Original Paper

Participatory Interventions for Sexual Health Promotion for Adolescents and Young Adults on the Internet: Systematic Review

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Abstract

Background: The World Health Organization recommends the development of participatory sexuality education. In health promotion, web-based participatory interventions have great potential in view of the internet's popularity among young people.

Objective: The aim of this review is to describe existing published studies on online participatory intervention methods used to promote the sexual health of adolescents and young adults.

Methods: We conducted a systematic review based on international scientific and grey literature. We used the PubMed search engine and Aurore database for the search. Articles were included if they reported studies on participatory intervention, included the theme of sexual health, were conducted on the internet (website, social media, online gaming system), targeted populations aged between 10 and 24 years, and had design, implementation, and evaluation methods available. We analyzed the intervention content, study implementation, and evaluation methods for all selected articles.

Results: A total of 60 articles were included, which described 37 interventions; several articles were published about the same intervention. Process results were published in many articles (n=40), in contrast to effectiveness results (n=23). Many of the 37 interventions were developed on websites (n=20). The second most used medium is online social networks (n=13), with Facebook dominating this group (n=8). Online peer interaction is the most common participatory component promoted by interventions (n=23), followed by interaction with a professional (n=16). Another participatory component is game-type activity (n=10). Videos were broadcast for more than half of the interventions (n=20). In total, 43% (n=16) of the interventions were based on a theoretical model, with many using the Information-Motivation-Behavioral Skills model (n=7). Less than half of the interventions have been evaluated for effectiveness (n=17), while one-third (n=12) reported plans to do so and one-fifth (n=8) did not indicate any plan for effectiveness evaluation. The randomized controlled trial is the most widely used study design (n=16). Among the outcomes (evaluated or planned for evaluation), sexual behaviors are the most evaluated (n=14), followed by condom use (n=11), and sexual health knowledge (n=8).

Conclusions: Participatory online interventions for young people's sexual health have shown their feasibility, practical interest, and attractiveness, but their effectiveness has not yet been sufficiently evaluated. Online peer interaction, the major participatory component, is not sufficiently conceptualized and defined as a determinant of change or theoretical model component. One potential development would be to build a conceptual model integrating online peer interaction and support as a component.

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KEYWORDS

sexual health; health promotion; internet; participatory interventions; adolescents and young adults; methods

Introduction

Adolescent sexual exposure is of concern due to the risk of contracting sexually transmitted infections (STIs), experiencing an unwanted pregnancy, and unexpected paternity/maternity [1]. Among the 333 million new cases of STIs each year, the highest rates occur among those aged 20 to 24 years, followed by those aged 15 to 19 years [2]. Among a group of 21 countries, the pregnancy rate among those aged 15 to 19 years is highest in the United States (57 pregnancies per 1000 females) [3]. The proportion of teenage pregnancies that result in abortion varies by country, but in half of those for which recent information is available (mainly in Europe, North America, and Oceania), 35%-55% of pregnancies ended in abortion [3]. In 2014, in the United States, females aged <15 years and 15 to 19 years accounted for 0.3% and 10.4% of all reported abortions in the country, respectively [4].

Adolescence and the transition to adulthood marks the entry into sexuality. Sexual health requires a positive and respectful approach to sexuality and sexual relations, and the ability to have enjoyable and safe sexual experiences that are free from coercion, discrimination, and violence [5]. Adolescents and young adults (AYA) represent a priority population for sexual health promotion and education [6]. The associated fields of intervention encompass the development of knowledge and level of information, the development of attitudes to sexual health (attitudes toward safe sex practice, including attitudes to condom use or voluntary testing for STIs), and the development of personal competencies and supportive relational skills (critical thinking, consent, negotiation, open-mindedness, respect, self-esteem).

For example, as stated by the Information Motivation Behavioral Skills (IMB) model (applied and validated for HIV risk reduction), behavioral competencies and therefore health behaviors may be influenced by the level of information, but also by motivation, namely beliefs and attitudes toward a particular health behavior and the perceived social support (or social norm) to engage in this behavior [7]. In addition, health literacy is the ability of individuals to obtain, process, and understand the information and services necessary to make appropriate health decisions [8]. Increase health literacy would enable the improvement of appropriate health decision making with regard to sexual health, promoting equity and achieving the United Nations' Sustainable Development Goals 2030 [9].

The recommendations of the World Health Organization are clearly stated [10]: sexuality education must be participatory (young people should not be mere passive receivers), interactive (with educators and program designers), and continuous. This education must be adapted to the language of the young people, while also teaching appropriate terminology to strengthen their communication skills.

In health promotion, digital media interventions for sexual health have great potential because of the scope and popularity of technologies such as the internet and mobile phones, especially among young people [11,12]. Interactive online interventions for sexual health promotion can also lead to better knowledge, self-efficacy, and positive sexual behavior, and have demonstrated a reduction in STIs [12].

The internet is a major health information resource, and online health information research is an important prerequisite for health empowerment and literacy [13,14]. Moreover, research on information flows and attitudes within social networks suggests that links between people can promote the exchange of relevant information between peers, and affect their attitude toward this information, as individuals are more receptive to information shared by others who are like them [15]. For example, the popularity of social networking sites and their interactive features have great potential to reach young people, and offer a new way to engage and communicate with AYAs, including the provision of appropriate education [16]. Nevertheless, their uses are for the most part "passive," and social networking sites are not yet used as tools for multidimensional communication and networking [17].

Our research question is whether interventions for the promotion of young people's sexual health include participatory components, and if so, how they are integrated and how the interventions are evaluated. Some publications and literature reviews have investigated sexual health interventions on the internet, social media [12,18], online serious games [19], or in digital media [12,20,21]. However, no publication has focused on the participatory aspects of this type of intervention in sexual health specifically aimed at young people (participation in an activity such as online games, quizzes), particularly interactive features such as the exchange of information and experiences between peers (persons of the same age, social context, function, education, or experience) or with professionals. The aim of this review is to identify and describe existing studies and the methods used to assess online participatory interventions aimed at promoting AYA's sexual health.

Methods

Overview

This systematic review was based on international scientific literature and grey literature. The review is structured in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) statement [22] and follows the associated guidelines (Multimedia Appendix 1). The systematic review protocol has previously been published on the PROSPERO International Prospective Registry of Technical Reviews (ID CRD42018088240).

Inclusion Criteria

Articles were included without time restriction according to the 5 following criteria: (1) Study of an intervention including a sexual health theme; (2) Population aged between 10 and 24 years (with an average age or an interval comprising all or at least part of this age group), because the WHO defines adolescents as aged 10 to 19 years and young people as aged

15 to 24 years [23,24]; (3) Study of a participatory intervention; (4) Study of an intervention conducted on the internet (website, social media, online gaming); (5) Design, implementation, and evaluation methods must be available via the article.

Strategy Search

The electronic search strategies are described in Multimedia Appendix 2. We used the PubMed search engine for our main search. For complementary research, we used the Aurore database of Institut National d'Études Démographiques (INED; a French public research institute), which includes scientific databases and grey literature, allowing access to a range of databases and electronic journals (see Multimedia Appendix 2 for selected international search engines). The last update was on January 28, 2019.

Study Selection

Reports were assessed by two reviewers (PM and LC), who screened the titles and abstracts to identify relevant studies. Full texts were read when abstracts met inclusion criteria, and when abstracts were not clear enough to determine eligibility. Disagreements between reviewers were resolved by discussion. When the full text was not available, authors were contacted by email; all the contacted authors responded favorably and shared their articles with us.

Data Collection

A standardized data collection form was developed, and two reviewers independently extracted data from studies. Our extraction grid was developed using the PICOTS (populations, interventions, comparators, outcomes, timing, and setting) elements [22], and was completed using Michie's taxonomy [25] to collect information on the behavior change techniques (BCT) used by interventions. The studies were classified according to different types: research protocol only, effectiveness evaluation, and process evaluation. Protocol articles are planned studies containing only the conceptual and evaluative methods intended for intervention research. An effectiveness study is defined as a demonstration of an intervention's efficacy in natural situations. It provides evidence of the intervention's effect on determinants or health outcomes. A process study provides evidence on the implementation and feasibility of an intervention, and also rates the intervention for attractiveness and acceptability. It helps to assess the reliability and quality of implementation, to clarify causal mechanisms, and to identify contextual factors associated with variations in outcomes [26].

Analysis

For the final studies selection phase, the degree of interreader agreement was assessed for both readers through the calculation of the κ coefficient.

We conducted descriptive analyses on data collected from studies on the following points: description of the population; characteristics of study methodology; description of the intervention; description of the media used; description of methods used for effectiveness, and process evaluation. We used Michie's [25] taxonomy to analyze the BCT used by interventions, depending on the information available in the intervention.

Results

The electronic search strategies used identified a total of 2555 references after removing duplicates. After selection based on title and abstract screening, the full text of 125 references was evaluated. After this inclusion phase, 49 articles describing 37 interventions were included. For each intervention included, we searched for other publications concerning it, and 11 additional studies were included, based on the references cited in the included articles. A total of 60 articles describing 37 interventions were included; several articles were published for the same intervention (Figure 1). The degree of interreader agreement for the final selection of the 60 articles was calculated with the κ coefficient and it was equal to 0.98. All the studies included in this systematic review are available in Multimedia Appendix 3. Descriptive data for the included studies and interventions are available in Table 1. Of the 60 articles included, 52% (n=31/60) were published in the last 5 years (Table 2).

Overall, 62% of the studies (n=36/58) were conducted in the United States. Of the types of studies, 45% (n=27/60) exclusively concerned process results, 22% (n=13/60) included process results and effectiveness results, 17% (n=10/60) exclusively had effectiveness results, and 17% (n=10/60) were exclusively protocol publications. Of the 37 interventions, 51% (n=19/37) addressed sexual health holistically. Overall, 51% (n=19/37) targeted a general population. In cases where specific populations were targeted (49%, n=18/37), 44% (n=8/18) were identified by their sexual orientation. In total, 65% (n=24/37) of all interventions were for both sexes, 22% (n=8/37) were for males only, and 11% (n=4/37) were for women only. The targeted population in terms of age was mainly individuals aged 10 to 24, strictly defined in 35% of the interventions (n=13/37). However, other studies had a less specific or different range of age targeted: aged 10 to 17 years, aged 10 to >24 years, aged 18 to 24 years, or aged 18 to >24 years; some studies simply referred to "students" or "youth." In total, 43% (n=16/37) used multiple recruitment methods.

Figure 1. Flow chart of the literature reviewing process. Aurore is a database of Institut National d'Études Démographiques (a French public research institute) that combines scientific databases and grey literature, allowing access to a range of databases and electronic journals.

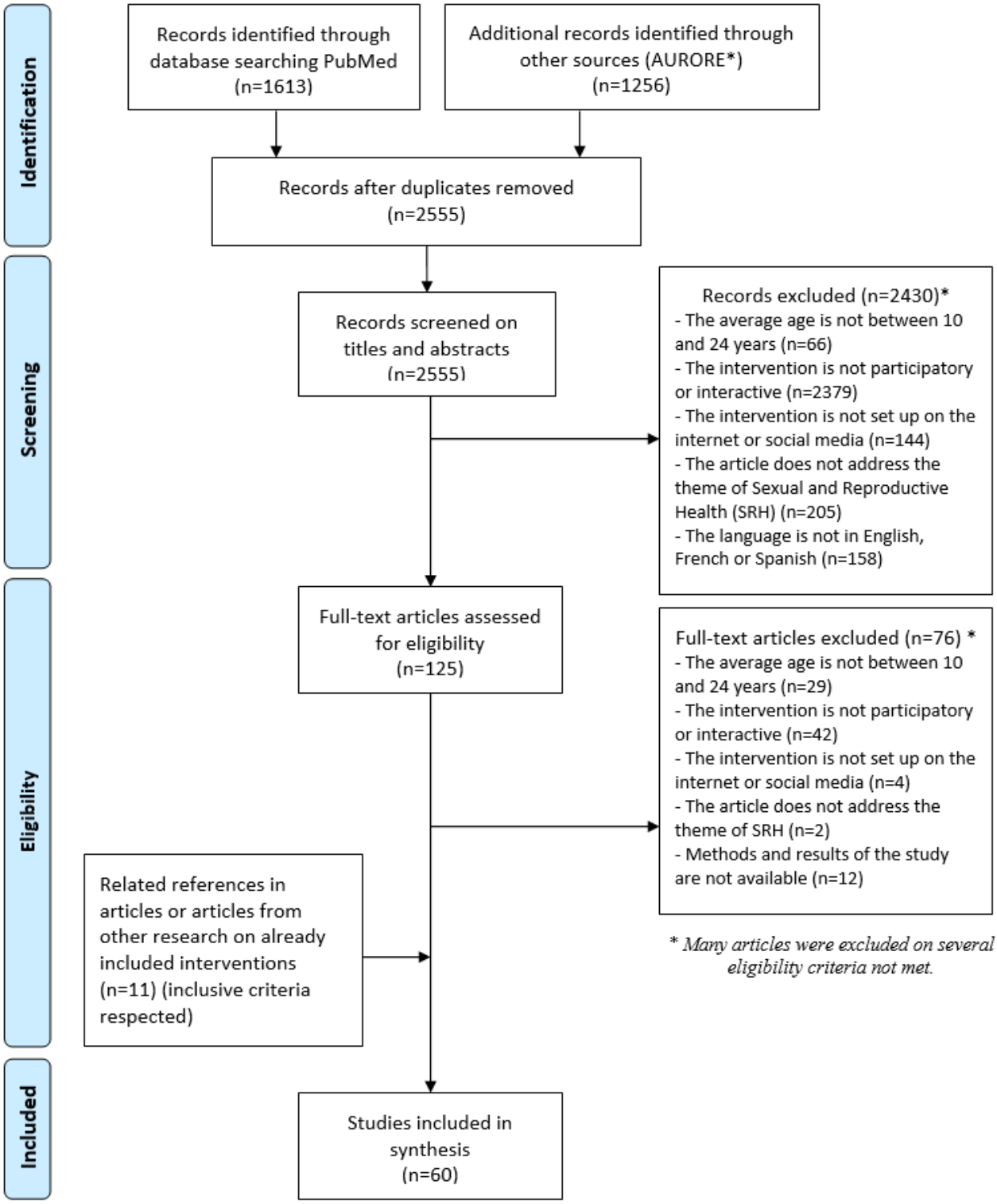

Table 1. Description of the characteristics of the 60 articles and the 37 interventions.

Characteristics	Studies, n (%)
Characteristics of articles	
Year of publication (n=60)	
2006-2009	2 (3)
2010-2014	27 (45)
2015-2019	31 (52)
Study country (n=58; NI[a]=2)	
United States	36 (62)
Canada	1 (2)
United Kingdom	4 (7)
Netherlands	1 (2)
Europe (other)	2 (3)
Australia	3 (5)
Uganda	4 (7)
Brazil	2 (3)
Chile	2 (3)
Asia	3 (5)
Study objective (n=60)	
Process evaluation only	27 (45)
Process and effects evaluation in one article	13 (22)
Effects evaluation only	10 (17)
Protocol study only	10 (17)
Measure for evaluation[b] (n=60)	
Process evaluation (quantitative questionnaire)	21 (35)
Process evaluation (qualitative measure)	21 (35)
Effectiveness evaluation (quantitative questionnaire)	19 (32)
Effectiveness evaluation (qualitative measure)	3 (5)
Characteristics of interventions	
Target population[b] (n=37)	
General	19 (51)
Specific	18 (49)
Sexual orientation	8 (22)
Ethnic minorities	4 (11)
Others	7 (19)
Sex (n=37)	
Males and females	24 (65)
Males only	8 (22)
Females only	5 (14)
Age group (years; n=37)	
10 to 17	2 (5)
10 to 24	13 (35)

Characteristics	Studies, n (%)
10 to >24	8 (22)
18 to 24	4 (11)
18 to >24	8 (22)
Age not specified but considered as “students” or “youth”	2 (5)
Recruitment[b] (n=34; NI[a]=3)	
Social networking sites	12 (35)
Internet	11 (32)
Secondary schools	9 (26)
Community or youth organizations	8 (24)
Clinics	7 (21)
Universities	5 (15)
Email	4 (12)
Peers and word of mouth	3 (9)
Phone	2 (6)
Registers	1 (3)
Smartphone apps	1 (3)
Health educators	1 (3)
Incentives[b] (n=23; NI[a]=14)	
Yes	21 (91)
Direct remuneration	12 (52)
Gift card	10 (43)
Book or movie voucher	1 (4)
Points for lot	1 (4)
Raffle for remuneration	1 (4)
No	2 (8)
Theme (n=37)	
Sexual health promotion	19 (51)
HIV/sexually transmitted infection prevention specifically	12 (32)
Sexual violence prevention	3 (8)
Hepatitis B virus and hepatitis C virus testing promotion	1 (3)
Improve HIV care linkage	1 (3)
Observe peer influence in sexual situations only	1 (3)

[a]NI: no information in the article.

[b]For a given article (N=60) or an intervention (N=37), several entries are possible. Totals do not always equal 100%.

Table 2. Number of publications over time.

Year	Studies published, n
2006	1
2009	1
2010	3
2011	2
2012	8
2013	10
2014	4
2015	5
2016	9
2017	10
2018	6
2019 (January)	1

Descriptive data on the intervention types, online supports, and features are shown in Table 3 (for a description of each intervention, see Multimedia Appendix 4). Concerning intervention types, 41% (n=15/37) involve a dissemination of information with participatory components (game, quizzes, discussions). The medium used is a website in 54% (n=20/37) of cases, followed by online social networks (35%, n=13/37), with Facebook used in 22% (n=8/37) of cases. Furthermore, 14% (n=5/37) use several different online supports for the implementation of the intervention. To protect the identity of participants, 49% (n=18/37) of the interventions provide anonymity. Of these, 72% (n=13/18) allow participants to use personal identifiers, and 67% (n=12/18) use private websites. The interventions based on social networking sites do not mention anonymity because this is not possible on such sites. However, on Facebook, one (n=1) intervention used a secret group for greater confidentiality, another (n=1) used a private SMS text messaging system, and another (n=1) used a private page that only registered participants can access. Concerning participatory features, 68% allow interaction, either between peers (62%, n=23/37) or with a professional (43%, n=16/37). This interaction is mainly through online social networks (22%, n=8/37) and discussion forums (19%, n=7/37). Overall, 5% (n=2/37) use multiple supports for interaction. Involvement in a game-type activity was possible in 27% (n=10/37) of cases. Videos were broadcast in 54% (n=20/37) of cases. Finally, 43% (n=16/37) of the interventions were constructed from a theoretical model, with 19% (n=7/37) using the Information-Motivation-Behavioral Skills model.

Table 3. Intervention type, online support, and features description (N=37).

Variables	Studies, n (%)
Intervention type	
Information dissemination with participatory components (games, quizzes, discussions)	15 (41)
Online community/discussion only	11 (30)
Participation in activities only (including games)	6 (16)
Participatory educational session only	3 (8)
Personalized assistance	2 (5)
Online support for implementation[a]	
Website	20 (54)
Social networking sites	13 (35)
Online game only	5 (14)
Apps	4 (11)
Social networking sites used[a]	
Facebook	8 (22)
YouTube	3 (8)
MySpace	2 (5)
Twitter	1 (3)
Flickr	1 (3)
Tumblr	1 (3)
Instagram	1 (3)
WeChat	1 (3)
Not specified	1 (3)
Participatory features (1) - interactive part[a]	25 (68)
Interaction between peers and with professionals	14 (38)
Interaction between peers only	9 (24)
Interaction with professionals only	2 (5)
Peer leaders formation and implication	5 (14)
Section to ask a professional	5 (14)
Support for interaction (peers and professionals)[a]	
Social networking sites	8 (22)
Forum discussion	7 (19)
Blog	3 (8)
On website without more information	3 (8)
Chat	2 (5)
In the online game	2 (5)
Video comment section	1 (3)
On application	1 (3)
“Ask the expert” section	1 (3)
Participatory features (2) - involvement in an activity[a]	16 (43)
Online video game system	10 (27)
Interactive quiz	4 (11)
Personal goals	2 (5)

Variables	Studies, n (%)
Other features (3) - receipt of information[a]	
Video system	20 (54)
Transmission or link of existing websites	4 (11)
Theory model used for intervention conception[a]	
No	21 (57)
Yes	16 (43)
Information-Motivation-Behavioral Skills Model	7 (19)
Social Identity Theory	2 (5)
Social Cognitive Theory	2 (5)
Social Learning Theory	1 (3)
Others	9 (24)
Two or more theories used	5 (14)
Community-based participatory research	
Yes	21 (57)
Unspecified	16 (43)

[a]An intervention can use several theories or several supports and contain different functionalities. Totals are not always equal to 100%.

The five most commonly used behavior change techniques are as follows (Multimedia Appendix 5). First, 78% (n=29/37) of interventions introduce or define an environmental or social stimulus to encourage or guide behavior. Second, 78% (n=29/37) provide information on the health consequences of performing the behavior. Third, 73% (n=27/37) present information from a credible source in favor of or against the behavior. Fourth, 70% (n=26/37) organize and provide some form of social support within the intervention. Fifth, 65% (n=24/37) provide information on what others think about the behavior. No intervention provides punitive measures or remuneration for the conduct of the behavior sought.

Of the 37 interventions, 57% (n=21/37) indicate that they called on young people for community-based participatory research (collective construction). This takes various forms: 38% (n=14) of the interventions conducted focus groups to discuss the proposed intervention, 27% (n=10) directly included youth in the development of content, 8% (n=3) adapted their content based on feedback from young people in pretest studies, 5% (n=2) involved youth in the evaluation, and 3% (n=1) formed a youth advisory committee.

Data on the design and evaluation methods are available in Table 4. For a description of the methods of each intervention, see Multimedia Appendix 6. In total, 43% (n=16/37) were evaluated according to a randomized controlled trial (RCT) design. Overall, 22% (n=8/37) provided a follow-up between 1 and 2 years, while the remainder reported a follow-up shorter than 1 year (59%, n=22/37) or did not specify a follow-up time (19%, n=7/37). For process evaluation, 35% (n=13/37) did an acceptability study, 30% (n=11/37) did an attractiveness study, and 27% (n=10/37) assessed feasibility. Regarding effectiveness, 46% (n=17/37) of the interventions were subject to an outcome evaluation and 32% (n=12/37) had a planned outcome evaluation. Among the outcomes evaluated (conducted or planned evaluation), sexual behaviors were the most evaluated (38%, n=14/37), followed by condom use (29%, n=11/37) and sexual health knowledge (22%, n=8/37).

Table 4. Intervention design and evaluation methodology (N=37).

Study information	Studies, n (%)
Design study	
Randomized controlled trial (RCT)	16 (43)
Control group (NI=2)[a,b]	15 (41)
Information-only control website[b]	4 (11)
Before-after study (no RCT)	7 (19)
Cross-sectional study	3 (8)
Other design	8 (22)
Unspecified	3 (8)
Follow-up	
No follow-up	3 (8)
0.5-2 months	3 (8)
3-5 months	9 (24)
6-11 months	7 (19)
12-24 months	8 (22)
Unspecified	7 (19)
Process outcomes evaluated[c]	
Acceptability	13 (35)
Attractiveness	11 (30)
Feasibility	10 (27)
Satisfaction	3 (8)
Implementation	3 (8)
Outcomes evaluation conducted[c]	17 (46)
Behaviors	10 (27)
Condom use, condom use intention, self-efficacy toward condom use, and attitude toward condom use	9 (24)
Attitudes	4 (11)
Communication	3 (8)
Knowledge	3 (8)
Behavioral skills	2 (5)
Self-efficacy	2 (5)
Contraception use	1 (3)
History of sexually transmitted infections	1 (3)
HIV stigma	1 (3)
HIV test history (date and result of the last test)	1 (3)
Incidence of sexually transmitted infections	1 (3)
Intentions related to risky sexual activity	1 (3)
Internalized homophobia	1 (3)
Intimate partner violence	1 (3)
Motivation	1 (3)
Pubertal development	1 (3)
Sexual abstinence	1 (3)
Waiting before having sex	1 (3)

Study information	Studies, n (%)
Other outcomes evaluated only once	17 (46)
Outcomes evaluation planned[c]	12 (32)
Knowledge	5 (14)
Behaviors	4 (11)
Condom use	2 (5)
Intentions	2 (5)
Self-efficacy	2 (5)
Occurrence of pregnancy	1 (3)
Occurrence of sexually transmitted infections	1 (3)
Self-reported pregnancy	1 (3)
Self-reported sexually transmitted infections	1 (3)
Fertility distress	1 (3)
Repeat HIV/sexually transmitted infection screening	1 (3)
Number of tests for *Chlamydia trachomatis*	1 (3)
HBsAg and anti–hepatitis C virus IgG test uptake	1 (3)
HIV-related care engagement	1 (3)
Motivation	1 (3)
Number of partners	1 (3)
Sexual communication self-efficacy	1 (3)
Use of safety strategies	1 (3)
Viral suppression	1 (3)
Other outcomes planned for evaluation only once	7 (19)
Unspecified outcomes evaluation	8 (22)

[a]NI: no information in the article.

[b]Since a control group can also be a group receiving an informational website only, the total exceeds the number of RCTs.

[c]An intervention can evaluate several outcomes or process components. Totals are not always equal to 100%.

Discussion

Principal Results

Our review identified 37 different interventions, which were the subjects of 60 articles. The number of online participatory interventions for the promotion of young people's sexual health has increased significantly over the past 5 years, especially in the United States. Three key points drew our attention: (1) Several different online supports are used by interventions and we would recommend adapting these to young people's preferences; (2) Online peer interaction is the participatory element most often used in interventions and is a promising health promotion approach; (3) In view of the limited number of effectiveness evaluations, it is necessary to define a conceptual model of interventions to enable comprehensive and rigorous evaluation and to understand the effect of peer interaction and participatory components.

How to Adapt to the Favorite Media of Young People?

Concerning the online support used, interventions are mainly first developed on websites. The second most popular medium is social networks, with Facebook dominating, as already shown in a previous review of social networking sites [18].

Surprisingly, young people's favorite social networks [27] are rarely used. Only one intervention was on Instagram [28], three were on YouTube, and none were on Snapchat. However, these three media have been described as the new preferred ones of youth, whereas the popularity of Facebook is declining [27]. The future challenge for researchers will be to develop interventions that can evolve with young people’s preferences, keeping up with rapid generational changes. In our review, few interventions use more than one online medium. One option would be to use a multichannel approach for interventions. Such an approach already exists to some extent in the American intervention “weCare,” which allows young people to choose how they connect with educators, with three possible contact modalities: Facebook Messenger, SMS text messaging, and app-based instant messages [29].

Our findings also highlight the need to design interventions adapted to the uses, languages, interests, and realities of young people, particularly through interactive and playful components. One way to remain close to the interests of young people is to

integrate promising new media in interventions, such as videos and games. It is also possible to allow users to insert their own content or to customize websites. Integrating attractive components that are correctly implemented will ensure better group retention. To know what is preferred by young people, it is therefore necessary to have measures of attractiveness. This review has cited different measures: online media usage, process data (number of visits, time spent, and interaction rate), technical recommendations, content adapted to the target audience (specificity and age), satisfaction, points of view, and involvement of participants (especially sexual minorities).

Web-based interventions also raise the challenges of security, privacy, and anonymity. For example, the lower use of social networking sites for research compared to websites may also be due to the fact that the ownership of the data from youth participation belongs to these media. This data would be less easy to protect in terms of security, confidentiality, and privacy, especially against cyberstalking, requiring moderation at all times. In the studies reviewed here, authors provided little information on how they protected participants' data. On social networking sites, some researchers use closed groups to control the exchange of participants' data. Others host the data through a secure external website. Technical partners, such as social networking sites, are bound by specific laws and contractual data protection clauses, and there is a clear regulatory framework for many countries [30]. As noted by some authors [11,31,32], ethical and data security frameworks need to be strengthened. For example, the importance of blocking public access to online interventions and developing powerful security features is underlined [33]. Concerning anonymity, protection of the identity of participants is possible mainly on private websites, which is especially important in the context of sexual health, where the internet is used to avoid embarrassment and overcome privacy issues [34].

How to Implement Peer Dynamics in Interventions?

All media can be used to disseminate information among young people, either top-down (from an educator to a young person) or cross-functionally (between peers). The interest of the 37 interventions assessed here rests on their participatory activities, of which peer interaction is the most frequent component.

Peer exchanges were described in different ways: counselling, experience-sharing, community involvement, personal stories, self-help, and peer support. Peers were considered not only as participants, but also as peer educators (opinion leaders) previously trained by professionals [35-37]. In one study, the potential for sharing and comparing real experiences was supported [38], with an expressed need for sharing experiences among peers. Participants also expressed the desire for social interaction online with other young people [39].

More personalized approaches better target the concerns of each individual, as seen in the Media Aware [40] and Queer Sex Ed [41] interventions (individuals' goals). Participants could also disseminate their own content, as seen in the HealthMpowerment intervention [42-44]. Peer dynamics also occur when young people are directly involved in the community-based participatory research process, especially in sexuality education programs [10]. This process can validate the role of community members and academics as equitable partners [45]. In our review, we determined that this process is widely used at the design stage. Peer interaction is thus enabled by most interventions and is described as strengthening an intervention's capacity to change behaviors, even if professionals are involved. The dynamics between peers, and the feeling of being "between young people," are seen as potentialities. Surprisingly, the term "peer education" is not a term used in the reviewed articles. "Peer education" is actually an exchange of experiences and information between peers in "real life," integrating the notion of "shared education" [46], and is thus well suited to these interventions. One intervention did use the term "peer-led" [35]. Peer dynamics are little conceptualized by the authors, and a model for designing and evaluating interventions is lacking.

How to Evaluate Interventions?

The objective of interventions is to change sexual health outcomes positively. For the moment, although experimental plans are defined, publications focus more on intervention processes than effectiveness in terms of health outcomes. This probably reflects the need to identify implementation problems beforehand, as a lack of effect may reflect a failure in implementation rather than the ineffectiveness of the intervention [26]. Implementing an intervention correctly will ensure better group retention. To evaluate effectiveness, the randomized controlled trial remains the most widely used or planned design. It does not preclude assessing the effect of an intervention on a range of outcome measures [47].

In interventions dealing with evaluation, behaviors were most often the main outcome, followed by knowledge, self-efficacy, and attitudes. A majority of follow-up interventions lasted less than 1 year. Nonetheless, it would be interesting to have a long-term follow-up to determine whether short-term changes persist [21]. Behavior measures are based on self-reported data, and many authors have highlighted the issue of social desirability bias as a limitation [36,40,41,48-51].

Our review found few plans to observe a robust indicator, such as STI incidence [52], HIV-related care engagement and viral suppression [29], or pregnancy [53,54]. These indicators can measure the real impact of an intervention on sexual health. Nevertheless, this requires a large sample size in order to have sufficient power to detect the effects of the intervention, especially when the expected outcomes have a low baseline rate of incidence (eg, HIV incidence), unless these studies are conducted on high-risk groups.

In this context of complex intervention, mechanisms of action should be identified and interventions should rely on a theoretical, conceptual, and operational model. This will enable all the participatory, social, and collective variables involved in the process to be measured and validated. Based on a literature review, Borek and Abraham developed a conceptual model of mechanisms of change in small groups [55]. For peer interventions, Simoni et al [56] argue for a strong theoretical framework to support behavior promotion, link to outcomes, and justify peer inclusion. In addition, strategies combining several theories and concepts may have a greater effect [57], as seen in the TeensTalkHealth intervention [58], which used the IMB model [7] combined with communication theory [59].

Several interactive processes (group development, group dynamics, social change) have been highlighted and could be used for the constitution and animation of social groups [55]. Finally, applying a comprehensive model of internet-based peer education (or peer-led behavior change) for sexual health is a promising approach, as long as a proliferation of concept and theoretical models does not occur. Rigorous methods, such as the 5 steps of the Intervention Mapping protocol, can contribute to the development of more effective behavior change interventions and methods of evaluation, assessing all stages of adoption, implementation, and sustainability of the intervention [60,61].

Limitations

Our review was conducted with a cross-validation methodology based on two search tools (PubMed and Aurore), but we cannot rule out that some interventions escaped our research. Participatory or interactive interventions may exist but may not be evaluated and published (for example, the website Sex, Etc [62]). Finally, wide variations in interventions made it inappropriate to synthesize the results using a meta-analysis.

Conclusions

This review describes existing interventions in participatory sexuality education for young people on the internet. It aims to provide guidance for interventions that meet the expectations of national and international strategies on youth sexuality education. Identified interventions are deployed on many internet media and have shown their feasibility, practical interest, and attractiveness. However, they are still in the early stages of design and evaluation, particularly as regards the effect of peer interaction, and do not always adhere to existing theoretical models. We recommend building a conceptual, theoretical, and evaluation model for community-based interventions involving peer interaction and participation in activities, providing the necessary operational and evaluative tools. Interventions must be designed with regard to media multiplicity, youth populations (orientations, gender identities), and a holistic sexual health approach. To improve these interventions, we recommend having a more participatory approach, involving young people in the whole process, including the design phase.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Checklist items pertaining to the content of a systematic review and meta-analysis.
[DOCX File , 17 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Research strategies used for PubMed research and Aurore complementary research.
[DOCX File , 13 KB-Multimedia Appendix 2]

Multimedia Appendix 3

All the studies included in the systematic review.
[DOCX File , 25 KB-Multimedia Appendix 3]

Multimedia Appendix 4

Description of the interventions included and their participatory components.
[DOCX File , 92 KB-Multimedia Appendix 4]

Multimedia Appendix 5

Coding of Michie's taxonomy on Behaviour Change Techniques.
[DOCX File , 24 KB-Multimedia Appendix 5]

Multimedia Appendix 6

Description of intervention studies, designs, and evaluation methods.
[DOCX File , 30 KB-Multimedia Appendix 6]

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Abbreviations

AYA: adolescents and young adults
BCT: behavior change techniques
IMB: Information-Motivation-Behavioral Skills
INED: Institut National d'Études Démographiques

RCT: randomized controlled trial
STI: sexually transmitted infection
WHO: World Health Organization

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Multimedia Appendix 1: PRISMA Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

Multimedia Appendix 2: Search strategies

PubMed search strategy

("adolescents"[MeSH Terms] OR "young adults"[MeSH Terms] OR "youth"[Text Word] OR "young"[Text Word] OR "AYA"[Text Word]) AND ("reproductive health"[MeSH Terms] OR "sexual behavior"[MeSH Terms] OR "sexual health"[Text Word] OR "contraception"[Text Word] OR "sexuality"[Text Word] OR "Intimate Partner Violence"[MeSH Terms] OR "Sex Offenses"[MeSH Terms] OR "Domestic Violence"[MeSH Terms] OR "Child Abuse, Sexual"[MeSH Terms] OR "Sexual Harassment"[MeSH Terms] OR "sexual well-being"[Text Word] OR "sexual"[Text Word] OR "reproductive health"[Text Word] OR "Sexuality"[MeSH Terms] OR "Abortion, Induced"[MeSH Terms] OR "Contraception"[MeSH Terms] OR "Sexually Transmitted Diseases"[MeSH Terms] OR "pregnancy"[Text Word] OR "unwanted pregnancies"[Text Word] OR "unwanted pregnancy"[Text Word] OR "sexual coercion"[Text Word] OR "Sexology"[MeSH Terms] OR "Sexual Dysfunctions, Psychological"[MeSH Terms] OR "Contraception Behavior"[MeSH Terms] OR "Circumcision, Female"[MeSH Terms] OR "Circumcision, Male"[MeSH Terms] OR "genital mutilation"[Text Word] OR "Rape"[MeSH Terms] OR (("reproductive health"[MeSH Terms] OR "sexual behavior"[MeSH Terms] OR "sexual health"[Text Word] OR "contraception"[Text Word] OR "sexuality"[Text Word] OR "Intimate Partner Violence"[MeSH Terms] OR "Sex Offenses"[MeSH Terms] OR "Domestic Violence"[MeSH Terms] OR "Child Abuse, Sexual"[MeSH Terms] OR "Sexual Harassment"[MeSH Terms] OR "sexual well-being"[Text Word] OR "sexual"[Text Word] OR "reproductive health"[Text Word] OR "Sexuality"[MeSH Terms] OR "Abortion, Induced"[MeSH Terms] OR "Contraception"[MeSH Terms] OR "Sexually Transmitted Diseases"[MeSH Terms] OR "pregnancy"[Text Word] OR "unwanted pregnancies"[Text Word] OR "unwanted pregnancy"[Text Word] OR "sexual coercion"[Text Word] OR "Sexology"[MeSH Terms] OR "Sexual Dysfunctions, Psychological"[MeSH Terms] OR "Contraception Behavior"[MeSH Terms] OR "Circumcision, Female"[MeSH Terms] OR "Circumcision, Male"[MeSH Terms] OR "genital mutilation"[Text Word] OR "Rape"[MeSH Terms]) AND ("Self Concept"[MeSH Terms] OR "Interpersonal Relations"[MeSH Terms] OR "Social Change"[MeSH Terms] "Social Norms"[MeSH Terms] OR "Social Marginalization"[MeSH Terms] OR "Social Isolation"[MeSH Terms] OR "Social Conditions"[MeSH Terms] OR "Social Environment"[MeSH Terms] OR "social transformations"[Text Word]))) AND ("internet"[MeSH Terms] OR "online"[Text Word] OR "web-based" [Text Word] OR "internet"[Text Word] OR "website"[Text Word]) AND ("community participation"[MeSH Terms] OR "social participation"[MeSH Terms] OR "community"[Text Word] OR "participatory"[Text Word] OR "interaction"[Text Word] OR "health information exchange"[MeSH Terms] OR "Peer Group"[MeSH Terms] OR "Group Structure"[MeSH Terms] OR "Sensitivity Training Groups"[MeSH Terms] OR "Group Processes"[MeSH Terms] OR "peer sexual education"[Text Word] OR "peer education"[Text Word] OR "empowerment"[Text Word] OR "information"[Text Word] OR "networking"[Text Word]

OR "social network sites"[Text Word] OR "social network websites"[Text Word] OR "blog"[Text Word] OR "forum"[Text Word] OR "facebook"[Text Word] OR "twitter"[Text Word] OR "snapchat"[Text Word] OR "instagram"[Text Word] OR "Video Games"[MeSH Terms] OR "myspace"[Text Word] OR "social network"[Text Word] OR "peer-to-peer"[Text Word] OR "peer to peer"[Text Word])

AURORE database of INED search strategy

"AB (adolescents or teenagers or young adults or teen or youth or student or adolescence or young or AYA) AND AB ((reproductive health OR sexual behavior OR sexual health OR contraception OR sexuality OR Intimate Partner Violence OR Sex Offenses OR Domestic Violence OR Child Abuse, Sexual OR Sexual Harassment OR sexual well-being OR sexual OR Abortion, Induced OR Contraception OR Sexually Transmitted Diseases OR pregnancy OR unwanted pregnancies OR unwanted pregnancy OR sexual coercion OR Sexology OR Sexual Dysfunctions, Psychological OR Contraception Behavior OR Circumcision, Female OR Circumcision, Male OR genital mutilation OR Rape OR ((reproductive health OR sexual behavior OR sexual health OR contraception OR sexuality OR Intimate Partner Violence OR Sex Offenses OR Domestic Violence OR Child Abuse, Sexual OR Sexual Harassment OR sexual well-being OR sexual OR Abortion, Induced OR Contraception OR Sexually Transmitted Diseases OR pregnancy OR unwanted pregnancies OR unwanted pregnancy OR sexual coercion OR Sexology OR Sexual Dysfunctions, Psychological OR Contraception Behavior OR Circumcision, Female OR Circumcision, Male OR genital mutilation OR Rape) AND (Self Concept OR Interpersonal Relations OR Social Change Social Norms OR Social Marginalization OR Social Isolation OR Social Conditions OR Social Environment OR social transformations))) AND AB (internet OR online OR web-based OR website) AND AB (community participation OR social participation OR community OR participatory OR interaction OR health information exchange OR Peer Group OR Group Structure OR Sensitivity Training Groups OR Group Processes OR peer sexual education OR peer education OR empowerment OR information OR networking OR social network sites OR social network websites OR blog OR forum OR facebook OR twitter OR snapchat OR instagram OR Video Games OR myspace OR social network OR peer-to-peer OR peer to peer)

AURORE research strategy for the following databases

- OpenAIRE n=417
- ERICn=238
- ScienceDirect n=226
- ProjectMUSEn=106
- Directory of Open Access Journalsn=87
- FRANCIS Archiven=58
- SwePubn=27
- SciELOn=22
- British Library EThOSn=22
- JSTOR Journalsn=16

- RePEc n=9
- Emerald Insightn=9
- ICPSR Data Archive n=7
- SSOAR – Social Science Open Access Repositoryn=3
- Openedition.orgn=3
- Gale Virtual Reference Libraryn=2
- Erudit n=2
- Books at JSTOR n=1
- OAPEN Library n=1

Types of sources

- University Journals (470)
- Magazines (267)
- Reports (239)
- Books (132)
- Dissertations / Theses (79)

Multimedia Appendix 3: Studies included by the systematic review

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Multimedia Appendix 4 : Intervention description

Intervention	Intervention objective	Target population	Intervention participation description	Support	Peers interact	Interact with pro	Terms of interactions
"+CLICK"(1)	Enhance sexual risk reduction skills	Young people with HIV	Animation, interactive activities, peer and expert video (activities adapted from "It's Your Game, Keep it Real").	Web-based application	Not described	Not described	Not described
No name (2)	Educate in sexual health	General population	Intervention that offered sexual and reproductive health knowledge, service information, counseling and discussion.	Website	Yes	Yes	AYA discussions (forum with supervision)
No name (3)	Promote safer sex	General population	Intervention developed by trained peer educators. Secret group for peer-to-peer discussion.	Facebook	Yes	No	Peer-to-peer discussion (with peers leader)
No name (4)	Identify predictors of susceptibility to peer influence in sexual situations	Rural, low-income middle schools AYA	Participants seated at computer workstations, "logged in" to the chat room, and connected with 3 other computer-generated students.	Website (Chat room)	Yes	No	Others students preprogrammed (not real)
No name (5)	Promote HBV and HCV testing	Men who have sex with men	Crowdsourced intervention: two images and two one-minute videos to men delivered every other day (total of 8 days).	WeChat	Not described	Not described	Not described
No name (6)	Preventing HIV	Gay, bisexual, queer	Focus group online as intervention: questions posted every day; participants answer moderators' questions and discuss with other members.	Website (Online focus group)	Yes	Yes	Discussion forum
CyberSenga (7–10)	Reduction in HIV risk behaviors	General population	Comprehensive sexuality education program. Six modules (1 hour per module). Puzzle as a game.	Website	Not described	Not described	Not described
FaceSpace project (11,12)	Promote Sexual Health (to disseminate sexual health messages)	General population	Fictional characters with a page for each (status updates, photos). Videos of the characters, texts intended to encourage dialogue. Quizzes to encourage users to consult pages and to interact.	Facebook, YouTube, MySpace, Twitter, Flickr	Yes	Yes	Discussions and interactions on social networks sites
Feel The Vibe (13)	To offer peer support, information on family violence in broad sense (dating violence, sexual health) and information about healthcare services	Population with family violence	Self-help and peer support through a forum, generated chats and the ability to “ask the expert” function. News page.	Website	Yes	Yes	Forum discussion, chat and "ask the expert"

Fex-Can Project (14)	To alleviate sexual problems and fertility-related distress	Cancer patients	Self-help on sexuality and infertility. Educational and behavior change content, multimedia, interactive online activities, and partial feedback support (discussion forum, feedback from experts).	Website	Yes	Yes	Discussions, testimonials and answers to publications (forum)
Get the Facts (15)	Preventing STI	General population	Information. "True Life Story" competition promoted through schools in which students were invited to submit a personal story for publication on the website.	Website	Not described	Not described	Not described
Have You Heard (16)	Preventing HIV	Youth homeless	Peer leaders trained to engage face-to-face peers in the creation of digital media. Participants invited "friends" from their social networks to join group pages for discussions (condom, HIV testing).	MySpace, Facebook	Yes	Not described	Discussion on Myspace and Facebook groups
HealthMpowerment.org (17–21)	Preventing HIV	Young black men who have sex with men	Supportive community to share experiences and discuss stigma-related content. "Ask Dr. W" section to post anonymous questions to a doctor. Share, comment on multimedia content created or linked to the web.	Website, YouTube	Yes	Yes	Exchanges on forum with discussions created by the participants
HOPE (22)	Preventing HIV	Rural Men Who Have Sex With Men	Three modules, each consisting of two 20-minute sessions. Virtual interactions observed by the participant and possibility to ask to know more.	Website	No	Yes	Ask professional for more information
In Case You're Curious (ICYC) (23)	Promote Sexual Health	General population	Participants text, email, or directly message with their questions and then professionals post an anonymous version of the question and an answer on the social media page.	Instagram	Yes	Yes	Instagram comments
iPOL (24)	Preventing HIV (HIV testing, risky behaviors)	Men Who Have Sex With Men	Investigators have trained opinion leaders (iPOL) so they can act on the group page with clips, news, videos, personal accounts and discussions about risky behaviors	Facebook	Yes	No	Discussions around topics brought by iPOLs
I-STIPI (25,26)	Preventing HIV/STI/domestic violence and addiction	General population	Information on different topics. Quizzes, blog to discuss the content of the session.	Website	Yes	NR	Discussion blog
Just/Us (27–29)	Preventing HIV and promote Sexual Health	General population	Facebook page (8 topics per week). Youth facilitators make multiple updates each day in the form of video links, quizzes, and games as well as threaded discussions.	Facebook	Yes	Yes	Discussion on Facebook page

Keep It Up! (30–34)	Preventing HIV	Young cisgender men who have sex with men	Discussions of community involvement, scenarios on hooking-up online, communication skills. Information is presented in various formats like games, animation, and peers' videos.	Website	Not described	Not described	/
Lucidity (35)	Promote reflection and communication about sexual violence and health topics	General population	Four mini-games: room-escape puzzle, point-and-click adventure, educational fill-in-the blank challenge, three-dimensional maze. Links to external websites.	Online game	Not described	Yes	/
Media Aware (36)	Promote Sexual Health	General population	Five-lesson comprehensive program. Interactive features: quizzes with feedback, videos of peers, popular media examples, and skills practice with real-time feedback, program personalization (personalized profile, personal goals).	Website	No	No	/
Midwest Teen Sex Show (MTSS) (37)	Promote sexual health (by humor in intervention)	General population	Online video show. Interactive features, online community with videos, groups, a forum, blog, and social networking pages.	Website, Social Networking pages	Yes	Not described	Online community with exchanges on blog and forums
MyHealthEd (38)	Promote sexual health (sexuality education)	General population	Chat simulator screenshot. To transform scripted role play activities to chat simulator by customizing role plays and allowing the chat simulator to tailor to students' responses.	Website	No	No	/
myHealthImpactNetwork (39)	Promote awareness of HIV prevention	Black female college students	Involvement of students in the design of the platform. Zones of exchange between peers possible on blog.	Website, Tumblr, Twitter, YouTube	Yes	No	Blogging areas
MyPlan (40–42)	Provides a personalized safety plan to prevent Intimate Partner Violence	Dating Violence survivors and their friends	Security decision app: the user enters information about: a) the health of the relationship; (b) security priorities; and (c) the severity of the violence / danger in the relationship.	Web-based smartphone application (App)	Not described	Not described	/
Not Anymore (43)	Engage students in training on sexual violence	General population	A 60-minute, customizable content online program that engages students in sexual violence training through the use of animated graphics, animations, survivor stories and spectator videos.	Website	Yes	Yes	Interactive Multimedia

Papo Reto (44,45)	Construction of knowledge in the field of sexuality	General population	Virtual city made up of Home, School, Internet, Parties and Street, gradually unlocked by the participants' scores. Problematic situations are presented to participant to discuss, propose and share way of thinking and acting.	Online game	Yes	Yes	Comments between players, Life situations, reactions to comments
PlayForward: Elm City Stories (46–48)	To decrease risk and prevent HIV infection	At-risk young minority adolescents	Interactive world where players "travel" through time using an avatar, facing challenges such as peer pressure to drink alcohol or engage in risky sexual behaviors.	Online game (tablet-based videogame)	Not described	No	/
Queer Sex Ed (49)	Promote Sexual Health	LGBT Youth	Five modules. An avatar (Ed) served as the moderator. Each module ended with a quiz about the presented materials. If a question was answered incorrectly, the correct answer was explained. Selection of Individualized Sexual Health Improvement Goals.	Website, Facebook	Not described	Not described	/
Sex Secrets (50)	Provide peer resource on sexual health and intimate relations	General population	"Sex secrets" confession page for exchanging tips and answers to questions. Several messages posted daily- page used in de-identified manner.	Facebook	Yes	No	Comments and peer counseling on the social network page
Sexunzipped (51–54)	Promote sexual well-being (sexual health)	General population	Each section contains a combination of interactive quizzes and decision-making activities (text-based information). Links to other topics on the site at the end of all activities and text-based pages.	Website	Yes	Yes	Quotations: peer-to-peer exchange of views
Sihle Web (55)	Preventing HIV / STI	African-American girls	Four sessions simulating the experience of live group participation by using an interactive, video-based design. Interactive activities to complete (with real-time feedback from their video peers, Health Educator, and Near Peer).	Website	Yes	Yes	Comments on the videos
Skyddslaget (56)	Improve sexual health and practices (condom use and C.trachomatis positivity)	General population	Information excerpts on safe sex and STI with interactive and engaging elements including weekly challenges (games, quizzes) and personal stories from peers	Web-based application	Yes	Not described	Personal stories related to sexuality peers

Stick to it! (57)	Preventing HIV / STI	Young Men Who Have Sex With Men	3 components: (1) online enrollment; (2) web-based activities (quizzes and countdown "timer" to facilitate screening reminders); (3) in-person activities that occur at 2 sexual health clinics.	Online game on website	No	No	/
TeensTalkHealth (58)	Promote condom use and other health behaviors	General population	Interactive intervention: information, thumbnails, videos, articles and discussion forums. 60 tasks to complete.	Website	Yes	Yes	Discussions on forum with conversation catalysts
Testing is Healthy (game: TimePlay) (59)	1) Reduce misperceptions around STIs, including HIV, 2) Raise awareness of where and how to get tested, 3) Increase testing for STI/HIV	General population	Campaign "Testing is Healthy" delivered through TimePlay, an interactive game released before Cineplex feature films.	Online game on mobile application	No	No	/
weCare (60)	To improve care linkage and retention and health outcomes	Men Who Have Sex With Men Afro American and Latino	weCare Health Educator communicate with each participant individually using theory-based messages specific to each participant's place on the Continuum	Facebook messenger, text messaging, and app-based instant messages	Yes	Yes	Exchanges between peers and the professional on closed group

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Multimedia Appendix 5 : Methodology intervention

Name	Study included	Protocol only	Health study	Proc. study	n=	Year	Behavior change theory	Study design	Control group	Recruitment	Incentives	Health outcomes evaluated or planned	Follow-up (months)	Process outcomes evaluated
+CLICK	Markham CM, 2009		X	X	32	2007	Social Cognitive Theory, self-regulation theory, Brief Motivational Enhancement Therapy	Pre-/post-test study	/	Clinics, community organizations	NR	Condom use self-efficacy; positive trends toward importance; waiting before having sex ***(evaluated)***	3	Feasibility, Acceptability, Usability
No name	Lou CH, 2006		X	X	1337	2003	NR	RCT	NR	Community organizations	NR	Overall knowledge and of each specific aspect of reproductive health, attitudes and behaviors ***(evaluated)***	10	Attractiveness
No name	Sun WH, 2017		X	X	194	2016	IMB model	RCT	Website directed by experts other than peers	SNS, e-mail, students organization	Direct remuneration	Condom use attitude, behavioral skills ***(evaluated)***	3	Attractiveness, online experiences
No name	Widman L, 2016		X		300	NR	NR	Exp. plan, Pre-/post-test study	/	Schools	Direct remuneration	Pubertal development, sexual outcome expectancies, hypothetical scenarios, sexual history, (Sexual	0	Not evaluated

												activity/behavior), peer influence susceptibility ***(evaluated)***		
No name	Fitzpatrick, 2018	X			NR	2018	NR	RCT	Control arm view no materials and will not be invited to submit suggestions	Smartphone applications	Direct remuneration	HBsAg and anti-HCV IgG test uptake confirmed by test report photo at 4 weeks post-enrolment ***(planned)***	1	Not evaluated
No name	Ybarra ML, 2014		X	X	75	2012-2013	NR	Cross-sectional study	/	Community organizations	Gift card	Behavioral/ attitudinal change ***(evaluated)***	3	Attractiveness, feedback
CyberSenga	Ybarra ML, 2012			X	20	2011	IMB model	RCT	Nothing	Schools	No	1) sexual abstinence; and 2) condom use during vaginal sex ***(evaluated)***	6	Feasibility, Acceptability, Attractiveness, program navigation
	Ybarra ML, 2014			X	366									
	Bull S, 2010			X	NR									
	Ybarra ML, 2013		X		366									
FaceSpace project	Nguyen P, 2013			X	173	2009-2010	NR	Cross-sectional survey	/	SNS, e-mail	Book or movie voucher	Sexual risk and health-seeking behavior ***(planned)***	NR	Reach project; Engagement
	Gold J, 2012			X	NR									

Feel The Vibe	van Rosmalen-Nooijens KA, 2013	X			NR	2011	NR	RCT	Usual care minimally improved	Internet, Social Network Sites	NR	PTSD symptoms, symptoms of depression and anxiety, Knowledge on sexual and reproductive health ***(planned)***	6	Not evaluated
Fex-Can Project	Winterling J, 2016	X			NR	NR	NR	Conception study	/	Registers	NR	Fertility distress ***(planned)***	NR	Not evaluated
Get the Facts	Mak DB, 2012			X	491	2009-2010	NR	Cross sectional study	/	NR	NR	NR	18	Attractiveness, Website usage
Have You Heard	Rice E, 2012			X	163	2009	Social identity theory and theories of community mobilization and empowerment via participatory community theater models	Pilot study	/	Community organizations, by peers, internet	Direct remuneration (only for peer leaders)	NR	No	Acceptability
HealthMpowerment	Bauermeister JA, 2018		X		238	2012-2016	NR	RCT	Information-only control website	Internet, SNS, clinics, word-of-mouth, flyers	Direct remuneration	Internalized Homophobia, Sexual Prejudice, HIV Stigma ***(evaluated)***	12	Feasibility, Acceptability, Satisfaction, Usage
	Hightow-Weidman, 2012			X	NR									
	Hightow-Weidman, 2012		X	X	50									
	Barry MC, 2019		X		48									

	Hightow-Weidman, 2018		X	X	474									
HOPE	Williams M, 2010			X	300	NR	IMB model	NR	/	Internet	NR	NR	NR	Satisfaction
In Case You're Curious (ICYC)	O'Donnell NH, 2017		X	X	839	NR	NR	RCT	4 experimental conditions	Universities	NR	Perceived message effectiveness, Attitudes toward condoms, systematic processing of sexual health information, perceived message sensation value and exposure to experimental messages ***(evaluated)***	No	Message design impact on perceived message effectiveness
iPOL	Ko NY, 2013		X		1037	2011	NR	Quasi-experimental study	Information-only control website	Internet, Social Network Sites	No	HIV test history (date and result of the last test), recreational drug use, history of STIs, and sexual behavior ***(evaluated)***	3	Not evaluated
I-STIPI	Villegas N, 2014		X		40	NR	IMB model	Pretest-post-test study	/	e-mail, phone	Direct remuneration	Change in STI- and HIV-Related Information,	1	Feasibility, Acceptability, Recommendations for improvement

	Villegas N, 2015			X	40							Motivation, Behavioral Skills, Behaviors, and Intimate Partner Violence ***(evaluated)***		
Just/Us	Bull SS, 2012,		X		652	2010-2011	NR	RCT	Facebook page other than SRH, Group news	Internet, SNS	Gift card	Sexual behaviors ***(evaluated)***	6	Ethics considerations
	Bull SS, 2013			X	NR									
	Bull SS, 2011			X	NR									
Keep It Up!	Greene GJ, 2016,		X	X	343	2012, 2013, 2015	IMB model	RCT	Information-only control website	Internet, Social Network Sites, previous studies, clinics, street, community-based HIV testing organizations, local and national advertising	Direct remuneration, Gift card, 50$ raffle	Incidence STI (primary outcome) - Sexual Health and HIV Risk Behaviors, HIV Knowledge, Condom Errors, Intentions to Use Condoms, Self-Efficacy, Decisional Balance ***(evaluated)***	12	Acceptability
	Mustanski B, 2017	X			901									
	Mustanski B, 2018		X		901									
	Mustanski B, 2013		X	X	102									
	Motley DN, 2017		X		901									
Lucidity	Gilliam M, 2016		X	X	24	2012	NR	Conception study	/	Secondary schools, youth programs	NR	Communication about sexual violence ***(evaluated)***	0,5	Attractiveness

Media Aware	Scull TM, 2018		X	X	281	2015	NR	RCT	Wait-list control group	Universities	Gift card	Sexual risk behaviors (primary outcome), attitudes, injunctive normative beliefs, self-efficacy, willingness, and intentions related to risky sexual activity, condom/contraception use, and SRH communication (secondary outcomes) ***(evaluated)***	NR	Feasibility, Satisfaction, Fidelity of implementation
Midwest Teen Sex Show (MTSS)	Campo S, 2010			X	41	NR	NR	Formative study	/	NR	NR	NR	NR	Attractiveness, value of using humor to attract and engage
MyHealthEd	Chen E, 2017			X	29	2015	NR	Pilot study	/	Secondary schools	Gift card	NR	NR	Attractiveness, Acceptability
myHealthImpact Network	Payton FC, 2016			X	60	NR	Affordance theory	NR	/	NR	Gift card	NR	NR	Acceptability
MyPlan	Glass N, 2015	X			300	NR	Dutton's empowerment model	RCT	Generic Information Application	Internet, Social Network Sites, Universities,	Direct remuneration, Gift card	Use of safety strategies, Decisional conflict ***(planned)***	12	Attractiveness, Acceptability, usefulness, understandability, appropriateness
	Alhusen J, 2015			X	31									

	Lindsay M, 2013			X	38					word-of mouth, phone				
Not Anymore	Draper JL, 2017		X		2522	NR	Cognitive Dissonance Theory	Pretest-post-test design	/	Universities	Gift card	Knowledge, attitudes around rape myths changed, and retained information ***(evaluated)***	3	Not evaluated
Papo Reto	Oliveira RNG de, 2016,			X	23	2014-2015	NR	Exp. plan	/	Secondary schools	NR	Knowledge ***(planned)***	3	Attractiveness, Interactivity
	Souza V de, 2017			X	NR									
Play Forward: Elm City Stories	Fiellin LE, 2016			X	333	2016	Social learning theory, self-efficacy, message framing, and delay discounting	RCT	Attention/time control with non-serious video games	Secondary schools	Gift card	Knowledge, intentions, self-efficacy and actual behaviors ***(planned)***	24	Implementation
	Hieftje K, 2016			X	NR									
	Duncan LR, 2014	X			NR									
Queer Sex Ed	Mustanski B, 2015		X	X	107	2012-2013	IMB model	Pretest-post-test design	/	Social Network Sites	Direct remuneration	Sexual risk behavior ***(evaluated)***	5	Feasibility, Acceptability
Sex Secrets	Yeo, 2017			X	NR	2015	NR	Exploratory study	/	Social Network Sites	NR	Topic Types and Health Concerns, Expectations, Exploration	6	Utility (of peer resource on Facebook)
Sexunzipped	Bailey JV, 2013,			X	1994	2010-2011	Theory of reasoned action (TRA),	RCT	Information-only control website	Internet, Social Network Sites, e-mail,	Direct remuneration, Gift card	Sexual behavior change (including	3	Feasibility, Attractiveness, Acceptability
	Carswell K, 2012,	X			902									

	McCarthy O, 2012,			X	67		Theory of planned behavior (TPB)			secondary schools, universities, by peers (word-of mouth), clinics, youth organizations		sexual health knowledge, sexual communication self-efficacy, and intention) as well as sexual behavior (condom and contraception use, use of services, partner numbers), and self-reported sexually transmitted infections and pregnancy ***(planned)***		
	Nicholas A, 2013			X	22									
Sihle Web	Danielson CK, 2013		X	X	41	NR	NR	Pre-/post-test study	/	Secondary schools, youth organizations	Direct remuneration	Sexual Behavior and Condom Use, Condom Self-efficacy, Partner Communication History, Self-esteem, Ethnic Pride ***(evaluated)***	12	Feasibility

Skyddsl aget	Nielsen A, 2018	X			268	NR	NR	RCT	Fictitious application without interactive modules	Internet, clinics	NR	Condom use (primary), Number of partners, number of tests for C. trachomatis during the study period. Occurrence of pregnancy, occurrence of STI (secondary) ***(planned)***	6	Not evaluated
Stick to it!	Mejia CM, 2017	X			NR	2017	Self-determinati on theory	RCT	NR	Internet, Social Network Sites, clinics, videos, flyers	Points for lot	Repeat HIV/STI screening ***(planned)***	6	Feasibility, Acceptability
TeensTa lkHealth	Brady SS, 2015			X	147	2011	IMB model	RCT	NR	Secondary schools, clinics	Direct remunerati on	Condom use and other health behaviors, Motivation, SRH Knowledge ***(planned)***	4	Feasibility, Acceptability
Testing is Healthy (game: TimePla y)	Zhang Q, 2017			X	NR	2014-2015	NR	NR	/	NR	NR	NR	12	Implementation, process evaluation indicators
weCare	Tanner AE, 2016	X			NR	2016	Social cognitive theory, theory of empowerm ent education	Compara tive before/af ter design	/	Health Educator	NR	HIV-related care engagement, health outcomes, ART prescription and adherence, viral	12	Not evaluated

												suppression ***(planned)***		

Multimedia Appendix 6: Coding of Michie's taxonomy on Behaviour Change Techniques

Michie Taxonomy		Taxon	Definition	N (++)=	N(+)	N(+ et ++)	%
						N = 37	
1 - Goals and planning	**1.1**	**Goal setting (behavior)**	Set or agree on a goal defined in terms of the behavior to be achieved	6	0	6	16%
	1.2	**Problem solving**	Analyze , or prompt the person to analyze, factors influencing the behavior and generate or select strategies that include overcoming barriers and/or increasing facilitators (includes 'Relapse Prevention' and 'Coping Planning')	8	6	14	38%
	1.3	**Goal setting (outcome)**	Set or agree on a goal defined in terms of a positive outcome of wanted behavior	4	1	5	14%
	1.4	**Action planning**	Prompt detailed planning of performance of the behavior (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive) (includes 'Implementation Intentions')	3	5	8	22%
	1.5	**Review behavior goal(s)**	Review behavior goal(s) jointly with the person and consider modifying goal(s) or behavior change strategy in light of achievement. This may lead to re-setting the same goal, a small change in that goal or setting a new goal instead of (or in addition to) the first, or no change	2	2	4	11%

	1.6	**Discrepancy between current behavior and goal**	Draw attention to discrepancies between a person's current behavior (in terms of the form, frequency, duration, or intensity of that behavior) and the person's previously set outcome goals, behavioral goals or action plans (goes beyond self monitoring of behavior)	0	0	0	0%
	1.7	**Review outcome goal(s)**	Review outcome goal(s) jointly with the person and consider modifying goal(s) in light of achievement. This may lead to resetting the same goal, a small change in that goal or setting a new goal instead of, or in addition to the first	0	1	1	3%
	1.8	**Behavioral contract**	Create a written specification of the behavior to be performed, agreed on by the person, and witnessed by another	2	2	4	11%
	1.9	**Commitment**	Ask the person to affirm or reaffirm statements indicating commitment to change the behavior	2	2	4	11%
2 - Feedback and monitoring	**2.1**	**Monitoring of behavior by others without feedback**	Observe or record behavior with the person's knowledge as part of a behavior change strategy	2	4	6	16%
	2.2	**Feedback on behavior**	Monitor and provide informative or evaluative feedback on performance of the behavior (e.g. form, frequency, duration, intensity)	1	4	5	14%
	2.3	**Self-monitoring of behavior**	Establish a method for the person to monitor and record their behavior(s) as part of a behavior change strategy	0	3	3	8%
	2.4	**Self-monitoring of outcome(s) of behaviour**	Establish a method for the person to monitor and record the outcome(s) of their behavior as part of a behavior change strategy	0	0	0	0%

	2.5	**Monitoring of outcome(s) of behavior without feedback**	Observe or record outcomes of behavior with the person's knowledge as part of a behavior change strategy	1	1	2	5%
	2.6	**Biofeedback**	Provide feedback about the body (e.g. physiological or biochemical state) using an external monitoring device as part of a behavior change strategy	0	1	1	3%
	2.7	**Feedback on outcome(s) of behavior**	Monitor and provide feedback on the outcome of performance of the behavior	0	0	0	0%
3 - Social support	**3.1**	**Social support (unspecified)**	Advise on, arrange or provide social support (e.g. from friends, relatives, colleagues,' buddies' or staff) or noncontingent praise or reward for performance of the behavior. It includes encouragement and counselling, but only when it is directed at the behavior	25	1	26	70%
	3.2	**Social support (practical)**	Advise on, arrange, or provide practical help (e.g. from friends, relatives, colleagues, 'buddies' or staff) for performance of the behavior	0	0	2	5%
	3.3	**Social support (emotional)**	Advise on, arrange, or provide emotional social support (e.g. from friends, relatives, colleagues, 'buddies' or staff) for performance of the behavior	0	0	2	5%
4 - Shaping knowledge	**4.1**	**Instruction on how to perform the behavior**	Advise or agree on how to perform the behavior (includes 'Skills training')	16	5	21	57%
	4.2	**Information about Antecedents**	Provide information about antecedents (e.g. social and environmental situations and events, emotions, cognitions) that reliably predict performance of the behaviour	4	1	5	14%

	4.3	**Re-attribution**	Elicit perceived causes of behavior and suggest alternative explanations (e.g. external or internal and stable or unstable)	0	0	0	0%
	4.4	**Behavioral experiments**	Advise on how to identify and test hypotheses about the behavior, its causes and consequences, by collecting and interpreting data	0	1	1	3%
5 - Natural consequences	**5.1**	**Information about health consequences**	**Provide information (e.g. written, verbal, visual) about health consequences of performing the behavior**	**14**	**15**	**29**	**78%**
	5.2	**Salience of consequences**	**Use methods specifically designed to emphasise the consequences of performing the behaviour with the aim of making them more memorable (goes beyond informing about consequences)**	**10**	**6**	**16**	**43%**
	5.3	**Information about social and environmental consequences**	**Provide information (e.g. written, verbal, visual) about social and environmental consequences of performing the behavior**	**8**	**10**	**18**	**49%**
	5.4	**Monitoring of emotional consequences**	Prompt assessment of feelings after attempts at performing the behavior	1	1	2	5%
	5.5	**Anticipated regret**	Induce or raise awareness of expectations of future regret about performance of the unwanted behavior	1	3	4	11%
	5.6	**Information about emotional consequences**	Provide information (e.g. written, verbal, visual) about emotional consequences of performing the behavior	1	8	9	24%
6 - Comparison of behaviour	**6.1**	**Demonstration of the behavior**	Provide an observable sample of the performance of the behaviour, directly in person or indirectly e.g. via film, pictures, for the person to aspire to or imitate (includes ‘Modelling’).	8	2	10	27%

	6.2	**Social comparison**	Draw attention to others' performance to allow comparison with the person's own performance Note: being in a group setting does not necessarily mean that social comparison is actually taking place	5	7	12	32%
	6.3	**Information about others' approval**	**Provide information about what other people think about the behavior. The information clarifies whether others will like, approve or disapprove of what the person is doing or will do**	**18**	**6**	**24**	**65%**
7 - Associations	**7.1**	**Prompts/cues**	**Introduce or define environmental or social stimulus with the purpose of prompting or cueing the behavior. The prompt or cue would normally occur at the time or place of performance**	**22**	**7**	**29**	**78%**
	7.2	**Cue signalling reward**	Identify an environmental stimulus that reliably predicts that reward will follow the behavior (includes 'Discriminative cue')	1	0	1	3%
	7.3	**Reduce prompts/cues**	Withdraw gradually prompts to perform the behavior (includes 'Fading')	0	0	0	0%
	7.4	**Remove access to the reward**	Advise or arrange for the person to be separated from situations in which unwanted behavior can be rewarded in order to reduce the behavior (includes 'Time out')	0	0	0	0%
	7.5	**Remove aversive stimulus**	Advise or arrange for the removal of an aversive stimulus to facilitate behavior change (includes 'Escape learning')	1	1	2	5%
	7.6	**Satiation**	Advise or arrange repeated exposure to a stimulus that reduces or extinguishes a drive for the unwanted behavior	1	2	3	8%

	7.7	**Exposure**	Provide systematic confrontation with a feared stimulus to reduce the response to a later encounter	0	0	0	0%
	7.8	**Associative learning**	Present a neutral stimulus jointly with a stimulus that already elicits the behavior repeatedly until the neutral stimulus elicits that behavior (includes 'Classical/Pavlovian Conditioning')	0	0	0	0%
8 - Repetition and substitution	**8.1**	**Behavioral practice/rehearsal**	Prompt practice or rehearsal of the performance of the behavior one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill	0	1	1	3%
	8.2	**Behavior substitution**	Prompt substitution of the unwanted behavior with a wanted or neutral behavior	0	0	0	0%
	8.3	**Habit formation**	Prompt rehearsal and repetition of the behavior in the same context repeatedly so that the context elicits the behavior	0	0	0	0%
	8.4	**Habit reversal**	Prompt rehearsal and repetition of an alternative behavior to replace an unwanted habitual behavior	0	0	0	0%
	8.5	**Overcorrection**	Ask to repeat the wanted behavior in an exaggerated way following an unwanted behaviour	0	0	0	0%
	8.6	**Generalisation of target behavior**	Advise to perform the wanted behaviour, which is already performed in a particular situation, in another situation	0	1	1	3%
	8.7	**Graded tasks**	Set easy-to-perform tasks, making them increasingly difficult, but achievable, until behavior is performed	0	0	0	0%

9 - Comparison of outcomes	**9.1**	**Credible source**	**Present verbal or visual communication from a credible source in favour of or against the behavior**	**22**	**5**	**27**	**73%**
	9.2	**Pros and cons**	Advise the person to identify and compare reasons for wanting (pros) and not wanting to (cons) change the behavior (includes 'Decisional balance')	1	3	4	11%
	9.3	**Comparative imagining of future outcomes**	Prompt or advise the imagining and comparing of future outcomes of changed versus unchanged behaviour	0	0	0	0%
10 - Reward and threat	**10.1**	**Material incentive (behavior)**	Inform that money, vouchers or other valued objects will be delivered if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	0	0	0	0%
	10.2	**Material reward (behavior)**	Arrange for the delivery of money, vouchers or other valued objects if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	1	0	1	3%
	10.3	**Non-specific reward**	Arrange delivery of a reward if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	0	0	0	0%
	10.4	**Social reward**	Arrange verbal or non-verbal reward if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	0	1	1	3%
	10.5	**Social incentive**	Inform that a verbal or non-verbal reward will be delivered if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	0	0	0	0%

	10.6	**Non-specific incentive**	Inform that a reward will be delivered if and only if there has been effort and/or progress in performing the behavior (includes 'Positive reinforcement')	0	0	0	0%
	10.7	**Self-incentive**	Plan to reward self in future if and only if there has been effort and/or progress in performing the behavior	0	0	0	0%
	10.8	**Incentive (outcome)**	Inform that a reward will be delivered if and only if there has been effort and/or progress in achieving the behavioural outcome (includes 'Positive reinforcement')	1	0	1	3%
	10.9	**Self-reward**	Prompt self-praise or self-reward if and only if there has been effort and/or progress in performing the behavior	0	0	0	0%
	10.10	**Reward (outcome)**	Arrange for the delivery of a reward if and only if there has been effort and/or progress in achieving the behavioral outcome (includes 'Positive reinforcement')	1	0	1	3%
	10.11	**Future punishment**	Inform that future punishment or removal of reward will be a consequence of performance of an unwanted behavior (may include fear arousal) (includes 'Threat')	0	0	0	0%
11 - Regulation	**11.1**	**Pharmacological support**	Provide, or encourage the use of or adherence to, drugs to facilitate behavior change	0	1	1	3%
	11.2	**Reduce negative emotions**	Advise on ways of reducing negative emotions to facilitate performance of the behavior (includes 'Stress Management')	3	3	6	16%
	11.3	**Conserving mental resources**	Advise on ways of minimising demands on mental resources to facilitate behavior change	0	0	0	0%

	11.4	**Paradoxical instructions**	Advise to engage in some form of the unwanted behavior with the aim of reducing motivation to engage in that behaviour	0	0	0	0%
12 - Antecedents	**12.1**	**Restructuring the physical environment**	Change, or advise to change the physical environment in order to facilitate performance of the wanted behavior or create barriers to the unwanted behavior (other than prompts/cues, rewards and punishments)	0	0	0	0%
	12.2	**Restructuring the social environment**	Change, or advise to change the social environment in order to facilitate performance of the wanted behavior or create barriers to the unwanted behavior (other than prompts/cues, rewards and punishments)	0	2	2	5%
	12.3	**Avoidance/reducing exposure to cues for the behavior**	Advise on how to avoid exposure to specific social and contextual/physical cues for the behavior, including changing daily or weekly routines	0	1	1	3%
	12.4	**Distraction**	Advise or arrange to use an alternative focus for attention to avoid triggers for unwanted behaviour	0	0	0	0%
	12.5	**Adding objects to the environment**	Add objects to the environment in order to facilitate performance of the behavior	0	0	0	0%
	12.6	**Body changes**	Alter body structure, functioning or support directly to facilitate behavior change	0	0	0	0%
13 - Identity	**13.1**	**Identification of self as role model**	Inform that one's own behavior may be an example to others	1	4	5	14%

	13.2	**Framing/reframing**	Suggest the deliberate adoption of a perspective or new perspective on behavior (e.g. its purpose) in order to change cognitions or emotions about performing the behavior (includes 'Cognitive structuring')	0	3	3	8%
	13.3	**Incompatible beliefs**	Draw attention to discrepancies between current or past behavior and self-image, in order to create discomfort (includes 'Cognitive dissonance')	0	0	0	0%
	13.4	**Valued self-identify**	Advise the person to write or completerating scales about a cherished value or personal strength as a means of affirming the person's identity as part of a behavior change strategy (includes 'Selfaffirmation')	2	0	2	5%
	13.5	**Identity associated with changed behavior**	Advise the person to construct a new selfidentity as someone who 'used to engage with the unwanted behavior'	0	0	0	0%
14 - Scheduled consequences	**14.1**	**Behavior cost**	Arrange for withdrawal of something valued if and only if an unwanted behavior is performed (includes 'Response cost').	0	0	0	0%
	14.2	**Punishment**	Arrange for aversive consequence contingent on the performance of the unwanted behavior	0	0	0	0%
	14.3	**Remove reward**	Arrange for discontinuation of contingent reward following performance of the unwanted behavior (includes 'Extinction')	0	0	0	0%
	14.4	**Reward approximation**	Arrange for reward following any approximation to the target behavior, gradually rewarding only performance closer to the wanted behavior (includes 'Shaping')	0	0	0	0%

	14.5	**Rewarding completion**	Build up behavior by arranging reward following final component of the behavior; gradually add the components of the behavior that occur earlier in the behavioral sequence (includes 'Backward chaining')	0	0	0	0%
	14.6	**Situation-specific reward**	Arrange for reward following the behavior in one situation but not in another (includes 'Discrimination training')	1	0	1	3%
	14.7	**Reward incompatible behavior**	Arrange reward for responding in a manner that is incompatible with a previous response to that situation (includes 'Counter-conditioning')	0	0	0	0%
	14.8	**Reward alternative behavior**	Arrange reward for performance of an alternative to the unwanted behavior (includes 'Differential reinforcement')	0	0	0	0%
	14.9	**Reduce reward frequency**	Arrange for rewards to be made contingent on increasing duration or frequency of the behavior (includes 'Thinning')	0	0	0	0%
	14.10	**Remove punishment**	Arrange for removal of an unpleasant consequence contingent on performance of the wanted behavior (includes 'Negative reinforcement')	0	0	0	0%
15 - Self-belief	**15.1**	**Verbal persuasion about capability**	Tell the person that they can successfully perform the wanted behavior, arguing against self-doubts and asserting that they can and will succeed	1	3	4	11%
	15.2	**Mental rehearsal of successful performance**	Advise to practise imagining performing the behavior successfully in relevant contexts	1	1	2	5%

	15.3	**Focus on past success**	Advise to think about or list previous successes in performing the behavior (or parts of it)	0	0	0	0%
	15.4	**Self-talk**	Prompt positive self-talk (aloud or silently) before and during the behavior	0	0	0	0%
16 - Covert learning	**16.1**	**Imaginary punishment**	Advise to imagine performing the unwanted behavior in a real-life situation followed by imagining an unpleasant consequence	0	0	0	0%
	16.2	**Imaginary reward**	Advise to imagine performing the wanted behavior in a real-life situation followed by imagining a pleasant consequence	1	4	5	14%
	16.3	**Vicarious consequences**	Prompt observation of the consequences (including rewards and punishments) for others when they perform the behavior	1	1	2	5%