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Factors Underlying the Success of Behavioral HIV-Prevention Interventions for Adolescents: A Meta-Review

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Abstract The purpose of this meta-review was to identify characteristics of successful HIV prevention interventions for adolescents based on quantitative (i.e., meta-analyses) and qualitative reviews published to date, and to inform intervention utilization and future development. To that end, we were guided by principles of triangulation. Searches of seven electronic bibliographic databases yielded five meta-analyses and six qualitative reviews that satisfied the selection criteria. Reviews were subjected to careful content analysis. All reviews reported that behavioral interventions had positive outcomes on at least one of the following outcomes: HIV-related knowledge, subjective cognitions and beliefs enabling safer sex, abstinence, delaying next sexual intercourse, decreasing number of sexual partners, and actual condom use. Four categories, suggesting factors more prominently linked to intervention success, emerged: *behavior change techniques* (e.g.,

cognitive-behavior and motivation enhancement skills training); *recipient characteristics* (e.g., age, vulnerability to contracting STIs/HIV); *prominent design features* (e.g., use of theory, formative research); and *socio-ecological features* (e.g., supportive school environment). Future interventions would benefit from conducting preliminary formative research in order to enable optimal implementation of all these factors.

Resumen El propósito de este meta-análisis fue identificar las características de las intervenciones de prevención del VIH con éxito para adolescentes basado en cuantitativos (es decir, los meta-análisis) y comentarios cualitativos publicados hasta la fecha, y que informe a la utilización de la intervención y el desarrollo futuro. Para ello, nos hemos guiado por los principios de la triangulación. Búsquedas de siete bases de datos bibliográficas electrónicas produjeron cinco meta-análisis y seis revisiones cualitativas que cumplieran los criterios de selección. Las críticas fueron sometidas a análisis de contenido con cuidado. Todas las opiniones informaron que las intervenciones conductuales tuvieron resultados positivos en al menos uno de los siguientes resultados: el conocimiento, las cogniciones y creencias subjetivas relacionadas con el VIH que permiten el sexo seguro, la abstinencia, el retraso a la próxima relación sexual, disminuyendo el número de parejas sexuales y el uso real del condón. Emergieron cuatro categorías que sugieren factores sobresalientes relacionados a la intervención exitosa: técnicas de cambios de comportamiento (por ejemplo, formación de habilidades, cognitivas—de comportamiento y de mejora de la motivación); características del participante (por ejemplo, la edad, la vulnerabilidad a contraer ITS/VIH); características de diseño importantes (por ejemplo, el uso de la teoría, la

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investigación formativa); y las características socio-ecológicas (por ejemplo, el medio ambiente escolar de apoyo). Futuras intervenciones se beneficiaran de llevar a cabo investigaciones formativas preliminares para poder implementar óptimamente todos estos factores.

Keywords Meta-review · HIV/AIDS · Health promotion · Intervention success · Adolescents · Content analysis · Communication · Triangulation

Introduction

Sexual transmitted infections (STIs), including the Human Immunodeficiency Virus (HIV), continue to be a global health concern [1]. Young people are identified as a high HIV-risk population for contracting STIs and HIV. Specifically, adolescents aged between 13 and 19 account for 4 % of new HIV diagnoses in the United States, whereas those aged between 15 and 24 account for 45 % of the HIV diagnoses worldwide [2]. There are indications that STI infection rates, especially, chlamydia, the human papilloma virus, and HIV, are on the increase among people under the age of 25 [3, 4].

Against this backdrop, numerous STI and HIV prevention interventions have been developed for adolescents, aiming to reduce sexual risk-taking and STIs, including HIV [5, 6]. In turn, a number of reviews, meta-analytic and qualitative in nature, have evaluated the efficacy of adolescent STI/HIV prevention interventions (e.g., Johnson et al. [7], Shepherd et al. [8]). By and large, these reviews suggest positive changes for non-behavioral outcomes, such as safer sex knowledge, attitudes, and intentions, and limited or no changes for behavioral outcomes, such as condom use [7, 9]. These trends notwithstanding, reviews often have differing foci and do not necessarily reach consensus regarding which factors are responsible for better or worse intervention efficacy. Moreover, reviews of these reviews (i.e., meta-reviews), systematically synthesizing factors linked to better outcomes in adolescent HIV prevention, are next to non-existent. Meta-reviews are particularly appropriate for describing whether the current evidence base is complete because they scrutinize and synthesize findings of relevant previous systematic reviews or meta-analyses.

To date, meta-reviews have examined intervention characteristics aiming to improve young peoples' sexual health and relationship education [10], intervention techniques decreasing unprotected sexual intercourse [11], as well as the methodological quality of reviews examining adolescent sexuality [12]. We believe that extant meta-reviews have had wide foci and a general approach to the relevant literature. For example, Michie and Abraham [11]

offered a non-systematic meta-review of 'selected reviews' that combined sexual risk and smoking reduction outcomes. Poobalan et al. [10] did not analyze specific details of components of effective intervention components. Huedo-Medina et al. [12] offered a meta-review of the methodological quality of studies gauging various dimensions of child and adolescent sexuality. These wide foci notwithstanding, extant meta-reviews have suggested that more successful intervention efforts tend to: target younger age groups, be tailored to appropriate development stages, be theory based, experimentally test theory-based techniques, provide skills training and links to contraceptive services [10, 11]. Finally, one previous meta-review [12] found that few reviews score high in validated scales of methodological quality.

At present, no systematic meta-review has evaluated the success of *behavioral interventions* for adolescents, which are extensively utilized in HIV prevention and include those in which learning techniques (especially new skills training and alternative/adaptive behaviors to reduce the frequency and severity of maladaptive behaviors) constitute the predominant intervention approach [13]. Thus, the purpose of this study was to conduct a meta-review of existing meta-analyses and qualitative systematic reviews of behavioral STI/HIV prevention interventions for adolescents. The inclusion of both quantitative and qualitative reviews was based on principles of *conceptual triangulation* [14], which combines different perspectives and methodologies, with the aim to identify logical patterns of relationships and meanings. In doing so, our goal was to (a) obtain comprehensive information on the same issue; (b) reach converging results, thus increasing rigor and accuracy; and (c) use the strengths of each method to account for the deficiencies of the other. Our approach in this meta-review was also guided by principles of triangulation.

The primary aim of this meta-review was to identify specific intervention features linked to reduced sexual risk-taking by synthesizing information from relevant meta-analyses and qualitative reviews. Secondary aims include determining points of convergence and divergence in these reviews and between the two types of reviews, as well as gauging the reviews' methodological quality. Contrary to extant meta-reviews of adolescent sexuality and health, our review aimed to employ a specific and clearly operationalized outcome variable in terms of HIV prevention/sexual risk-taking reduction (also see methods section). Thus, the included reviews would have to synthesize evidence from behavioral interventions focused on sexual-risk reduction. Inasmuch we aimed to offer homogeneity, comparability, and logical relevance among the concepts we used, our operationalizations, and our results. Moreover, we sought to identify and discuss *specific features* that have been linked to reduced sexual risk-taking, aiming thus for

nuanced trends. Identifying such factors can inform future prevention efforts, review strategies of relevant literature, and public policy.

Methods

Literature Search

Seven electronic databases were searched systematically in August 2011 for reviews: (a) PubMed; (b) EBSCO *host*-psychology and behavioral sciences collection; (c) PsycINFO; (d) CINAHL Plus with Full-text; (e) CINAHL; (f) ERIC; and (g) Proquest Dissertations and Theses. An updated literature search of these sources in June 2012 yielded two more relevant reviews and another in August 2013 obtained no further qualifying reviews. The search terms were [(meta-analysis or synthesis) OR (review and (systematic or methodological or analytical)) OR (effective* or efficac*)] AND (HIV or AIDS or STI or STD or “HIV” or “acquired immune deficiency syndrome” or “sexually transmitted” or condom) AND (prevention or interven* or “risk reduction”) AND (adolesc* or youth or young).

Selection Criteria for Reviews

We focused on meta-analyses and qualitative reviews that were systematic in nature, as these generally provide the highest quality of evidence [15]. *Systematic* refers to reviews that claimed to follow an explicit, detailed, and comprehensive a priori strategies, in order to reduce bias by identifying, appraising, and synthesizing all relevant studies. Reviews were included if they (a) were meta-analyses or systematic qualitative reviews; (b) surveyed behavioral or social intervention programs designed to prevent HIV infection; (c) evaluated intervention efficacy on HIV risk outcomes; (d) examined specific features linked to intervention efficacy; (e) sampled adolescents up to 19 years of age. Reviews were excluded if they (a) were not systematic in nature, that is, did not describe strategies for identifying, collecting, assessing, and synthesizing data; (b) were not strictly behavioral/social in nature; (c) were pregnancy prevention interventions, STI contact tracing or partner notification strategies, mass media campaigns, legislation or policy overviews, general sexual health interventions; (d) included only statistically significant outcomes; (e) provided no evaluation of intervention efficacy on HIV risk outcomes; (f) provided no information on particular intervention features linked to better outcomes; (g) sampled young people over 19 years of age; or (h) were duplicate reviews. One review [9] was deemed a duplicate of an earlier but more comprehensive review [8]. Another review [16] was the forerunner of another review [17] but

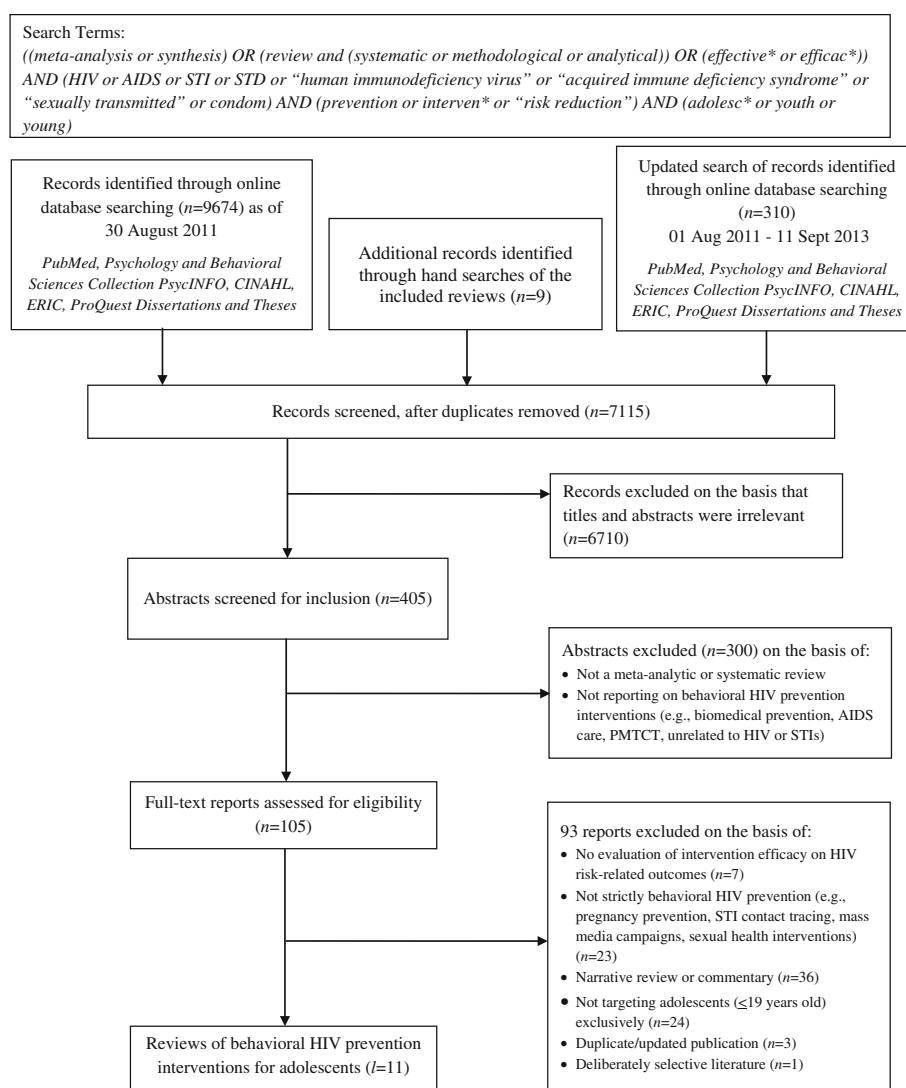
was included in the sample because it had more general selection criteria. In turn, the Johnson et al. [17] review was excluded because an updated review appeared [7]. We applied no language restrictions to our study search. Figure 1 provides the PRISMA flowchart of the search terms, included studies, and excluded studies, as of the most recent search.

This meta-review defines adolescents as young people between 10 and 19 years of age. Although the upper age boundary for adolescents is sometimes stretched to 21 or 25 years, there is widespread agreement that those in the age range of 10–19 may be considered adolescents [18, 19]. The terms ‘HIV prevention intervention’ and ‘HIV risk reduction’ are mostly used, yet some of the sampled studies also included STI prevention efforts, or implied that HIV promotion also accounts for STI protection. Throughout this review, ‘sexual risk-taking’ is used as an overarching term for risk gauged as decreased condom use, HIV-related knowledge, or lack of abstinence (or increased sexual frequencies more generally). It was deemed appropriate to conceptualize sexual risk-taking as an “umbrella” for more than one measure, given that included reviews [20] used a similar composite sexual risk outcome variable. Thus, terms such as ‘reductions in sexual risk-taking’ or ‘better intervention outcomes’ refer to increased condom use and HIV-related knowledge, or practicing abstinence.

Analysis

To identify which intervention dimensions work best, we subjected reviews to content analysis, following the process described by Elo and Kyngäs [21]. Content analysis is a systematic way of analyzing written texts, aiming to “attain a condensed and broad description of the phenomenon, and the outcome of the analysis is concepts or categories describing the phenomenon” [21], p. 108. Specifically, we followed an inductive content analysis approach (i.e., moving from the specific to the general), whereby particular instances of interest (e.g., intervention features linked to better outcomes) were observed and then combined into a larger whole or general statement (i.e., the themes). Our content analysis had three main phases: preparation, organizing, and reporting of the data. The preparation phase typically begins by selecting the appropriate/representative unit of analysis from the ‘universe’ from which it is drawn [22]. Our systematic literature search had ensured that we had chosen a suitable unit of analysis, drawn from a representative universe (i.e., the reviews of adolescent behavioral HIV-prevention interventions). Next, content analysis requires what is known as data immersion, which meant reading the reviews in depth, and several times, until we had a thorough understanding of the reviews. At this stage, “making sense of the data” meant having a good,

Fig. 1 PRISMA flowchart of study inclusion and reasons for exclusion



clear, yet, overall, understanding of ‘who’ is reporting; ‘where’ it is happening; ‘when it happened; ‘what’ happened; and ‘why’ [23]. The next phase of content analysis, organizing, includes open coding, creating categories, and abstraction. Open coding entails writing notes and headings (e.g., intervention features of interest) in the margins of the review articles, while reading them across several iterations, in order to describe as many aspects of the reviews as possible. Then, the intervention features were transferred from the margins to coding sheets, where they were grouped together under higher order headings, which is essentially a data-reduction process. Thus, intervention features were brought together because they “belonged” semantically to a group, which entails relatedness of the features in question. Data organization ends with abstraction, which is formulating a general description of the data by generating categories [24]. Abstraction implies that intervention features belonging semantically together are given an appropriate

label, aiming to capture the essence of those features. Abstraction may continue both as far as reasonable and as far as possible. In our data analysis, abstraction was not a linear or “once-off” process, but cyclical, requiring re-grouping of intervention features, and revisiting of the review material. The phases of data preparation and reporting were carried out by both authors. Data organization was carried out by the first author; the second author reviewed these results and offered critiques based on his expertise and knowledge of the literature.

In our sample of reviews, the categories in qualitative reviews typically derived from descriptive statements of factors linked to better outcomes, and sometimes from test statistics of efficacy in the reviewed interventions. Meta-analyses quantitatively identified factors linked to better outcomes via moderator analyses. We report categories and factors by synthesizing findings from both types of reviews, striving for convergence. Moreover, we checked

for potential areas of divergence between the reviews' findings.

Assessment of Review Methodological Quality

We critically appraised the quality of our included reviews via the 10-item overview quality assessment questionnaire (OQAQ), created by Oxman and Guyatt [25], which has been found to be valid and reliable [26]. The OQAQ's first nine items assess various aspects of review methodological quality, including the performance of a thorough search, the avoidance of bias in the inclusion of studies, the appropriate reference to the validity of the included studies, the appropriate combination of the results, and the appropriate conclusions from the data. These first nine items have set answers of "yes," "no," or "partially/can't tell". The tenth item is an assessment of the overall scientific quality of the systematic review on a scale of 1–7, based on the answers to the previous nine items. Overall scientific quality scores are grouped as follows: 1 and 2 indicate extensive flaws, 3 and 4 indicate major flaws, 5 and 6 indicate minor flaws, and 7 indicates minimal flaws. The scores are not weighted. To ensure sound and standardized interpretation, we followed OQAQ scoring guidelines [27]. Both authors assessed methodological quality with the OQAQ independently and inconsistencies were resolved through discussion. Reliability was high (mean $r = .72$ for the first nine items; $r = .92$ for item 10).

In addition to carrying out qualitative content analysis and critical assessment of methodological quality, and as another triangulation strategy, statistical analyses were conducted to describe the nature of the reviews (t -tests, means, standard deviations and medians) using Stata 11.2; t -tests assumed unequal variances.

Results

Description of Studies

Five meta-analyses and six qualitative reviews qualified for the meta-review ($l = 11$). As Table 1 shows, reviews appeared between 1997 and 2011 (median = 2003). Nine reviews were published in journals, one was a dissertation [16] and another was a self-published public health department report [28]. The number of authors on these reviews ranged from one to 11 (median = 3) and they reviewed between six and 98 interventions, which were published as early as the mid-1980s and as recently as 2008. Meta-analyses tended to sample more studies (median = 40) than did qualitative reviews (median = 23), although there was considerable variability. Participants in

the reviewed studies were adolescents aged as young as ten and as old as 19. Table 1 highlights in **boldface** reasons why samples of studies varied widely, between 15 and 98 studies, trials, or interventions. Specifically, in most reviews, adolescents were studied in school or community settings, whilst some reviews focused on higher risk youth (e.g., runaways). Some reviews restricted their samples to particular parts of the world (e.g., sub-Saharan Africa, the U.S.), whereas others had no geographic restriction. Some reviews restricted studies to randomized controlled trials (RCTs), whereas larger reviews also included studies with other types of controls. Some reviews pooled data from trials that included non-behavioral outcomes or biological outcomes. Some meta-analyses examined only trials with behavioral outcomes (e.g., condom use, abstinence, monogamy) whereas some had studies with non-behavioral outcomes (e.g., HIV-related knowledge, communication skills) or biological markers (e.g., STIs). Finally, four meta-analyses [7, 8, 16, 20] divided studies for gender and race or ethnicity, treating within-trial effects as independent.

Overall Intervention Efficacy

As Table 1 shows, all reviews reported positive outcomes on at least one of the following measures: HIV-related knowledge, subjective cognitions and beliefs enabling safer sex (e.g., high self-efficacy, favorable attitudes, intentions), abstinence, delaying next sexual intercourse, decreasing number of sexual partners, and actual condom use. The meta-analyses confirmed that such general trends were statistically significant but that the outcomes were generally marked by statistically significant heterogeneity. That is, for nearly all outcomes examined in the meta-analyses, intervention findings tended to vary across trials and studies more than sampling error alone would predict.

Description of Factors Linked to Intervention Efficacy

Table 2 summarizes the 30 factors that at least one review reported to be linked to reduced sexual risk-taking, as assessed by at least one behavioral, non-behavioral, or biological outcome, revealing feature frequency across reviews. Table 3 provides a categorization matrix of the features, situating them in the categories to which they "belong," as well as indicating their prominence in reviews. Reviews were somewhat idiosyncratic in the factors considered: Table 2 reveals that many factors were not considered or discussed in the individual reviews' results. Indeed, reviews were more likely *not* to address one of the 30 identified dimensions than to address it ($M = 37.90\%$, $SD = 14.26$). Reviews discussed between 4 (13 % of the 30) and 19 (63 %) dimensions; these

Table 1 Description of included reviews, ordered alphabetically

| Review, type, included dates | Interventions | Participants | Outcome measures | Findings in brief |
|--|--|---|---|---|
| Johnson et al. [7] meta-analysis, 1985–2008 | 98 behavioral interventions advocating sexual risk reduction for HIV prevention that included a control group (RCTs and quasi-experimental) | 51,240 adolescents, aged 11–19, most in school and community settings; some engaged in sex trading or were incarcerated, had mental illness, or were HIV-positive | Only behaviors: Condom use; sexual frequency; condom use skills; interpersonal communication skills; condom acquisition; incidence of sexually transmitted infections (STIs) | Interventions reduced STI incidence; sexual frequency, and number of partners. Interventions significantly increased abstinence/delay of next intercourse; condom use; communication skills; condom acquisition |
| Juárez and Díez [29] qualitative review, 1990–1995 | 29 AIDS prevention programs, with a variety of research designs | Adolescents from school settings, aged 13–19 | Behavioral (condom use frequency; protective behaviors; abstinence; monogamy) and non-behavioral (HIV-related knowledge; communication skills; beliefs; intentions; attitudes; risk perception; norms; self-efficacy) | All programs modified knowledge and attitudes; most modified intentions and behavior. Increase in knowledge and favorable attitudes were important, while changes in intentions and behavior were small |
| Kim et al. [33] meta-analysis, 1983–1995 | 40 AIDS prevention interventions, with a variety of research designs (six were assessed via meta-analysis) | Adolescents, aged 10–18, from a variety of USA settings | Behaviors and non-behaviors: Attitudes about AIDS risk and protective behaviors; intention to abstain from sexual intercourse; condom use; sexual risk behaviors | For each outcome assessed, the majority of studies found a positive intervention impact |
| Levin [16] meta-analysis, 1989–1999 | 58 HIV prevention interventions, with a variety of research designs | Over 25,000 adolescents, with a mean age of 14.29, from a variety of settings | Behaviors and non-behaviors: HIV/AIDS-related knowledge; attitudes; subjective norms; intentions; condom use; abstinence; frequency of sexual behavior | Interventions significantly impacted HIV/AIDS-related knowledge, condom use attitudes and intentions, subjective norms, self-efficacy, and condom use. Interventions did not significantly impact abstinence and frequency of sexual behavior |
| Morrison-Beedy and Nelson [31] qualitative review, 1990–2004 | Six HIV prevention interventions; all were RCTs | USA-only adolescent girls , under 19 years old, from a variety of settings | Behaviors: Condom use; number of sexual partners; risky sex; STI incidence | Most interventions reduced HIV risk-related behaviors to varying degrees |
| Mullen et al. [20] meta-analysis, 1988–1998 | 16 behavioral HIV prevention interventions, that included a control group (RCTs and quasi-experimental) | USA-only adolescents , aged 13–19, from a variety of settings | Composite sexual risk behavior measure (sex without condoms; number of partners; risk index) or biological marker | Statistically significant protective effect of sexual risk-reduction behavior, primarily the risk of having sex without condoms (both in and out of the classroom) |
| Paul-Ebhohimhen et al. [44] qualitative review, 1985–2006 | 12 sexual health interventions to prevent STI/HIV that included a control group | Sub-Saharan African adolescents , under 19 years old, from school settings | Behavior and non-behaviors: HIV-related knowledge; attitudes; intentions; HIV/AIDS/STI preventive behavior (abstinence and condom use) | Knowledge and attitude-related outcomes were the most associated with statistically significant change. Behavioral intentions were more difficult to change and actual behavior change was least likely to occur |

Table 1 continued

| Review, type, included dates | Interventions | Participants | Outcome measures | Findings in brief |
|---|---|---|--|--|
| Pedlow and Carey [43] Qualitative review until September 2000 | 22 HIV risk reduction interventions; all were RCTs | Adolescents, aged between 13–19, from a variety of settings (schools, community sites, health care centers) | Sexual risk behavior (frequency of unprotected sex; condom use) | More than half of interventions achieved significant risk reduction effects. In no case did the experimental intervention do worse than the control intervention |
| Pedlow and Carey [32] qualitative review until 2003 | 25 developmentally-appropriate sexual risk reduction interventions; all were RCTs | Adolescents under the age of 19, from a variety of settings (schools, community sites, health care centers, correctional and detention facilities) | Behaviors and non-behaviors: Abstinence; delaying onset of sexual activity; condom use; sexual communication; socio-cognitive measures (e.g., norms) | Overall, interventions were more effective in delaying the onset of sexual activity than in promoting abstinence among sexually-active youth. Some interventions were effective in improving communication skills and norms for safer sex, as well as reducing sexual risk behavior |
| Shepherd et al. [8] meta-analysis and narrative synthesis, 1985–March, 2008 | 15 behavioral interventions to reduce STIs ; all were RCTs | Adolescents, aged 13–19, from school settings | Behaviors and non-behaviors: Initiation of sexual intercourse; condom use; sexual intercourse; contraception and pregnancy; STI infection rates; number of sexual partners; HIV-related knowledge; skills; self-efficacy; attitudes; intentions | Interventions improved HIV-related knowledge and increased self-efficacy, but did not significantly influence sexual risk-taking behavior or infection rates |
| Yamada et al. [28] qualitative review, until October 1998 | 24 primary prevention programs to prevent STIs , which were RCTs or Controlled Clinical Trials | Adolescents, aged 10–19, from a variety of settings (schools, school-based clinics, freestanding clinics, practice based services, community centers) | Behaviors and biological outcomes: Initiation of sexual intercourse (or continued abstinence); condom use; number of sexual partners; frequency of sexual intercourse; frequency of unprotected sexual intercourse; number of diagnosed STI cases | Interventions had a positive impact on at least one of the following outcomes: improved condom use, reduced number of sexual partners, and reduced frequency of sexual intercourse. None of these interventions had negative impacts (e.g., increasing initiation of sexual intercourse) |

Table content and reporting style reflects differences in the nature of the reviews (e.g., meta-analyses, systematic/qualitative reviews); **boldfaced** text is used to highlight differences in the design, settings, and outcomes examined

numbers were roughly equivalent between meta-analyses (median = 11.0, range = 8–14) and qualitative reviews (median = 12.5, range = 4–19), although the latter were more variable in identifying factors.

Of the factors that each review discussed, positive findings were most common, whereas negative, null, and mixed findings were rare. Qualitative reviews identified more positive results ($M = 11.83$, $SD = 5.11$; median = 12.5) than did meta-analyses ($M = 5.80$,

$SD = 2.95$; median = 7.0), a difference that reached significance despite the small sample size, ($t = 2.44$, $p < .05$). Meta-analyses were more likely to identify factors that had a null relation ($M = 3.60$, $SD = 4.51$; median = 1) than were qualitative reviews ($M = 0.33$, $SD = 0.52$; median = 0), although only marginally significant ($t = 1.61$, $p < .10$). Negative or mixed conclusions were rare (only 5 instances) and only occurred in meta-analyses.

Table 2 Features that were evaluated in at least one review in the sample, in reverse order of feature frequency

| Feature | Reviews (%) | Reported risk reduction pattern ^a | | |
|--|-------------|--|---------|----------|
| | | Positive | Null | Negative |
| Theory-based intervention | 9 (82) | 9 B, NB | 0 | 0 |
| Communication/negotiation skills training | 8 (73) | 7 B, NB | 1 B | 1 NB |
| Control groups | 8 (73) | 6 B, NB | 2 B, NB | 0 |
| Age/developmentally appropriate | 7 (64) | 5 B, NB, Bio | 2 B | 0 |
| Dose of intervention content | 7 (64) | 5 B, NB | 2 B, NB | 0 |
| Ethnic/race relevant content | 6 (55) | 5 B, NB | 1 B | 0 |
| Cognitive-behavioral skills training | 6 (55) | 5 B, NB | 1 B, NB | 0 |
| Longer follow-up assessments | 6 (55) | 4 B, NB, Bio | 2 B | 0 |
| Formative research | 5 (45) | 4 B, NB | 1 B | 0 |
| Randomized controlled trial | 5 (45) | 4 B, NB | 1 B | 0 |
| Provision of HIV/safe-sex messages | 5 (45) | 5 B, NB, Bio | 0 | 0 |
| Gender-relevant content | 5 (45) | 4 B, NB | 1 B, NB | 0 |
| Classroom setting | 5 (45) | 4 B, NB | 0 | 1 B, NB |
| Targeting immediate social influences | 5 (45) | 5 B, NB | 0 | 0 |
| Acceptance cues | 4 (36) | 4 B, NB | 0 | 0 |
| Vulnerable samples | 4 (36) | 4 B, NB | 0 | 0 |
| Larger sample size | 4 (36) | 2 B, Bio | 2 B | 0 |
| Motivational enhancement | 3 (27) | 3 B, Bio | 0 | 0 |
| Individual intervention | 3 (27) | 3 B, Bio | 0 | 0 |
| Group intervention | 2 (18) | 2 B, Bio | 0 | 0 |
| Peers as facilitators | 2 (18) | 2 B, NB | 0 | 0 |
| Abstinence messages | 2 (18) | 0 | 1 B | 1 B |
| Condom use skills training | 2 (18) | 2 B | 1 B | 0 |
| Booster sessions | 2 (18) | 2 B | 0 | 0 |
| Sexually active samples | 2 (18) | 1 B | 1 B, NB | 0 |
| Sexually inexperienced samples | 2 (18) | 1 B | 1 B, NB | 0 |
| Emotional management | 1 (9) | 1 B, NB, Bio | 0 | 0 |
| Supportive school environment | 1 (9) | 1 B, NB | 0 | 0 |
| Adults as facilitators | 1 (9) | 1 NB | 0 | 0 |
| Targeting multiple cohorts | 1 (9) | 1 B, NB | 0 | 0 |

B behavioral outcome. Bio biological outcome/number of reviews. NB non-behavioral outcome

^a Meta-analyses can contribute more than one pattern (e.g., a meta-analysis might find that one feature reduced risk on a behavioral outcome yet had no bearing on biological outcomes). **Boldfaced** features are those discovered by at least one review with an overall quality score of at least 4 (see Table 4)

Emerging Categories

Content analysis revealed four main categories of factors linked to intervention efficacy. Table 3 provides the review categories as well as feature frequency and co-occurrence within reviews.

Behavior change techniques (BCTs). All but one review [29] concluded that one or another type of BCT reduced sexual risk-taking. By BCTs, we refer to observable and replicable components of behavior interventions [30]. Some reviews used the term ‘cognitive behavior skills training’ generically, without specifying particular techniques, whereas other reviews identified particular

cognitive behavior skills training techniques that reduced sexual risk-taking. The most frequently cited efficacious BCTs were sexual communication and negotiation skills training (e.g., learning how to communicate sexual needs, negotiate and practice condom use, be assertive, and refuse unprotected sex). Three reviews [7, 31, 32] concluded that motivational enhancement training and provision of HIV and safe-sex information reduced sexual risk-taking. Examples of motivational enhancement included motivational interviewing, increasing readiness for and commitment to protective behaviors, fear/threat induction, appraising susceptibility to contracting HIV, and hypocrisy manipulations. The technique least frequently cited as

Table 3 Categorization matrix: emerging categories and frequency and co-occurrence of features linked to intervention efficacy

| Behavior change techniques (BCTs) Co-occurrence: 27 | Recipient features Co-occurrence: 26 | Prominent design features Co-occurrence: 49 | Socio-ecological features Co-occurrence: 21 |
|--|---|--|--|
| Abstinence messages [2] | Vulnerable samples [4] | Theory-based [9] | Acceptance cues [4] |
| Condom use skills-training [2] | Age/developmental stage [7] | Formative research [5] | Supportive school environment [1] |
| Motivation enhancement training [3] | Ethnic/race relevant [6] | Randomized controlled design [5] | Classroom setting [5] |
| Emotion management training [1] | Gender-relevant [5] | Control groups [8] | Targeting immediate social influences [5] |
| Communication/negotiation skills training [8] | Sexually active samples [2] | Individual intervention [3] | Group intervention [2] |
| Cognitive-behavior skills training [6] | Sexually inactive samples [2] | Larger samples [4] | Peers as facilitators [2] |
| Provision of HIV and safe-sex information [5] | | Longer follow-ups [6] | Adults as facilitators [1] |
| | | Dose [7] | Targeting multiple cohorts [1] |
| | | Booster sessions [2] | |

Numbers in parentheses show the *l* of reviews in which a feature appears, indicating feature frequency. Co-occurrence values show how many times a feature appears across reviews, indicating feature prominence. **Boldfaced** features are those discovered by at least one review with an overall quality score of at least 4 (see Table 4)

efficacious was abstinence messages; indeed, one meta-analysis even found a statistically significant trend for abstinence messages in behavioral interventions to backfire, *increasing* the frequency of sexual interactions [7]; the one qualitative review that considered abstinence messages concluded that they had a null relation [32] (see Table 1).

Recipient characteristics. Two types of recipient, or sample, characteristics emerged: those ‘inherent’ to participants, such as age and gender, and those influenced by the environment/other people, such as being sexually active or being socially vulnerable in some way. Inherent characteristics appeared more prominently, with reviews indicating that interventions were more successful when tailored to the gender, ethnicity or race, and age or developmental stage of intervention recipients. Four meta-analyses [7, 14, 15, 19] divided studies for gender and race or ethnicity, treating within-trial effects as independent. No clear patterns emerged: Levin [16] found a statistically significant benefit of conducting single sex interventions on reduced sexual risk-taking (more favorable attitudes towards condom use), whilst Shepherd et al. [8] and Johnson et al. [7] found no such link. Mullen et al. [20] reported better outcomes in single-ethnic group interventions (but this finding referred only to outside school interventions). The reviews’ most frequently reported parameter was age or developmental stage, implying that if tailored for age, interventions work better. In terms of environmentally-influenced recipient characteristics, a few reviews reported better outcomes when intervention content was tailored to vulnerable samples (e.g., institutionalized, homeless, runaway, low-income, or STI-infected adolescents). Qualitative reviews were more likely than meta-analyses to link sample features to intervention success, whereas meta-analyses were

more likely to find null patterns when these features were examined.

Prominent design factors. Most reviews concluded that one or more design issues influenced intervention efficacy. Half of the meta-analyses [8, 16, 33] found a positive association between theory-based interventions and efficacy, and the others did not consider this factor directly. All of the qualitative reviews considered this factor and concluded it was associated with intervention success. Nearly all reviews indicated that to be efficacious, interventions and, specifically, BCTs, ought to be based on sound psychological theory. The most frequently cited theoretical framework was social learning/cognitive theory [34, 35], followed by the theories of reasoned action and planned behavior [36, 37], the health belief model [38], the peer influence model [39], the information-motivation-behavioral skills model [40], protection motivation theory [41], and cognitive dissonance theory [42]. Some of the meta-analyses that did not explicitly evaluate whether theory-based interventions succeeded better evaluated these dimensions more directly, by virtue of BCTs that are linked to particular theories.

Five reviews [7, 16, 32, 33, 43] considered whether preliminary formative research was associated with intervention success; four found support for it and one did not [7]. One meta-analytic review [33] found that use of randomized controlled trials (RCTs) was associated with smaller attitudinal and condom use effects, but the others did not consider or discuss it, perhaps because many of them used RCT design as a selection criterion (Table 1). All four qualitative reviews that considered it [31, 32, 43, 44] found that RCTs had more success than non-RCTs. Out of the three of the meta-analyses considered whether having a control group influenced success [7, 16, 20], two

found no linkage and one [7] found better results for at least some outcomes.

Only one meta-analysis [16] found that larger sample sizes related to effect size, an inverse function for two outcomes, knowledge and condom use; two qualitative reviews [29, 31] reported positive functions for behavioral and/or biological outcomes. Meta-analyses were unlikely to find that longer follow-up periods were linked to better outcomes, whereas the qualitative reviews that considered this issue [29, 31, 43, 44] concluded that effects appeared more efficacious at longer intervals. The one meta-analysis [8] and two qualitative reviews [43] and [31] that considered whether group or individual format is better found the latter format to be best. Only two reviews, both qualitative, examined and concluded that booster sessions enhance intervention success [43] and [32]. Finally, all reviews that examined a form of dose–response effect supported it [7, 28, 29, 33, 44], except for the reviews of Pedlow and Carey [43] and Mullen et al. [20].

Socio-ecological features. A number of features reflected the impact of the immediate and wider intervention context on intervention efficacy. Two meta-analyses [16, 20], and three qualitative reviews [31, 32, 43], examined whether classroom-based interventions succeed better; the qualitative reviews concurred that they are more successful, whereas the meta-analyses diverged or found that this effect depended on sample features. Only one review, a meta-analysis [16], examined whether adult facilitators succeed better, concluding it enhanced efficacy as gauged by knowledge, but not on other outcomes. Two reviews, one meta-analysis [16] and one qualitative review [32] examined and concluded that peer facilitators are associated with somewhat better efficacy, although for one [16], the effect was evaluated in tandem with adult facilitators. Of the four reviews that examined the use of acceptance cues, all concur that these improve efficacy across an array of outcomes [8, 16, 28, 44]. Only one (qualitative) review examined and concluded that supportive school environments promote intervention success [44]. Five reviews [8, 32, 33, 43, 44] examined whether targeting immediate social influences on the adolescents succeed better than interventions that do not do so; all concluded that this procedure works. Finally, only one (qualitative) review examined and concluded that interventions succeed better when they target multiple cohorts [32]. As Table 3 indicates, design features appeared most prominently linked to intervention efficacy, whereas socio-ecological features were the least prominent.

Methodological Quality

The results of the application of the OQAQ appear in Table 4. In terms of search strategies used in a review, the

search methods were clearly reported in three reviews (27 %), and the search was relatively comprehensive in five reviews (45 %). Trial selection criteria were adequately reported in nearly all reviews (91 %) but, in nearly all reviews (91 %), it was still unclear if selection bias was completely avoided. In terms of study validity, seven reviews (63 %) reported using criteria to assess the methodological quality of their included studies and the authors referenced an appropriate quality scoring system in five reviews (45 %). In terms of data pooling, the methods used to combine the findings of the relevant studies were reported in six studies (55 %) and combined appropriately relative to the primary question in the same six reviews (55 %). Most reviews (81 %) seemed to draw appropriate conclusions from their data. In terms of overall scientific quality, two reviews (18 %) were rated as having extensive flaws (score of 1 or 2), six (55 %) were rated as having major flaws (score of 3 or 4), two (18 %) had minor flaws (score of 5 or 6), and one (9 %) was rated as having minimal flaws (score of 7). Meta-analyses were rated as of higher scientific quality compared to the qualitative reviews; no meta-analysis received an overall quality score of <3, whereas no qualitative review received a score >4 (Table 4).

The weakest areas within the included reviews related to selection bias and comprehensiveness of the literature search. As a possible explanation for this problem, we further inspected the search strategies employed by the reviews and found differences between and within review types. Notably, compared to meta-analyses, qualitative reviews used fewer search strategies and specified strategies with less clarity. Also, three to six search strategies were used in meta-analyses, whereas one to five strategies were used in qualitative reviews. Fig. 2 shows that many reports included in the largest review, by Johnson et al. [7], were also included at least once in other reviews ($k = 52$), but this review also included 46 reports that no other review included and many of these were available to sample but were not included. Similarly, unpublished trials never appeared in more than one review. Of the 84 reports that were not included in the Johnson et al. meta-analysis, 67 were in only one review, 12 in two reviews, four in three reviews and one in seven reviews.

Assessment of methodological quality also helped us identify ‘key’ features linked to better outcomes. We expected that features discovered by at least one review with an overall quality score of at least 4 would be more consensually indicated to be linked to intervention efficacy. The sixteen such features that we found appear in **boldface** in Tables 2 and 3: condom use skills-training; communication/negotiation skills training; cognitive-behavior skills training; vulnerable samples; age/developmental stage; ethnic/race relevant content; gender-relevant

Table 4 Methodological quality of included reviews as judged on the overview quality assessment questionnaire Oxman and Guyatt [25], with meta-analyses and qualitative reviews ordered chronologically

| Review/statistic | Item on the overview quality assessment questionnaire | | | | | | | | | |
|--|---|-----------------------------------|-------------------------------|--------------------------|------------------------------|-----------------------------------|------------------------------|-----------------------------------|---------------------------------|----------------------------|
| | 1—Search methods stated | 2—Search relatively comprehensive | 3—Inclusion criteria reported | 4—Selection bias avoided | 5—Validity criteria reported | 6—Validity assessed appropriately | 7—Combining methods reported | 8—Findings combined appropriately | 9—Conclusions supported by data | Overall scientific quality |
| <i>Meta-analyses</i> | | | | | | | | | | |
| Kim et al. [33] | Yes | P/CT | Yes | P/CT | Yes | Yes | Yes | Yes | Yes | 6 |
| Levin [16] | P/CT | Yes | Yes | P/CT | No | No | Yes | Yes | Yes | 3 |
| Mullen et al. [20] | P/CT | P/CT | Yes | P/CT | No | No | Yes | Yes | Yes | 3 |
| Shepherd et al. [8] | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | 7 |
| Johnson et al. [7] | P/CT | Yes | Yes | P/CT | Yes | Yes | Yes | Yes | Yes | 6 |
| Percentage “Yes” | 40 % | 60 % | 100 % | 20 % | 60 % | 60 % | 100 % | 100 % | 100 % | |
| Percentage “P/CT” | 60 % | 40 % | 0 % | 80 % | 0 % | 0 % | 0 % | 0 % | 0 % | |
| Percentage “No” | 0 % | 0 % | 0 % | 0 % | 40 % | 40 % | 0 % | 0 % | 0 % | |
| <i>Qualitative reviews</i> | | | | | | | | | | |
| Juárez & Díez [29] | P/CT | P/CT | No | P/CT | Yes | P/CT | P/CT | P/CT | P/CT | 2 |
| Yamada et al. [28] | P/CT | Yes | Yes | P/CT | Yes | Yes | P/CT | P/CT | Yes | 4 |
| Pedlow & Carey [43] | P/CT | P/CT | Yes | P/CT | Yes | P/CT | P/CT | P/CT | P/CT | 3 |
| Morrison-Beedy & Nelson [31] | P/CT | P/CT | Yes | P/CT | No | No | No | P/CT | Yes | 2 |
| Pedlow & Carey [32] | P/CT | P/CT | Yes | P/CT | No | No | Yes | Yes | Yes | 3 |
| Paul-Ebhohimhen et al. [44] | Yes | Yes | Yes | P/CT | Yes | Yes | P/CT | P/CT | Yes | 4 |
| Percentage “Yes” | 17 % | 33 % | 83 % | 0 % | 67 % | 33 % | 17 % | 17 % | 67 % | |
| Percentage “P/CT” | 83 % | 67 % | 0 % | 100 % | 0 % | 33 % | 67 % | 83 % | 33 % | |
| Percentage “No” | 0 % | 0 % | 17 % | 0 % | 33 % | 33 % | 17 % | 0 % | 0 % | |
| Overall quality score is judged with 1–2 = extensive flaws; 2–4 = major flaws; 4–6 = minor flaws; 6–7 = minimal or no flaws; overall score is based on the answers to the first nine questions. P/CT = partial/cannot tell | | | | | | | | | | |



Fig. 2 Number of times each study appeared in the 11 included reviews, with scatter points jittered. *Open diamonds* represent published studies and *closed diamonds* unpublished studies in the largest review to date [7]. *Open circles* represent published studies and *closed circles* represent unpublished studies that appeared only in other reviews

content; theory-based; formative research; randomized controlled design; control groups; acceptance cues; supportive school environment; and targeting immediate social influences.

Discussion

This meta-review synthesized evidence from existing quantitative and qualitative reviews, in order to identify categories and features linked to reduced sexual risk-taking in behavioral interventions for adolescents aged between 10- and 19-years old. To our knowledge, the current meta-review is the first to focus specifically on behavioral HIV prevention interventions for adolescents and to triangulate across review methodologies. Our strategy enabled us to isolate themes of consensus in the reviews in terms of sexual risk reduction. Reviews were likely to conclude that intervention success depended on particular designs, BCTs, and characteristics of intervention recipients. Specifically, of all reported design parameters, use of theory and including control groups was more frequently linked to better intervention outcomes. In terms of BCTs, cognitive behavior skills training and (especially) practicing communication and negotiation techniques were the parameters mostly linked to reduced sexual risk-taking. Finally, inherent recipient characteristics, especially age and ethnicity, as well as the social ecology of the intervention, especially the influence of the immediate environment and classroom setting, emerged as factors linked to better intervention outcomes. Design features appeared more prominently (more frequently and co-occurring/overlapping) in reviews, as compared to other features, indicating

that a rigorous intervention design is paramount to intervention efficacy. Socio-ecological features, such as having a supportive school and social environment, acceptance cues, were the least prominent. We also identified the features that were more “consensually” indicated to be linked to efficacy, across all categories (Tables 2 and 3). There was consensus among reviews that the following sixteen parameters were key in reducing sexual risk taking: condom use skills-training; communication/negotiation skills training; cognitive-behavior skills training; vulnerable samples; age/developmental stage; ethnic/race relevant content; gender-relevant content; theory-based; formative research; randomized controlled design; control groups; acceptance cues; supportive school environment; and targeting immediate social influences.

Although many elements may underlie intervention efficacy, the ways these factors are conceptualized and translated into intervention activities, are often far from optimal. One area of concern is the use of theory. Theory is widely used, with interventionists stating that their methods and BCTs are aligned with identifiable theoretical models. Still, interventions rarely specify how theory is translated into BCTs, and inconsistencies are identified between BCTs and their theoretical frameworks. For example, Pedlow and Carey [32] noted that only one trial out of the 23 reviewed provided a clear protocol of how social, cognitive, and social influence theories were implemented. Other studies reported being based on social cognitive theory but provided only a leaflet or video session as intervention techniques. Social cognitive theory requires at least some practical application of skills learned through observation or information. No review in our sample that examined whether theory-driven interventions succeed better also evaluated whether the BCTs identified by these theories were the only intervention content underlying success [45]. Until they do so, the conclusion that theory-led interventions work better for adolescents would seem quite limited indeed. In the bigger picture, being ‘theory-led’ should not be linked to intervention efficacy when the BCTs identified by the theory are modelled at the same time. Specifically, if a meta-analysis examines whether theory-led interventions succeed better, it should also examine whether the particular BCTs identified by the theory in question fully mediate this effect. Moreover, some of the meta-analyses in the sample can be considered, in the end, theory-friendly because they have identified particular BCTs that are linked with greater efficacy, such as Johnson et al.’s [7] demonstration that greater condom skills and motivational enhancement dosage is linked with larger condom use effect sizes.

More generally, optimal choice of BCTs is another area of concern. Although reviewers seem to agree that cognitive behavior skills training techniques are the most

successful BCTs (Table 3), it is still unclear if certain techniques should be prioritized and how many of these techniques to include. Morrison-Beedy and Nelson [31], for example, suggested that all of these BCTs should be included for better intervention outcomes, whereas Paul-Ebhohimhen et al. [44] argued that emphasis should be given to the practical and experiential aspects of these BCTs. Other sources [11] have argued that choice of BCT could be based on the needs of the target population: BCTs could differ as a function of being sexually active, of relationship status, of extent of sexual risk-taking, and previous sexual activity. Also, BCTs could be modified depending on recipients' emotional needs, by including stress and anger management training. To elucidate the old question of whether abstinence messages are linked to better intervention outcomes, no review provided information favoring this BCT. On the contrary, Johnson et al. [7] found that abstinence messages resulted in worse intervention outcomes. Drawing from our included reviews as well as from others [e.g., 46], it is safe to conclude that, by and large, abstinence messages lack efficacy. More than one review (e.g., [8, 44]) strongly argued for the need to adapt the intervention to recipients' culture-relevant characteristics, such as moral and religious beliefs of the school and community, whilst still taking steps to ensure intervention fidelity. This feat is certainly not easy and health interventionists have long discussed an "adaptation-versus-fidelity tension", also known as the "local adaptation-fidelity debate" [47, p. 47].

Conducting preliminary formative research was not only a factor linked to better intervention outcomes, but also a recommendation for securing intervention efficacy, in a number of reviews [8, 16, 43]. This factor notwithstanding, it is often unclear what counts as preliminary formative research, and intervention studies vary by providing detailed descriptions of their adaptation procedures to merely stating that the intervention was 'appropriate for adolescents'. Pedlow and Carey [32, 43], discussed in length the importance of conducting preliminary formative research to determine key developmental factors of adolescents, and to use those factors to develop adolescent HIV prevention interventions. Pedlow and Carey [32] concluded that, too often, HIV prevention interventions are described as 'age or developmentally appropriate' without specifying what makes them appropriate for young people. For example, interventions are described as 'appropriate for adolescents' merely on the basis of including components that are expected to appeal to young people such as, theatre, music, videos, cultural icons, slang language. We concur with Pedlow and Carey [32] that age, or, developmentally-appropriate interventions "...consider those aspects of intervention design, content, and delivery that are associated, empirically or theoretically, with the unique

risk reduction needs of youth" (p. 173). Formative research can also reveal which facilitator characteristics mostly resonate with the sample under investigation. Facilitator type and characteristics (e.g., adult versus peer, enthusiastic, credible, highly educated) were linked to better intervention outcomes in a number of reviews [16, 28, 44] but what counts as an effective facilitator is bound to differ per adolescent sample. In addition to the primary facilitators, that is, those who deliver content, other people in the school or other intervention site, can be instrumental in facilitating (optimal) delivery of intervention, consistent with a social environmental approach to HIV prevention [48]. Authors have illustrated how supportive or unsupportive environments can enhance or impede, respectively, intervention success. For example, Paul-Ebhohimhen et al. [44] discussed how the full support of a school principal facilitated intervention implementation and success, and strongly suggested that everyone affected by the intervention in addition to students (especially parents and teachers) should participate in intervention development. Thus, preliminary formative research is a means of gauging and modifying, where necessary, aspects of the environment that may prove important in relation to the intervention.

Recipient characteristics, 'inherent' or socially determined, were linked to better intervention outcomes. Of all 'inherent' characteristics, age, or the developmental stage of adolescence, emerged more prominently. Some posit that adolescent sexual risk-taking is shaped by a number of developmental and social factors unique to this age group [32]. Such factors include biology (e.g., earlier physical maturity in girls); cognition (e.g., egocentric thinking, diminished risk appraisal, optimistic bias, present-oriented thinking); emotion (e.g., difficulty of dealing with intense emotions experienced in sexual relationships); peers and parents (e.g., susceptibility to peer pressure, lack of parental monitoring and communication). It must be noted, however, that developmental experts have not reached consensus about which characteristics uniquely predispose adolescents to more risk-taking, or even if adolescents actually take more risks than adults [49]. As mentioned above, it is strongly advisable to conduct preliminary formative research to uncover the developmental factors that uniquely impact sexual risk-taking in the adolescent sample under investigation. In addition, sample characteristics could form the basis of choosing appropriate outcome measures. Interventions targeting vulnerable samples, such as homeless, runaways, institutionalized, and STI infected adolescents, would benefit from including biological markers as outcome measures of sexual risk-taking. Outcome measures of abstinence and delayed next sexual activity might make sense only for virgins or adolescents with rudimentary sexual involvement. Not basing outcome measures on the unique characteristics of the adolescents

under investigation might account, partly, for diminished intervention efficacy. Several reviews [8, 9, 31, 33] recommended using a combination of outcome measures, including biological markers where appropriate. At the very least, using a combination of outcome measures would enable comparability across intervention results, as well as gauging unexpected results of HIV prevention interventions.

Gender emerged as a parameter linked to better outcomes, albeit not overwhelmingly (i.e., in four reviews and for some intervention outcomes), yet it is customary for studies—both primary and secondary—to recommend tailoring interventions to gender. Some discussion is justified here, given the almost unequivocal acceptance of gender based-differences in sexual practices and sexual risk-taking. Men tend to report higher levels of sexual involvement, whereas women seem to take more sexual risks, especially non-condom use. This situation is often explained on the basis of an existing patriarchy, which bears and sustains differences in unsafe sex behaviors, especially in contexts of economic strife and inequality [48, 50]. Nonetheless, scrutiny of data coming from contexts where gender imbalances are indeed prominent (e.g., African nations) reveal that the linkage between gender and sexual practices is far from clear. For example, Bryan, Kagee, and Broaddus [51] found gender interacting with ‘perceptions of control over sexual encounter’, to be a significant predictor of actual condom use in South African adolescents. Male adolescents reporting *less* control over the encounter were *more* likely to use condoms than those reporting more control. For female adolescents, no reliable relationship was found, but females perceived significantly *higher* control over the behavior. Studies conducted in developed nations too, have found no gender-based differences in young peoples’ non-condom use [52]. The possibility exists, consonant to patriarchal structures, that in cases other than rape, women decide if sexual activity will occur, assuming the role of the relationship’s gatekeeper, and consequently perceiving high levels of control over sexual activity [53]. The point made here is that the decision to tailor interventions to gender should not be arbitrary, or based on stereotypical views of sexual relationships between men and women. Once again, preliminary formative research is the only way to uncover gender-based inequalities in particular samples before investing in a gender-specific intervention.

On the whole, the methodological quality of included reviews, as assessed by the OQAQ, was not impressive (Table 4), even though our selection criteria emphasized systematic review methods. Thirty-six percent of the reviews received an overall quality score of 3 (the most common score across reviews) indicating “major flaws”. Meta-analyses received higher overall quality scores (no

meta-analysis received an overall quality score of <3), as compared to qualitative reviews (no qualitative review received a score >4). Across both review types, the weakest areas were those relating to selection bias and comprehensiveness of the literature search. A recent meta-review assessing the reporting quality of search methods in HIV behavioral interventions [54] also found selection bias and comprehensiveness of the literature search to be problematic (Fig. 1). Compared to meta-analyses, qualitative reviews used fewer search strategies and tended to describe these strategies with less clarity. In addition, within review type, there were variations in the number of search strategies used and some variation in selection criteria (e.g., some excluded uncontrolled trials). Such differences in strategies may be one reason why study samples varied widely. Still, reviews had strong areas, and those mostly related to the explicit statement of inclusion/exclusion criteria and reaching sound conclusions. In parallel, note that in our meta-review, qualitative reviews were more likely than meta-analyses to conclude that certain factors were linked with intervention success, even though these reviews considered relatively small samples of relevant studies. Meta-analyses that considered the same factors were more likely to contradict the qualitative reviews’ conclusions. In contrast, factors that had a more marked moderation pattern—such as dosage of condom skills training and of motivational enhancement—were likely to be confirmed in qualitative reviews. In keeping with Cohen’s definition [55] of a medium effect size as one likely to be visible to a careful observer without the aid of statistics, it would seem that qualitative reviews would have difficulty reaching definitive conclusions about moderators unless the moderators’ impact was quite marked. In contrast, meta-analyses could more routinely find small moderation patterns, as well as more marked patterns.

With the exception of certain design features (use of RCTs, larger sample sizes and classroom setting), the remaining factors did not diverge in any substantial way between meta-analytic and qualitative review data, offering additional assurances about the accuracy of our results. Still, as might be expected by the use of triangulation, there were occasions whereby one type of review (but not the other) obtained dimensions linked to reduced sexual risk-taking. Employing individual as well as group format, booster sessions and adult facilitators were linked to better outcomes only in qualitative reviews. The absence of such obtained factors in one type of review may reflect deficiencies of its method. Consequently, in this meta-review, triangulation may have helped to overcome deficiencies of a single-method meta-review, suggesting that both strategies offer insight into best strategies of risk reduction for adolescents. Nonetheless, it is striking that reviews of the same literature yielded such different moderation patterns.

We suggest the following interrelated reasons why this pattern of results may have appeared.

First, some reviewers did not operationalize particular dimensions and therefore could not test whether such dimensions were related to efficacy. Given that systematic reviews use extensive search processes, it is curious that there was not more uniformity in the dimensions considered, especially in the more recent reviews. This lack of communication between reviews is even starker given that many authors participated on more than one review. It is our hope that the present meta-review will generate more convergence in future reviews. Second, different reviews focused on different outcomes, with some considering non-behavioral measures, others biological outcomes, and others behavior (see Table 1). Third, some reviews deliberately defined small literatures of studies, which reduces statistical power to detect moderation patterns. Fourth, some moderation patterns are not large, meaning that larger samples of studies would be necessary to detect them. A factor that makes only a small difference will usually go undetected in a small literature. Finally, some meta-analyses used multi-predictor models, which enabled them to drop factors that did not uniquely explain variation in effect sizes. A factor that showed a statistically significant bivariate linkage might disappear when other factors are controlled. By the logic of inferential statistics, a simpler story thus emerges. For example, Johnson et al. [7] concluded that significant bivariate meta-analytic moderation patterns in condom use outcomes due to date of study, amount of interpersonal skills training, use of an irrelevant-content control group, and sampling Africans or African Americans could be attributed to interventions providing greater amounts of condom skills training and/or more motivational training.

Conclusions and Limitations

This meta-review triangulated information from quantitative and qualitative reviews, aiming to enhance rigor by combining the two methods. Regarding outcome measures, all reviews reported positive outcomes in at least one of the following: HIV and safer sex knowledge acquisition, self-efficacy, attitudes, perceptions of control and norms, intentions, abstinence, delaying next sexual intercourse, abstinence, decreasing number of sexual partners, sexual frequency, and actual condom use. Thus, we have reason to be optimistic about the efficacy of behavioral HIV prevention interventions for adolescents. As Johnson et al. [7] concluded, “including more than 20 years of research on adolescents, our review confirms the efficacy of behavioral interventions to prevent sexually transmitted acquisition of HIV in a group that may have the most to profit by remaining HIV-free” (p. 82). We semantically grouped

features linked to reduced sexual risk-taking in four categories: intervention design, BCTs, recipient characteristics, and social ecology. The methodological quality of included reviews is a reason for concern, especially in relation to qualitative reviews, because many had flaws in selection bias and comprehensiveness of the literature search.

We acknowledge certain limitations to our endeavor, most of which are inherent to the nature of this study design. Specifically, a meta-review aims to synthesize reviews, providing an overview of the evidence. Still, the evidence of a meta-review is ‘twice removed’ from the original primary data, and thus, detailed evidence of better intervention outcomes is not possible. Relevant to this concern, not all included reviews had the same foci or same outcome measures, with some reviews employing a ‘sexual risk-taking’ composite outcome variable. Consequently, we too were careful to notice intervention factors that reduced ‘sexual risk-taking’, acknowledging that the concept is somewhat crude. Furthermore, even though we included only systematic reviews, aiming for higher quality evidence, it is still possible that (a) high quality reviews contain poor quality evidence; and (b) high quality interventions exist but have not yet been synthesized into reviews. Future research could grade the methodological quality of the trial in relation to the studies’ inclusion into systematic reviews and answer this question with greater certainty. As these primary interventions cannot be included in a meta-review, it is possible that we have indirectly suggested gaps in the primary evidence. It is also possible that reviews were missed, despite our systematic approach to searching the literature. Still, in reviews other than meta-analyses, there is no pressing aim to include all existing studies. When conducting content analysis or other qualitatively-oriented analytic procedures, the index of adequate sample size is usually theoretical/conceptual saturation, that is, the point where no new data seem to emerge during coding [56, 57]. We are confident that our meta-review was conducted with a thorough search of the literature and reached conceptual saturation. A final potential limitation is that our conceptualization of BCTs is only loosely aligned with recent BCT taxonomies [58–60].

Limitations notwithstanding, this meta-review identified and discussed the nuanced categories of factors that may be linked to improved HIV prevention intervention outcomes for adolescents, through a systematic synthesis and content analysis of data from eleven sources. It is our hope that in organizing and critiquing past reviews’ conclusions, prevention efforts for adolescents will grow stronger with time.

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