designing and developing a teleconsultation application through mobile devices that we called "Doctor Chat Mobile". We wanted to test its impact to answer the following question: Is a teleconsultation service on sexual and reproductive health through mobile devices a strategy that generates a positive effect on the sexual risk behaviors of young adults from the users' perception?

Given that in Colombia and Latin America, the penetration of cellular phones reaches 100% (Figure 1) [15] and that “each year of -sexual- education reduces by 2%” the risk of pregnancy in women younger than 20 years of age [16], it is of great importance to assess intervention strategies through mobile devices such as “Doctor Chat Mobile”. These strategies should be evaluated as high-potential and high-efficacy tools for the prevention of risk behaviors and the promotion of sexual and reproductive health, which are areas of high social and economic impact in the region.

Figure 1. Mobile phone subscriptions in Colombia, 2000-2011.



Data taken from International Telecommunication Union 2012 (<http://www.itu.int/ITU-D/ict/statistics/index.html>)

In this paper we report our experience with the use of Doctor Chat Mobile among young adults, and the sexual risk factors detected among the users.

METHODS

Study

A before and after observational study was designed. Based on the previous experience with Doctor Chat and in alliance with the Systems and Computing Engineering Department of the Universidad de los Andes in development for mobile devices, we developed an application that allowed users to consult about sexual and reproductive health topics on their mobile devices. Inquiries were sent on free text with the possibility of multimedia files' attachment, and were answered by the medical team at our Center for Telehealth. The application ran on the 4 mobile

platforms (iOS/iPhone, Android, RIM/Blackberry and Symbian) and 27 mobile devices most used by a cohort of 371 potentially eligible subjects who responded a short e-mail based survey which questioned about their interest in the project and the type of mobile device owned.

Potential subjects were invited to participate through a massive email message using the databases of the participating institutions. A total of 12463 invitations were sent. Participation in the study was voluntary and anonymous. Recruitment was undertaken by self-reporting of the selection criteria and acceptance of the terms and conditions through the study’s web page [17] (Table 1).

The perception of changes in sexual and reproductive risk behavior after the use of the application was measured using the validated survey “Family Health International (FHI) – Behavioral Surveillance Survey (BSS) – Survey for Adults between 15 and 40 Years” [18]. The participants answered the survey online before and after the intervention, defined as the use of the mobile application over a period of six months. Data for analysis corresponded to the responses to these two surveys. During the intervention period, users’ consultations were answered anonymously and individual follow up was not undertaken.

Participants

Adult males and females who met the selection criteria (Table 1).

Table 1. Selection criteria.

INCLUSION CRITERIA	EXCLUSION CRITERIA
Age: 18 - 29 years	Health students and professionals.
Residing in Colombia	People who planned to leave the country for more than 20% of the time available to use the service during the teleconsultation time.
Have access to a mobile device that	Sex worker.
<ul style="list-style-type: none"> – Allows navigation using a wireless network or an owned data plan. 	Intravenous drug user.
<ul style="list-style-type: none"> – Allows the installation of the application (installation requirements were provided). 	

Have read, understood, and accepted the terms and conditions of the study.	
--	--

Reference population and sample

The reference population was established from the previous experience with the Doctor Chat web service [13, 14]. A non-probabilistic convenience sampling was performed with the aim of recruiting at least 261 individuals, representing the universe of the experience with Doctor Chat on sexual and reproductive health (average annual number of users residing in Colombia making consultations on sexual and reproductive health risk behavior).

Survey

The “Family Health International (FHI) – Behavioral Surveillance Survey (BSS) – Survey for Adults between 15 and 40 Years” [18] was chosen to evaluate the perceptions of sexual risk behaviors in young adults. This survey has been used and validated for more than 10 years in 20 countries, proving to generate significant results in this matter. The BSS was conducted for the first time in Bangkok in 1993, and since then, has been conducted mostly on people at high risk of contracting HIV and other sexually transmitted infections in developing countries. The data obtained from these surveys worldwide have enabled the implementation of more robust monitoring and control systems of sexually transmitted diseases such as HIV [18].

Statistical Analysis

To ensure consistent analysis, data were initially collected and compared with the selection criteria. Data with inconsistencies or lacking internal integrity were eliminated. Subsequently, the data were normalized following the second normal form defined by Kifer [19], which ensured right consistency and helped in the analysis process by dividing the results into work domains. This normalization also allowed the data to be related to the Doctor Chat application database, determining which users used the application and how often. Thus, an initial descriptive analysis of the data could be performed.

To perform the inferential statistical analysis, data were divided into three groups based on the nature of the questions on the instrument used. This division permitted the comparison of the results between the questions from the first and second survey. Samples were considered to be independent and in most cases followed a normal distribution.

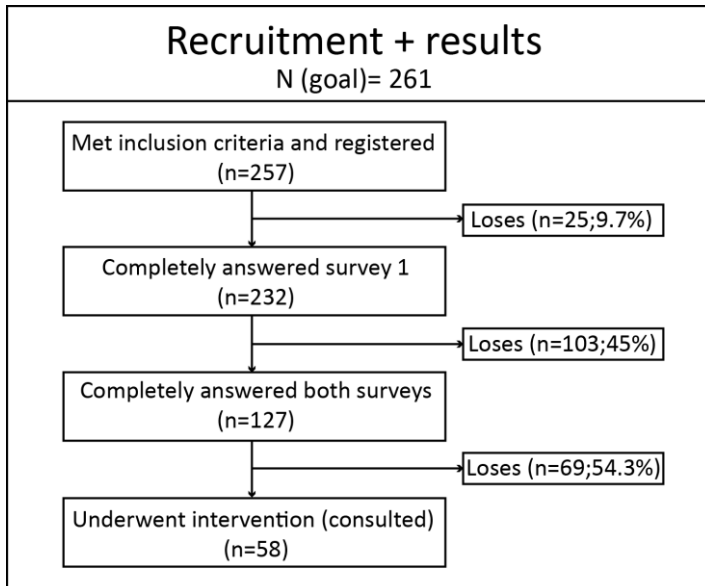
The three analysis groups were as follows: dichotomous data (with positive or negative answers), discrete quantitative data, and ordinal data (such as the Likert scale). For all tests, a confidence interval of 95% was established. For dichotomous nature data, the Chi-squared test was used, not assuming the Yates correction for continuity. This test was used due to its statistical power and the construction of the contingency tables. For quantitative data, and given the paired nature of the results, Student's t-test was used, which allows a statistical approach in small samples. This approach allowed the comparison of the variances and means of each sample. Finally, for the ordinal-class data, the measurement scale was established, and the Mann-Whitney-Wilcoxon test was used, which allows the determination of differences between two scalar samples given their ranges. All statistical tests were performed using the R Statistical Software (The R Project for Statistical Computing, Institute for Statistics and Mathematics, Wirtschaftsuniversität Wien) using the standard package.

RESULTS

Recruitment

Of the 261 subjects who were set as the recruitment goal, 257 were registered on the virtual platform to participate and met the selection criteria. Of these, 232 completely answered the pre-intervention survey and, therefore, were eligible to advance to the intervention phase. At the end of the intervention phase, 127 subjects completely answered the post-intervention survey. Nonetheless, when checking the number of consultations per subject (real intervention on research subjects), 54% (n=69) of them reported not having used the "Doctor Chat Mobile" service during the study period. This result meant a further loss of analyzable data, leaving an effective population of 58 subjects to be analyzed (Figure 2).

Figure 2. Recruitment and loss of subjects



Demographic data

Of the total analyzable subjects, 53% (n = 31) were female, and 47% (n = 27) were male. The subjects had an average age of 21 years, ranging from 18 to 40 years. The subjects had lived in Bogotá (the city where the study was performed) for 13.3 years on average, ranging from 0 to 29 years (Table 2). Most were mestizos, and all of the subjects had completed a high school education or higher. With respect to religion, most subjects were Catholic (n=41; 71%), followed by non-religious affiliation (n=11; 19%). Table 3 summarizes the demographic data of the subjects.

Table 2. Age of the subjects and years of residence in Bogota

	Mean (years)	SD
Mean age		
• Male	20	2.9
• Female	21	4.1
• TOTAL	21	3.6
Years residing in Bogotá		
• TOTAL	13.3	9.4

Table 3. Demographic information of the subjects

	n	%
Gender		
• Male	27	47
• Female	31	53

• TOTAL	58	100
Education level (higher education)		
• Male	19	33
• Female	24	41
• Total	43	74
Education level (high school)		
• Male	8	14
• Female	7	12
• Total	15	26
Religion		
• Catholic	41	71
• None	11	19
• Don't know	3	8
• Christian	2	3
• Other	1	2
• TOTAL	58	100
Ethnic group		
• Mestizo	41	71
• Caucasian	15	26
• Other	2	3
• TOTAL	58	100

Consultation through the mobile service

Of the 58 subjects who consulted through the mobile application (i.e., subjects who were effectively intervened), 48 (83%) did so from one to three times. The other 17% consulted the application four or more times, and one person (2%) consulted the application 29 times. The distribution for this group of subjects (who consulted at least four times) was trimodal, in 4, 8 and 16 consultations (Table 4).

Table 4. Number of consultations per number of subjects

Number of consultations	Number of subjects	%
1	24	41
2	16	28
3	8	14
4	2	3
5	1	2
6	1	2
7	1	2
8	2	3
16	2	3
29	1	2
TOTAL	58	100

Sexual background

To the question “Have you ever had sex?” 91% (n = 53) answered “yes”, 7% (n = 4) answered “no”, and 2% (n = 1) did not answer. Approximately 67% (n=39) started their sexual life between 15 and 18 years of age, ranging between 13 and 22 years, with a mean of 18 years and a standard deviation of 3.3 (Table 5).

Table 5. Age of first sexual relation

Age	n	%
13	2	3
14	2	3
15	6	10
16	12	21
17	7	12
18	14	24
19	4	7
20	2	3
21	1	2
22	3	5
N/A	4	7
No answer	1	2
TOTAL	58	100

By comparatively analyzing the answers given by the subjects in the pre-intervention versus the post-intervention survey, no statistically significant differences were found. However, risk behaviors among subjects could be identified.

With respect to the sexual background of the subjects (Table 6) and the main sexual risk behaviors identified, the surveys demonstrated that over 80% of the subjects had sex in the six months prior to the surveys. In the first survey, two (7%) men claimed to have had sex with another man, whereas in the second survey, three (11%) did so, with an average of three partners in the past six months in the second survey. Furthermore, in the first survey, 12 (44%) men and eight (25%) women claimed to have had sex with non-regular partners (to whom they were not married, whom they had never lived with and who did not receive any payment), whereas in the second survey, 13 (48%) men and nine (29%) women did so. From these data, there was an average of 2.6 partners for men and 1.6 partners for women (a non-statistically significant difference). On average, men had 2.6 sexual relations in the past 30 days with their last non-regular partner, and women had two sexual relations (non-statistically significant difference). Likewise, three men (11%) and zero (0%) women claimed to have had commercial sex partners in the last six months, with an average of 1.7 commercial partners in the last six months for the first survey and three partners in the second. In the first survey, no subject answered how many times they had sexual relations with their last commercial sex partner in the past 30 days. However,

in the second survey, the subjects claimed to have had sexual relations twice on average with their last commercial partner.

Regarding the use of condom, 18 persons (31%) reported having sex without a condom in the last six months. One person (2%) reported in the second survey not having used a condom during his last sexual relation with a commercial partner. Seven (12%) persons in the first survey and six (10%) in the second reported not using a condom the last time they had sexual relations with a non-regular partner. Finally, 34% of the subjects did not use a condom the last time they had sexual relations with their regular partner.

Table 6. Sexual Background

	Survey 1 ^a	Survey 2 ^b	
	N or mean (SD)	N or mean (SD)	<i>P</i>
Have you had sex in the last 6 months?			
• Yes	50	47	.23
• No	4	8	
Commercial Partners Do you know how many female COMMERCIAL partners you have had in the last 6 months? (Partners with whom you have exchanged money for sex).			
• Yes	3	3	NA ^c
• No	20	20	
How many commercial partners have you had in the last 6 months?	1.7 (1.15)	3 (0)	.18
Think about your most recent commercial sexual partner. How many times did you have sex with this person during the last 30 days?	0 (0)	2 (2.83)	NA ^c
Non-regular partners For men: Do you know how many non-regular female partners you have had in the last 6 months? (Partners to whom you are not married and whom you have never lived with and who did not receive any payment. Do not include current couple(s) or sexual partners in common-law union).			
• Yes	12	14	.55
• No	11	19	
How many NON-REGULAR partners have you had in the last 6 months?			
• Men	1.25(0.46)	1.86(0.69)	.06
• Women	1.5(0.84)	1.22(0.67)	.487
Think about your most recent NON-REGULAR sexual partner. How many times did you have sexual relations with this person during the last 30 days?			
• Men	3 (4.44)	2.11 (3.82)	.64
• Women	2.44 (2.24)	1.43 (0.78)	.38

For women: Do you know how many NON-REGULAR male partners you have had in the last 6 months? (Partners to whom you are not married and whom you have never lived with, and who did not receive any payment. Do not include current couple(s) or sexual partners in common-law union).			
• Yes	8	9	.75
• No	17	15	
Use of Condom The last time you had sexual relations with your REGULAR partner, did you and your partner use a condom?			
• Yes	21	21	.91
• No	20	19	
The last time you had sexual relations with your COMMERCIAL partner, did you and your partner use a condom?			
• Yes	3	0	.15
• No	2	1	
The last time you had sexual relations with your NON-REGULAR partner, did you and your partner use a condom?			
• Yes	13	15	.66
• No	7	6	
During the last 6 months, did you ever have sex without a condom with any commercial sexual partner or any other sexual partner with whom you have never lived nor been married?			
• Yes	18	18	.94
• No	30	29	
Male homosexual relations For men: Have you had sexual (homosexual) relations in the last 6 months? (Sexual relations defined as penetrative anal intercourse)			
• Yes	2	3	.81
• No	1	1	
How many male partners have you had anal sexual relations with in the last 6 months?	1 (0)	3 (2.64)	.32

^aSurvey 1: Pre-intervention survey; ^b survey 2: Post-intervention survey; ^c NA: Not applicable.

Sexually Transmitted Diseases

With respect to knowledge about sexually transmitted diseases (STDs) (Table 7), 100% (n=58) of subjects were aware of the existence of STDs. In the first survey, 40 (69%) subjects answered that malodorous discharge is a symptom that can occur in both men and women. However, 15 (26%) answered that this symptom manifests in only men or only women, and 3 (5%) answered that this symptom does not occur. For this same question in the second survey, 50 individuals (86%) answered that this

symptom can occur in both men and women, 5 (9%) answered that it manifests in only men or only women, and 3 (5%) answered that this symptom does not occur. This change represented a statistically significant difference between both surveys ($P=.04$).

24 (41%) subjects in the first survey and 18 (31%) subjects in the second survey did not consider anal irritation or discharge to be a symptom of STDs. In the first survey, 19% (n=11) of the subjects answered that itching is a symptom present in only men or only women, and 12% (n=7) answered the same in the second survey.

Table 7. Knowledge on Sexually Transmitted Diseases

	Survey 1 ^a	Survey 2 ^b	
	N	N	P
Have you ever heard of diseases that can be transmitted through sexual intercourse?			
• Yes	58	58	NA ^c
• No	0	0	
STD symptoms. Do you know any symptoms of STDs in women and men?			
Genital discharge			
• Women and men	44	46	.75
• Only women or only men	10	8	
• None	4	4	
Malodorous discharge			
• Women and men	40	50	.04
• Only women or only men	15	5	
• None	3	3	
Genital ulcers			
• Women and men	46	48	.81
• Only women or only men	11	5	
• None	1	5	
Anal irritation or discharge			
• Women and men	23	35	.06
• Only women or only men	11	5	
• None	24	18	
Itching			
• Women and men	46	47	.99
• Only women or only men	11	7	
• None	1	4	
Flu-like symptoms			
• Women and men	25	30	.40
• Only women or only men	1	1	
• None	32	27	
Abdominal pain			
• Women and men	11	21	.24
• Only women or only men	18	25	
• None	29	12	

Irritation when urinating			
• Women and men	49	48	.74
• Only women or only men	8	7	
• None	1	3	
Headache			
• Women and men	20	19	.88
• Only women or only men	0	3	
• None	38	36	
Diarrhea			
• Women and men	18	21	.69
• Only women or only men	2	1	
• None	38	36	
Nausea and vomiting			
• Women and men	16	19	.93
• Only women or only men	10	6	
• None	32	33	

^aSurvey 1: Pre-intervention survey; ^b survey 2: Post-intervention survey; ^c NA: Not applicable.

HIV / AIDS

With respect to HIV awareness (Table 8), one person (2%) claimed not to have ever heard of HIV. 7 individuals (12%) in the first survey and 4 (7%) in the second survey claimed that a person can contract HIV by sharing food with someone who is infected. 19% (n=11) of the subjects answering the first survey and 17% (n=10) answering the second survey did not know whether a woman with HIV or AIDS can transmit the virus to her newborn child through breastfeeding.

Table 8. HIV knowledge

	Survey 1 ^a	Survey 2 ^b	
	N	N	P
Have you ever heard about HIV or the disease called AIDS?			
• Yes	57	58	.32
• No	1	0	
Can people protect themselves from HIV, the virus that causes AIDS, by using a condom correctly whenever they have sexual relations?			
• Yes	56	57	.32
• No	1	0	
Can a person be infected with HIV by a mosquito bite?			
• Yes	7	4	.51
• No	42	37	
• Doesn't know	8	17	
Can people protect themselves from HIV by having a faithful sexual partner who is not infected?			
• Yes	46	45	.64
• No	8	10	

• Doesn't know			
Can people protect themselves from HIV by abstaining from sex?			
• Yes	38	41	.64
• No	19	17	
• Doesn't know	0	0	
Can a person be infected by HIV by sharing food with someone who is infected?			
• Yes	7	4	.36
• No	46	48	
• Doesn't know	4	6	
Can a person be infected with HIV by injecting with a needle someone else used?			
• Yes	56	58	.31
• No	1	0	
• Doesn't know	0	0	
Do you think that a person who looks healthy can be infected with HIV, the virus that causes AIDS?			
• Yes	56	58	.31
• No	1	0	
• Doesn't know	0	0	
Can a pregnant woman who is infected with HIV or AIDS transmit the virus to her baby?			
• Yes	56	56	.32
• No	0	1	
• Doesn't know	1	1	
Can a woman with HIV or AIDS transmit the virus to her newborn child through breastfeeding?			
• Yes	20	25	.55
• No	11	10	
• Doesn't know	26	23	

^aSurvey 1: Pre-intervention survey; ^b survey 2: Post-intervention survey.

Substance use

Regarding the use of substances (Table 9), 26% (n=15) of subjects answering the first survey and 31% (n=18) answering the second reported consuming alcohol at least once a week in the last six months.

24 subjects (41%) in the first survey and 22 (38%) in the second claimed to have used a psychoactive substance at least once, with the most common substances being marijuana (38%), tobacco (33%), and cocaine (9%).

Table 9. Substance use

	Survey 1 ^a	Survey 2 ^b	
	N	N	P

During the last 6 months, how often have you ingested drinks containing alcohol?			
• Less than once a week	40	36	.49
• At least once a week	15	18	
Have you ever tried any psychoactive substance?			
• Yes	24	22	.70
• No	34	36	
Have you ever use any of the following substances?			
LSD			
• Yes	2	5	.17
• No	22	17	
Ecstasy			
• Yes	0	0	NA
• No	24	22	
Cocaine			
• Yes	5	6	.61
• No	19	16	
Marijuana			
• Yes	23	21	.95
• No	1	1	
Tobacco			
• Yes	19	19	.52
• No	5	3	
Popper			
• Yes	4	5	.60
• No	20	17	
Injectable drugs			
• Yes	0	0	NA ^c
• No	24	22	

^aSurvey 1: Pre-intervention survey; ^b survey 2: Post-intervention survey; ^c NA: Not applicable.

DISCUSSION

Comparison with Prior Work

More than 5 years ago, we reported the first experience since the release of Doctor Chat, a free-access service of virtual medical orientation in Spanish [13, 14]. From September 2006 to March 2007, 270 teleconsultations were received, mostly from women (62%) and users between 18-29 years-old (54%). The main topics of consultation were those related to sexual and reproductive health [9]. Subsequently, the two-year follow-up of the experience was reported [14]. We observed a tendency similar to that of the first report; between 2007 and 2009, 1624 consultations were received from users mainly 18-29 years old (53%). The main topic of consultation

remained sexual and reproductive health (26%). We concluded, in both reports, that the service could be an innovative way to improve community access to health information, particularly sexual and reproductive health. Observing the rapid increase in the spread of mobile devices in Colombia and Latin America, we also concluded that mobile-based interventions could positively impact the delivery of health information. This encouraged us to develop Doctor Chat Mobile, an application to support the service of Doctor Chat on mobile devices.

Principal results

The expectations with which we decided to develop a mobile teleconsultation service, based on our previous reports, were not completely fulfilled. Although the recruitment goal was almost reached (98%), the analyzable subjects, i.e., those who completely filled out both surveys (pre-intervention and post-intervention) and consulted the service, represented only 23% of the recruited subjects, with a loss rate of 77%. As we have reported in our previous studies, this behavior reflects the Law of Attrition described by Eysenbach in 2005 [20]. The law states that eHealth initiatives suffer from a common problem that involves a loss of users over time. This effect is most likely due to the motivational decrease of the user after their curiosity towards the application has been satisfied by using the application a few times.

Similarly to our two previous reports, the gender distribution of the users of Doctor Chat Mobile was almost equivalent. Most subjects were between 21 and 25 years old with an incomplete university education (university students or subjects who had completed at least high school).

The majority of subjects self-classified as Catholics, which is unsurprising given that Catholicism is the main religion in the Colombia [21]. Of the included subjects, 76% reported belonging to a religion versus 19% who declared no religious affiliation. This distribution could have influenced the answers obtained, due to Christian restrictions regarding some sexual behaviors.

Most subjects reported consuming alcohol less than once a week (68%) and denied having tried psychoactive substances (58%). Of those who did try psychoactive substances, the most commonly used substance was marijuana, followed by tobacco and cocaine.

When performing the consolidated comparative analysis of changes in sexual risk behaviors pre- and post-intervention, most of the results were not statistically significant. However, this study did not intend to change risk behaviors but rather to obtain a descriptive dataset regarding risk behaviors. Furthermore, the study

intended to provide a baseline for future guided educational strategies using mobile devices. To our knowledge, our study represents the first published results on this topic in Latin America. Therefore, we believe that our study provides interesting information that will allow advances in the formulation of strategies to improve the indicators related to sexual and reproductive risk behaviors, such as the rate of unwanted pregnancies, the rate of sexually transmitted diseases, the rate of abortions and maternal and perinatal mortality, among others.

Apparently, the use of Doctor Chat Mobile did not influence sexual practice. Ninety-four percent of the subjects who claimed to have had sexual relations six months prior to the pre-intervention survey maintained their sexual activity during the post-intervention period. Only men reported having had sex with commercial partners. It is notable that these men did not answer how many times in the past 30 days they had had sexual relations with their last commercial partner in the first survey. However, in the second survey, these men answered this question. Additionally, it is clear that men in this study had more non-regular partners than did women, and this difference was statistically significant.

Likewise, there were no differences regarding sexual practices among homosexual men or the use of condoms. However, there was a difference of only one additional person who used a condom with his regular partner between the pre and post-intervention survey. Moreover, three additional subjects reported using condoms with irregular partners in the second survey, and two additional subjects reported not using a condom with a commercial partner in the second survey. There were no differences regarding the use of condoms in heterosexual men, with a difference of only one additional person who reported having used a condom in the past six months with a non-commercial or non-regular partner.

Interestingly, although all subjects had heard about sexually transmitted diseases, one person had never heard about HIV / AIDS before the intervention, but this status changed after the use of Doctor Chat Mobile. Likewise, one person learned that this infection can be prevented with the proper use of condoms. Furthermore, two to three people learned that HIV / AIDS can be prevented with sexual abstinence, whereas another three learned that the risk of infection is minimal after sharing food with an infected person. Two subjects learned that they can become infected after sharing a needle with someone who is infected; at the end of the intervention, all participant subjects knew this fact. Similarly, two subjects learned that an HIV-infected person can appear healthy, and all subjects were aware of this fact by the end of the intervention.

Paradoxically, two additional subjects, after the intervention, did not think they could protect themselves from HIV by having one uninfected faithful sex partner (they previously thought they could). Additionally, doubt about the vertical transmission of HIV persisted in the only person who reported doubt at the beginning of the study. However, doubt did not persist in the case of breastfeeding, as one to three people learned of the causal relationship.

Although the differences in knowledge and risk behaviors for HIV / AIDS were subtle, they are nonetheless important, considering that in 2011, approximately 2.5 million people became infected, and 1.7 million died from AIDS-related causes [22].

Other indicators, such as those concerning knowledge of the symptoms of sexually transmitted infections, seemed to improve with the intervention. Specifically, 10 people learned, with the intervention, that malodorous discharge may be a symptom of sexually transmitted infections, which represented a statistically significant difference.

To summarize, medical guidance service via “Doctor Chat Mobile” on mobile devices resulted in no significant changes in the knowledge or sexual and reproductive health risk behaviors in the population studied.

The mobile service did not result in statistically significant changes in the sexual activity of the subjects, the number of sexual partners, the use of condoms, or the general knowledge of sexually transmitted diseases, specifically HIV / AIDS. However, the study revealed risk behaviors among those surveyed, including heterosexual and homosexual unprotected sex, sex with non-regular and commercial partners, and substance consumption.

Additionally, there was a positive and statistically significant impact on the knowledge of the symptoms of sexually transmitted diseases, specifically, malodorous discharge. Furthermore, there were positive subtle changes, although not statistically significant, with respect to the number of non-regular partners in the last six months. The largest positive changes were related to the acquisition of knowledge in terms of the modes of HIV infection and prevention.

There were also negative post-intervention results, although they were not statistically significant, in terms of abstinence as a prevention method and in the frequency of condom use with regular and non-regular partners.

Limitations

Among the limitations of this study, the Doctor Chat Mobile application works only on smartphones. This limitation may have contributed to the low use of the mobile teleconsultation service, given that it was necessary to exclude from the study 54% of the subjects initially recruited for failing to consult the service through Doctor Chat. Moreover, of those who did consult the service, more than 80% accessed the application three times, and less than 20% of the subjects accessed the service four or more times. Unfortunately, the paradoxical situation of telemedicine suggests that the population that is most likely to benefit from such information technology services is the population that has the least access to them [23]. It would be useful to repeat this study in other populations that are more vulnerable in terms of age, educational level, and socioeconomic status compared to this study's subjects. However, this task would involve a mobilization of resources and a much greater budget than that available for our study. Repeating this study in a new population could reveal interesting results, especially considering that in Latin America, at least 30% of women aged 15 to 19 have had some type of sexual experience. Additionally, in Colombia, 33% of women under the age of 18 and 70% under 20, have had a sexual experience, only 7% having used a contraceptive method [24].

Taking into account that obtaining an answer from the Doctor Chat Mobile service could take up to 48 hours, it may be that people are not willing to wait for basic information on sexual and reproductive health. Although it could seem a good option to have access to professional staff through mobile devices, people may prefer to consult Internet resources from their cell phones for general initial information to obtain instant information, and keep services such as Doctor Chat Mobile only for cases in which doubts remain or highly specific, sensitive or personal information is required. Studies such as that by Formigós have demonstrated that "one in six patients consult the Internet before going to the doctor, and one in four do so afterwards to contrast or complete the information" [25]. On the other hand, the US National Institutes of Health - Health Information National Trends Survey (HINTS) [26] reported that the first source consulted by patients when consulting specific information is the Internet, despite the fact that the physician is the most trustworthy source of health information.

According to Kirby [27], educational strategies aimed at sexual health have a positive impact on sexual risk behaviors without negative effects. This positive impact is associated with increased use of condoms and oral contraceptives, delay in the onset of sexual life, and reduction in the frequency of sexual activity. There are several reasons why young people would request guidance in sexual and reproductive health through a mobile teleconsultation service. The first could be age. Although the

“computer culture” is not yet fully consolidated in Colombia, it is likely that young people make the most use of the Internet to address their health information needs compared with other age groups. Second, in Colombia, the parents or legal guardians are responsible for scheduling medical appointments for minors (defined as those less than 18 years of age). Hence, social embarrassment and other limitations may restrict teens from asking their parents or guardians or requesting a medical appointment to solve issues considered “taboo”, typically those related to sexual and reproductive health. Moreover, and related to the above statement, monetary issues could also be an important factor; few teenagers can afford a private face-to-face consultation. For the group over 18 years old with purchasing power and access to the health care system (which represents the minority), waiting times for a face-to-face consultation can be extensive, and the administrative process necessary to request an appointment, rather complex. Finally, another possible explanation could be supported by the desire of the users to evaluate the severity of their symptoms before scheduling a face-to-face consultation.

In this context, we think that it is worth insisting on the modeling of strategies for sexual education and guidance aimed at young people through their most used tools, including mobile devices. As ultimate information technologies become more accessible to the least favored, these strategies could enhance patient empowerment, improve macroeconomic indicators, and achieve Millennium Development Goals such as improving maternal health and combatting diseases such as HIV/AIDS [28].

Conclusions

The medical consultation service “Doctor Chat Mobile” via mobile devices did not result in significant changes in the knowledge or sexual and reproductive risk behaviors in the population studied. Although the recruitment was satisfactory, the loss of subjects was high, and the rate of the use of the service was low. The only indicators that exhibited statistically significant changes were as follows: the question concerning malodorous discharge as symptom of STDs, with a positive change in terms of knowledge acquisition; and the number of commercial partners in the last six months, with a negative change evidenced by the increase of this indicator post-intervention. The study revealed different risk behaviors in the participating subjects. This finding confirms the importance of promoting education strategies on this topic and the importance of encouraging the empowerment of the patients with easy access to reliable information. It would be worthwhile to repeat this study in a more vulnerable population than the one hereby included, such as teenagers with low education and socioeconomic status.

Acknowledgements

This study was funded by the IV Fundacion Santa Fe de Bogota – Universidad de los Andes Joint Grant. We thank the engineering and medical students involved in this study, for helping with the development of the mobile application, subjects' recruitment and data retrieval.

Conflicts of Interest

None declared

REFERENCES

1. Florez CE, Vargas E, Henao J, González C, Soto V, Kassem D. Adolescent fertility in Colombia: Incidence, Trends and Determinants. A life story. Bogot : Universidad de los Andes; 2004.
2. National Survey on Demography and Health (NSDH). Bogota: Profamilia; 2005.
3. Induced Abortion: A public health problem. Bogota: Bogota's District Health Department; 2006.
4. Colombian Ministry of Health and Social Protection. Strategies of sexual and reproductive health in teenagers. <http://www.minsalud.gov.co/salud/Paginas/Estrategias-de-salud-sexual-y-reproductiva-en-adolescentes.aspx> . Archived at: <http://www.webcitation.org/6J5kdNTAZ>
5. United Nations Population Fund (UNFPA). UNFPA Colombia. HIV/AIDS Prevention. <http://www.unfpa.org.co/menuSupIzqui.php?id=4>. Archived at: <http://www.webcitation.org/6J5e5tvvd>
6. Bogota's District Health Department. Strategy Health to Schools. <http://www.saludcapital.gov.co/paginas/saludalcolegio.aspx>. Archived at: <http://www.webcitation.org/6J5eCBDPi>
7. Florez CE, Soto V. Fecundidad Adolescente y Pobreza: Diagn stico y Lineamientos de Pol tica. 1st Edition. Bogota: Departamento Nacional de Planeaci n; 2007.
8. Columbia Health. Go Ask Alice. <http://goaskalice.columbia.edu/>. Archived at: <http://www.webcitation.org/6J5mJxqvS>

9. American Sexual Health Organization. I wanna Know!
<http://www.iwannaknow.org/teens/index.html>. Archived at:
<http://www.webcitation.org/6J5mThbVp>
10. Gilbert LK, Temby JR, Rogers SE. Evaluating a teen STD prevention Web site. J Adolesc Health 2005;37(3):236-42. PMID: 16109344
11. Lou CH, Zhao Q, Gao ES, Shah IH. Can the Internet be used effectively to provide sex education to young people in China? J Adolesc Health 2006 Nov;39(5):720-8. PMID:17046509
12. Hagley M, Carne C. Telemedicine and its use in promoting sexual health. Int J STD AIDS 2003 Jan; 14(1):66; Comment on [Can telemedicine be used to promote sexual health?](#) [Int J STD AIDS. 2001]. PMID: 12590802
13. Valenzuela JI, Arguello A, Cendales JG, Rizo CA. Web-Based Asynchronous Teleconsulting for Consumers in Colombia: A Case Study. J Med Internet Res 2007; 9(4):e33. PMID:17954469
14. Valenzuela JI, Lopez C, Guzmán Y, Fajardo R. Web-based asynchronous teleconsulting for consumers in Colombia: a 2-year follow up. Stud Health Technol Inform 2010;160(Pt 1):559-63. PMID: 20841749
15. Sandoval AE. This month there will be as many phones as people in Latin America. Diario El Tiempo.
http://www.eltiempo.com/tecnologia/telecomunicaciones/ARTICULO-WEB-NEW_NOTA_INTERIOR-9032680.html. Archived at:
<http://www.webcitation.org/6J5iCOTYF>
16. Liga Colombiana de Lucha contra el SIDA. <http://www.ligasida.org.co/>
17. DoctorChat Mobile Web Page. <http://drchat.uniandes.edu.co/>. Archived at:
<http://www.webcitation.org/6J5ig34gx>
18. Family Health International. Behavioral Surveillance Survey.
http://www.who.int/hiv/strategic/en/bss_fhi_sp.pdf . Archived at:
<http://www.webcitation.org/6J5iTYTfL>

19. Kifer M, Berstein A, Lewis P. Database Systems: An Application-Oriented Approach. Second Edition. Addison-Wesley; 2005.
20. Eysenbach G. The law of attrition. J Med Internet Res 2005;7(1):e11. PMID: 15829473
21. Colombia info. Religion.
<http://www.colombiainfo.com/colombiainfo/infogeneral/religi%F3n.asp>.
Archived at: <http://www.webcitation.org/6J5ipzGvH>
22. World Health Organization. Questions and Answers on HIV/AIDS.
<http://www.who.int/features/qa/71/es/>. Archived at:
<http://www.webcitation.org/6J5isqkvM>
23. Telemedicine: fad or future? Lancet 1995;345(8942):73-74.
[http://dx.doi.org/10.1016/S0140-6736\(95\)90054-3](http://dx.doi.org/10.1016/S0140-6736(95)90054-3)
24. Darroch JE, Singh S, Frost JJ. Differences in teenage pregnancy rates among five developed countries: the roles of sexual activity and contraceptive use. Fam Plann Perspect 2001 Nov-Dec; 33(6):244-50, 81. PMID:11804433
25. Formigós J. The role of new technologies in the production and use of information on health and medicine and its impact on the doctor-patient relationship. Madrid: Universidad de Alcalá; 2009.
26. Hesse BW, Moser RP, Rutten LJ. Surveys of physicians and electronic health information. N Engl J Med 2010;362(9):859–60. PMID: 20200398
27. Kirby DB, Laris BA, Roller LA. Sex and HIV education programs: their impact on sexual behaviors of young people throughout the world. J Adolesc Health 2007 Mar;40(3):206-17. PMID: 17321420
28. UN. Millennium Development Goals.
<http://www.un.org/es/millenniumgoals/>. Archived at:
<http://www.webcitation.org/6J5kXkYKd>