

Original Article

Health information technologies for sexual and reproductive health: Mapping the evidence in Latin America and the Caribbean

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Abstract In Latin America and the Caribbean (LAC), the sexual and reproductive health (SRH) of populations is a high priority for governments. Health information technologies (HITs) have been proposed as tools to close access gaps for SRH services. We developed an “evidence map” through a systematic search of articles published between 2005 and 2015 about the use of HITs to enhance SRH services in LAC countries. Two hundred and thirty-two registries were identified and screened. Thirty-one were eligible for full-text assessment. Most of the documents retrieved correspond to information provided by technology developers, targeting primarily the prevention of sexually transmitted infections and adolescent health. Although there has been clear progress in the use of HITs for SRH in the region, many institutional and technological challenges persist. Further studies should be carried out to test the beneficial effects of HITs on improving access to SRH services.

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Introduction

The reduction of maternal mortality rates by 38 per cent over the past fifteen years across the Latin America and the Caribbean (LAC) region was the result of demographic and social policies with strategies focused on the attainment of universal access to sexual and reproductive health (SRH) services.¹ Grounded within a human rights perspective, the LAC region still faces many challenges in guaranteeing good quality and affordable SRH services including the control of HIV infection among vulnerable groups, the reduction in adolescent pregnancies, and high rates of cesarean section deliveries.²

Health information technologies (HITs) are being widely proposed as one element of a complementary strategy to strengthen health systems and achieve the health-related Millennium Development Goals.^{3–5} The World Health Organization's Global Observatory for eHealth defines mobile health or mHealth as the medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices.³ mHealth is a component of eHealth, being the transfer of health resources and health care by electronic means.⁴

A substantial number of eHealth and mHealth services and applications are available on the market. They range from medical data communication systems to educational tools, mobile technology to provide patients with remote consultation with health providers (medical doctors, nurses, or pharmacists), electronic health records, registries/vital events tracking, provider training education, supply chain management, etc.⁶ mHealth applications have also been used to improve care for conditions such as diabetes, mental health, behavioral disorders, oncology, and women's health. The evidence shows that mobile and electronic health can strengthen SRH systems and improve access to health services in the population⁷, particularly when they are aligned with the population's and providers' needs. By providing information in a discreet manner, HITs have the potential to overcome cultural taboos that prevent informed discussions about SRH issues. Use of mHealth tools supports the continuum of care for HIV/AIDS patients, including access to care, retention in care, and adherence to antiretroviral treatment.⁸ Similarly, social media promote social connectivity and community engagement with institutional programs, transmitting useful information to promote healthy lifestyles.⁹ In many



cases, social media can also promote the engagement of civil organizations interested in health issues and support the governance role of the state to establish public health goals.⁹

The use of HITs for the prevention of sexually transmitted infections (STIs) and SRH promotion in the LAC region has many potential advantages. Mobile telephone coverage in most of LAC countries exceeds 80 per cent and over 60 per cent have access to the internet.¹⁰ Access and service costs have decreased and such technologies require few skills for their use. Hence, the use of HITs can reach poor and marginal populations¹¹, enabling access to health services regardless of geographical location.²

In the LAC region, the Pan American Health Organization (PAHO) encourages the use of digital technologies in health.¹² PAHO's Strategy and Plan of Action on eHealth is based on four key strategic areas encompassing the implementation and evaluation of HIT projects: improve public health through the use of HIT; promote cooperation among countries for the development of the digital health agenda; and carry out knowledge management and training of health workers and citizens in the use of HIT. Despite this and the significant penetration of mobile and internet technology in the region, experience in the use of such technologies in SRH is limited mostly to pilot studies.² There is an urgent need for assessment of the progress made in LAC countries about the use of HITs for SRH and the existing knowledge gaps that need to be filled.¹³

This study presents a systematic *evidence map* of the use of technologies for prevention and promotion of SRH in LAC region within the last decade, a time period characterized by accelerated widespread use of HITs globally.¹⁴

Methods

Search strategy

Using an adaptation of the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI Centre) methodology for systematic reviews, we carried out a systematic literature search to compile an evidence map of the technologies used for prevention of STIs and the promotion of SRH in the LAC region.^{15,16} We developed a PICO

(Population-Intervention-Comparator-Outcome) question as an entry point, using the methodology suggested by the Cochrane Editorial Unit.¹⁷ We searched the following databases: PubMed, EMBASE, LILACS, and Cochrane library. We inquired about HITs used for the prevention of STIs and for the promotion of sexual and reproductive or maternal health during the last 10 years for people older than 14 years of age living in LAC countries.

We also searched the gray literature using Open Grey, Google Scholar, Google, and specialized websites such as those of the WHO and PAHO. We used a combination of text terms to generate our initial search, including the words mhealth, text message, mobile technology, apps, web technology, Latin America, breast cancer, cervical cancer, HIV, STI, and pregnancy. The full-search algorithm is available upon request. We also searched through the references in published studies to identify other relevant studies.

Eligibility criteria

We included all studies published from 2006 to 2015 in English, Spanish, or Portuguese. We considered any mHealth or eHealth intervention, addressing any SRH outcome among people from LAC countries. The studies were about breast or cervical cancers, STIs, prenatal care, and adolescent pregnancy.

Exclusion criteria

We excluded all studies considering mobile or electronic technologies used as recruitment strategies, plus provider-oriented technologies or technologies developed or implemented in non-LAC countries.

Study selection

Two reviewers independently extracted relevant data from the selected studies. Screening was performed by title and abstract, and we decided on eligibility criteria for full-text assessment by consensus.

Data extraction

Information extracted from the selected studies included the year of publication, study design (e.g., clinical trial, cross-sectional), type of publication (e.g., developers' information and website), country where the



technology was used, type of technology (e.g., mobile applications, SMS, social media, and internet web pages), field (breast cancer, cervix cancer, HIV or AIDS, adolescent pregnancy, and other STIs), coverage of use (local, national, or international), cost of using the technology, target population (age, sex, and other characteristics), the purpose of the technology (e.g., information dissemination, health needs assessment), barriers and facilitators of the use of the technology, among other features.

Data synthesis

The extracted data were described quantitatively and the results are reported in the narrative form.

Results

We retrieved 187 studies from electronic databases and an additional 45 through the gray literature search. After removing duplicates ($n = 220$) and an eligibility assessment, we reviewed 31 full-text reports for data extraction (Figure 1). Of these reports, seven were peer-reviewed articles. Two-thirds of the reports were written in Spanish and one-third in English.

Publications on HITs related to SHR increased over the 10-year literature review search period (Figure 2): just 3.3 per cent of the studies were published in 2006; 30 per cent in 2015. Figure 3 presents the distribution of study designs of HITs for SRH. The largest group of studies were reports produced by technology developers (25.0 per cent), followed by case reports (21.5 per cent), and narrative syntheses (10.7 per cent). Developers were mainly community organizations (29 per cent), national programs (22.6 per cent), primary care providers (6.5 per cent), and hospitals (3.2 per cent). We identified one systematic review (SR) and one clinical trial. The systematic review assessed the effectiveness of strategies for STI prevention and the promotion of SRH worldwide, including 17 internet-based randomized controlled trials focused on STI prevention in particular vulnerable groups (e.g., persons living with HIV, and adolescents). This SR showed that until 2011 no such studies had been carried out in LAC countries.¹⁸ Two studies reported improved access to and services use by targeted populations of LAC in 2015.

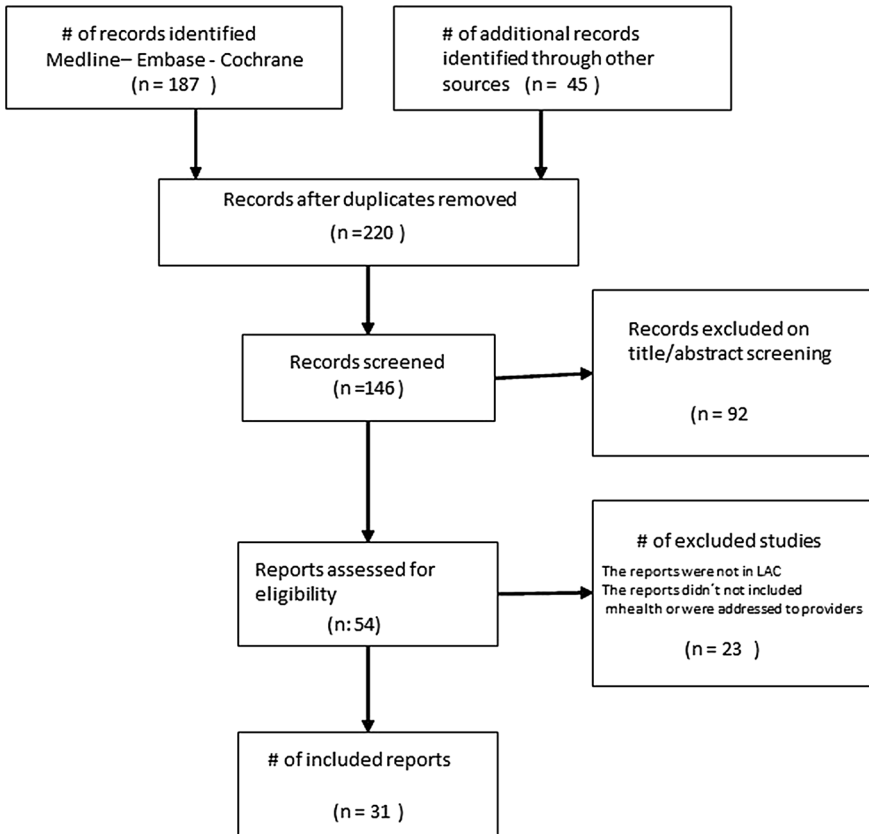


Figure 1: Studies selection flow chart.

Several technologies were developed through collaborative work between countries (Table 1). Community-Embedded Reproductive Health Care for Adolescents in Latin America (CERCA) is a project developed with support from Belgian institutions to assess the SRH needs of adolescents in the three LAC partner countries (Bolivia, Nicaragua, and Ecuador).^{19,20} The program reached adolescents through the use of social media (internet and text messages) to disseminate information, assess health needs, strengthen community participation, and reach targeted populations. HOPE (Harnessing Online Peer Education) in Peru used a social media intervention for HIV infection prevention. The University of Southern California in Los Angeles and Peruvian institutions developed the intervention.²¹ Other

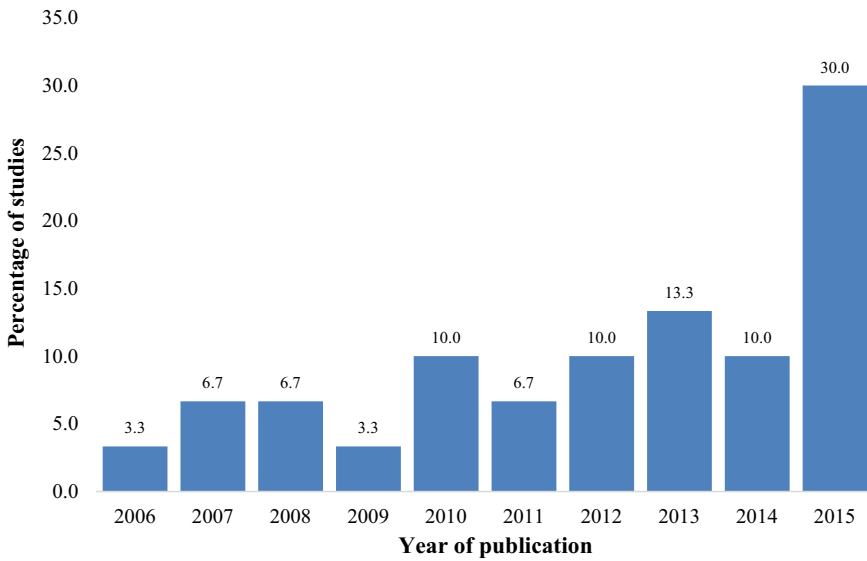


Figure 2: HITs for Sexual and Reproductive Health in LAC region by calendar year.

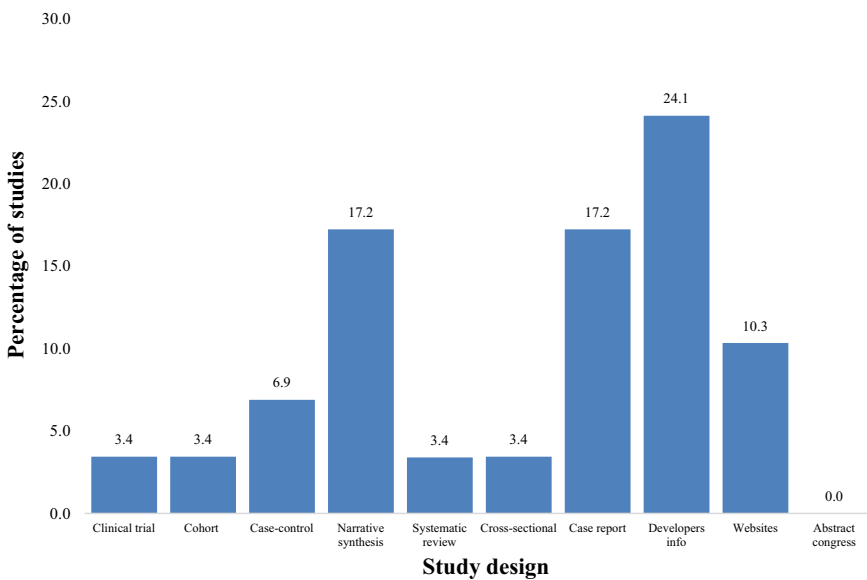


Figure 3: Study designs of HITs for Sexual and Reproductive Health identified in the LAC region.

**Table 1:** HITs characteristics for SRH in LAC countries

<i>Name of technology/developer</i>	<i>Type of technology</i>	<i>Scope of used technologies</i>
Community-embedded reproductive health care for adolescents in Latin America (CERCA project)/country governments	Email, Facebook, Twitter	Information dissemination Health needs assessment Strengthening of community participation Reach target populations
Inter-American Development Bank	App, SMS, Email, Cell Phone calls	Information dissemination
Universidad Peruana Cayetano Heredia, Lima, Peru & University of Washington, Seattle, USA	Website	Information dissemination
Sexappretos	App, Website	N/A
Instituto Colombiano de Bienestar Familiar y Bayer HealthCare AG		Information dissemination
Sexualidapp	App, Website	N/A
Mujer y Salud en Uruguay (MYSU)		Information dissemination Strengthening of community participation
TIC y salud	Website	N/A
Fundación Huésped of Argentina		Information dissemination Health needs assessment
Modo Rosa, Agencia Tripartita Comunicaciones de Colombia	App, Website	Information dissemination Strengthening of community participation
Planificación familiar, Violencia doméstica y sexual	Email	N/A
Salud Sexual y Reproductiva		Information dissemination Strengthening of community participation
Internacional (Américas)	App, SMS	N/A
Estrategia y Plan de Acción Sobre Salud (2012-2017)		Information dissemination Strengthening of community participation
Punto J	Cell phone calls	Information dissemination
Sensi Femme: guía de autoexploración mamaria	App, email	Information dissemination
International organization	Cell phone calls	Information dissemination Strengthening of community participation
Women on Web	Website	N/A
The HOPE (Harnessing Online Peer Education) Peru study	Website, social media	Information dissemination Health needs assessment Strengthening of community participation
University of California, Los Angeles y Epicentro (Perú)		N/A
Expert panel: Mano a Mano-Mujer of Chile	Website	Information dissemination

**Table 1:** *Continued*

<i>Name of technology/developer</i>	<i>Type of technology</i>	<i>Scope of used technologies</i>
Secciónsexosentido Diario online juventudrebelde of Cuba	Website	N/A Information dissemination Strengthening of community participation
Rehue Cable a tierra Facultad de CienciasMédicas de la Universidad Nacional del Comahue y Ministerio de Educacion de Argentina	Website	N/A Information dissemination Strengthening of community participation

N/A Not available.

technologies are from nonprofit entities, for example applications to spread information on STI prevention. *Sexualidapp* (Uruguay) provides information on pregnancy prevention methods and sexual and reproductive rights of adolescents.²² *Modo Rosa* (Colombia) used tools for breast cancer detection.²³ Other technologies were created as community initiatives, such as *Rehue Cable a tierra* (Argentina)²⁴ and *Sexto sentido* (Cuba),²⁵ both developed by and for adolescents to answer their sexual health questions with the support of academic institutions and governmental agencies.

The overall scope for the use of these technologies covers four groups that are not mutually exclusive: a) to assess health needs, b) to reach target populations, c) to disseminate information, and d) to strengthen community participation. Most of the HITs (80 per cent) were designed to disseminate information and strengthen community participation.

Figure 4 shows the distribution by country of identified studies. The largest number came from Peru (29.6 per cent), followed by Argentina (14.8 per cent), and Colombia (11.1 per cent). Four studies (14.8 per cent) were conducted by teams of researchers from more than one country. One-third of the HITs were developed by public entities and two-thirds by private organizations.

Among types of technology, websites (e.g., specialized information centers, blogs, and forums) were the most common (30.3 per cent), followed by short message services (SMS) (27.3 per cent) and mobile applications (12.1 per cent) (Figure 5). Among studies on SMS (10 reports), three were designed for antenatal care, three for promotion of contraceptive methods, and two for scheduling mammography tests and vaginal cytology. Half of the mobile applications were intended to

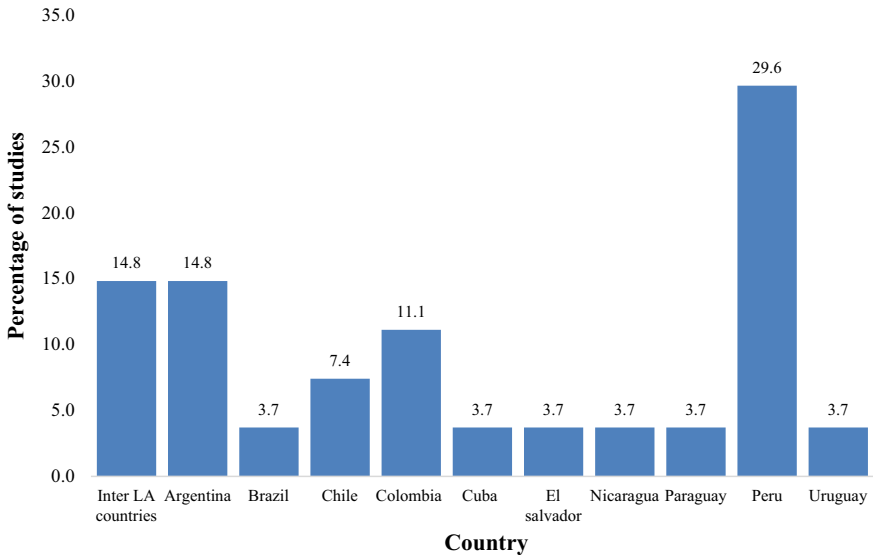


Figure 4: Distribution of HITs use in Sexual and Reproductive Health by country in the LAC region.

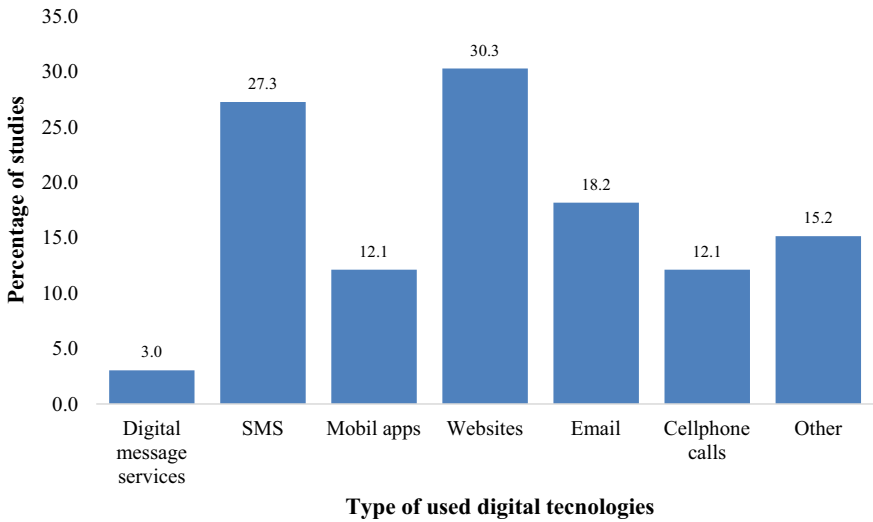


Figure 5: Distribution of type of HITs for Sexual and Reproductive Health in the LAC region.

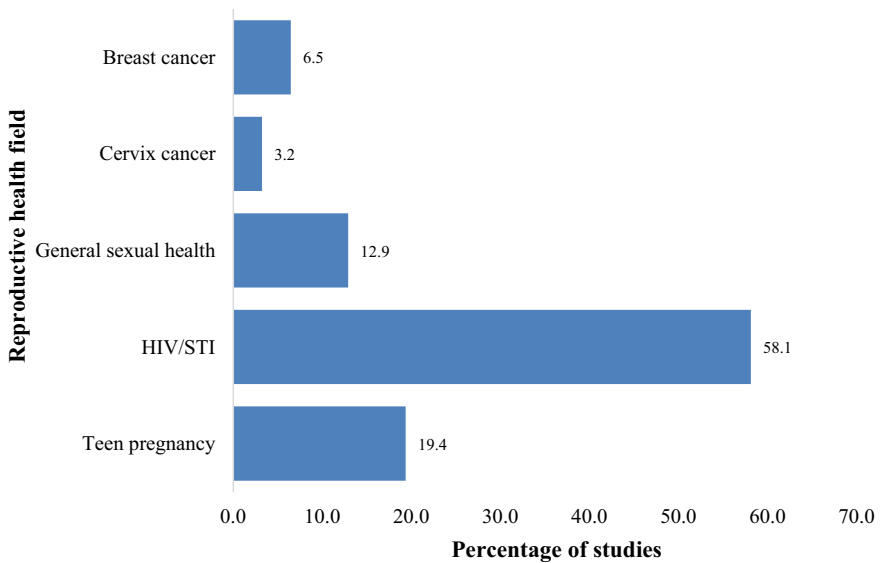


Figure 6: Distribution of HITs by specific Sexual and Reproductive Health field.

disseminate information, while the other half focused on strengthening community participation. Only two studies used social media as a HIT.

Most of the studies focused on technologies developed for HIV prevention (58 per cent), adolescent pregnancy (19.4 per cent), and general sexual health (12.9 per cent). These categories are not mutually exclusive, given that some HITs cover several fields (Figure 6). The technologies we identified were developed to improve access to SHR and coverage at the community (27.6 per cent of studies), regional (13.8 per cent), national (24.1 per cent), and international (34.5 per cent) levels (Figure 7). Most studies (66.75 per cent) focused on technologies that were free of charge. Only one mobile application charged a small user fee.

Just 17.9 per cent of the SHR HIT-related studies targeted men, while 32.1 per cent targeted women. Half targeted both sexes. Technologies targeting adolescents constituted 37.0 per cent, while 22.2 per cent targeted adults and 40.7 per cent both age groups. Twenty-one of the documents we studied reported on technologies targeting healthy populations, seven focused on pregnant women, and three were specific to HIV patients.

Five studies reported on the relationship between health insurance and the use of mobile and HITs. They showed that populations with

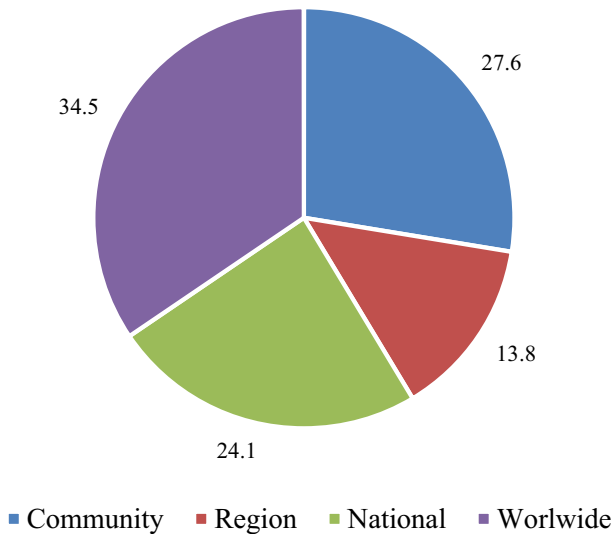


Figure 7: Geographical scope of HITs for Sexual and Reproductive Health in the LAC region.

health insurance had better access to HITs services. These studies were concentrated in Peru, Chile, and Nicaragua.

The studies also reported on the barriers to use and what facilitated use of the technology. These included a lack of information and a perception of high cost of the HIT ($n = 5$), poor access to the internet and the technology ($n = 6$), and low prevalence of cell phones ($n = 4$). Respondents included community organizations ($n = 5$), governmental programs ($N = 6$), health care providers aware of the technology ($n = 4$), and international organizations ($n = 3$).

Discussion

Our results show that available literature on the use of HITs in LAC for STI prevention and SHR promotion has steadily increased over the past decade. This trend may be explained by the recent rise in mobile telephone and internet coverage and mobile telephone adoption among LAC populations¹⁰ as well as by international efforts (e.g., PAHO) to promote the use of new information technologies for SRH improvements in the region.¹² Most of the documents we reviewed refer to one or more of PAHO's strategic areas, particularly the training of workers,



the dissemination of HITs to the population, the evaluation of these experiences, and public–private collaboration.

In some countries, for example in Peru, government authorities and research institutions demonstrated considerable interest in the implementation and evaluation of technological developments to improve health care access for specific population groups.²⁶ Our findings show that most of the studies come from Peru, as the application of digital technology is widespread in the health field, not only for SRH interventions, but also for a broad set of interventions.² Other countries have not yet developed this capacity, as they prefer to stick to traditional ways of expanding access to health care services.²⁷

Most of the retrieved documents contain information provided by technology developers. The technologies were targeted preferentially to STI prevention, adolescent populations, delivered through websites, and developed by international collaborative partnerships. In line with WHO's second global survey on eHealth, conducted in 2002,^{3,9} we found that technologies focusing on community mobilization and health promotion were common in the LAC region. In contrast to the WHO survey showing that health call centers were the most frequent mHealth initiatives in the LAC region, we found that text messages and websites were more common.

Adolescent pregnancy was addressed by almost a third of the retrieved reports. This population is a target for SRH mobile and electronic interventions as previously noted.²⁸ A large percentage of internet users in the LAC region are adolescents and young adults, with more than 80 per cent of adolescents having access to mobile phones.²⁹ This helps explain our finding that most of the studies focused on intervention for adolescents.

The type of reports we identified most frequently were those published by technology developers, followed by those providing narrative syntheses and case reports of interventions. Although reports provide valuable information, they should not necessarily be considered evidence for decision making or further studies. They may be biased by a commercial or institutional interest.^{22,30} Narrative syntheses frequently do not provide detailed information about individual cases, limiting their value as providers of evidence. Case reports have more relevance because they tend to provide full descriptions of methods and results of experiences, but they tend to remain descriptive, reducing the capacity of studies to assess outcomes and effects, and to maintain their scope in the assessment of implementation.

SMS and websites are the most common technologies used. Both platforms create an interface between users and providers. They have been used to accomplish many goals, including setting dates for antenatal care consultations and appointment reminders, as well as transferring information to target groups, particularly adolescents, about contraceptive options to prevent unwanted pregnancies and to reduce the risks of STI.^{31,32} Aimed at improving health outcomes, mobile applications and social media might be considered more promising applications based on their potential to engage end users in a more interactive way and to disseminate instantly and widely their messages. HOPE, the social media intervention to increase HIV testing among men who have sex with men in Peru, is a good example of a study to assess outcomes. The assessment showed that this intervention was a sound approach to increasing HIV testing among this population.²¹

Our results also show that LAC countries still lack the resources for the widespread use of HITs. This reflects lack of access to the internet and limited knowledge of the platforms. Governments must address and resolve these barriers. Additional policy barriers may be related to financial resources available. SRH challenges in LAC are present during an “epidemiological transition,” where resources are being progressively transferred from disease prevention and health promotion to the treatment and care of chronic and degenerative diseases.^{33,34}

Most of the technologies were developed through collaborative work between government bodies, universities and/or health care organizations. This demonstrated the relevance of the development and implementation, through a partnership approach, of electronic and mobile health in low and middle-income countries. Civil society organizations play a crucial role in improving SRH in most LAC countries — provision of services to pregnant women and the dissemination of relevant information, especially from a SRH rights perspective.³⁵

A major limitation of this study was the lack of a comprehensive literature search strategy. Although we considered published and gray literature, some unpublished or poorly promoted technologies might not have been identified. We retained for our review one search result that was the only systematic review of randomized controlled trials. We kept it in the sample to be reviewed despite the fact that no study in the LAC region was included. It helped us show that evaluation of efficacy of HIT for SRH is absent in the region. Because most studies lacked rigorous study design and analytical methods, there was a limited



capacity to assess the effectiveness of the implemented technology on health and health equity outcomes.³⁶

Conclusion

Our results show that despite the efforts made in the LAC region and recent increases in the availability of HIT for SRH, no general strategy to expand and evaluate the use of HITs exists. This should be encouraged, given the increasing use of HITs within the LAC region. The region should look to successful implementation of digital technologies in other developing countries, framing questions within public health policy. Suitable regulation can guarantee that usage improves the performance of health services provision—achieving universal coverage, maximizing quality of care, and the optimizing the use of available resources. The expansion of these technologies around the world offers a promising picture and LAC health systems should take advantage of this opportunity to launch innovations that could help close the gap between SRH services and populations.

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