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Developmentally-Appropriate Sexual Risk Reduction Interventions for Adolescents: Rationale, Review of Interventions, and Recommendations for Research and Practice

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Abstract

Context—Despite awareness of the need to design developmentally-appropriate sexual risk reduction interventions for adolescents, limited information exists to identify the aspects of intervention design or content that make an intervention “developmentally appropriate.”

Objectives—(a) To clarify the rationale for designing developmentally-appropriate interventions, (b) to review randomized controlled trials (RCTs) of adolescent sexual risk reduction interventions, (c) to identify developmentally-appropriate strategies, (d) to examine the relationship between developmental appropriateness and sexual risk outcomes, and (e) to provide recommendations for research.

Study Selection—Studies ($n = 24$) published before 2003 that evaluated a risk reduction intervention, sampled adolescents, used a RCT study design, and evaluated sexual behavior outcomes.

Results—Content analysis indicated that the interventions tested were often tailored to the cognitive level of adolescents, as indicated by the use of exercises on decision-making, goal-setting and planning, and concrete explanation of abstract concepts. Interventions also addressed the social influences of risky sex such as peer norms and provided communication skills training. Overall, the interventions tested in RCTs were more effective in delaying the onset of sexual activity than in promoting abstinence among sexually-active youth. Interventions with booster sessions were effective in reducing sexual risk behavior. The use of process measures, linked with developmental constructs, was rare. However, improvements in sexual communication skills and perceived norms for safer sex were associated with reductions in sexual risk outcomes.

Conclusions—Developmental transitions during adolescence influence sexual behavior, and need to be considered when developing and evaluating risk reduction interventions for youth. Future research should assess process measures of key developmental constructs as well as risk behavior and biological outcomes.

Introduction

Adolescents (youth aged 13 to 19) have been identified as a vulnerable group for acquiring HIV and other sexually transmitted diseases (STDs). One-half of the approximately 40,000 new HIV infections each year are among people under 25 (1–2). Sexual risk behavior accounts for the majority of HIV infections in youth (3), and has led to epidemic rates of STDs among 13 to 19 year olds (4).

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Sexual risk reduction interventions have been implemented with adolescents in a variety of settings. Although recent reviews and meta-analyses of the literature suggest that interventions can be efficacious (5–9), few of the extant interventions have been replicated. Moreover, some interventions appear ineffective, and much of the variance in reducing sexual risk remains unaccounted for, suggesting that additional factors or theoretical frameworks are needed to guide future intervention studies (10). Thus, there remains an urgent need to continue to refine prevention programs for adolescents to reduce new cases of HIV/STDs.

Increasingly, the importance of developmental factors in designing adolescent interventions is recognized (7,11). However, previous reviews found that only a small percentage of adolescent studies addressed developmental issues (7). Furthermore, although the term “developmentally-appropriate” is used frequently to characterize adolescent interventions, interventions that report being developmentally-appropriate vary widely in format and delivery. Studies rarely specify what aspects of intervention design, content, or delivery are “developmentally-appropriate.” Hence, greater guidance is needed to assist researchers who seek to design and tailor interventions to the developmental level of adolescents.

Our view is that the effectiveness of interventions for adolescents will be increased if such interventions are designed and evaluated mindful of developmental factors. Toward this goal, a review of the adolescent literature may yield information about how developmental factors have been addressed. Accordingly, the purposes of this review are to: (a) clarify the rationale for developmentally-appropriate interventions; (b) review adolescent sexual risk reduction interventions to identify strategies used to tailor the interventions so that they are developmentally-appropriate; (c) examine the relationship between developmental appropriateness and sexual risk outcomes; and (d) provide recommendations for designing developmentally-appropriate interventions.

Rationale for Developmentally-Appropriate Interventions

There is consensus in the literature that tailored interventions are more efficacious than a “one-size-fits-all” approach to HIV prevention. Intervention content, design, and delivery can be tailored to different populations by addressing specific risk behavior patterns, hypothesized antecedents of risk behavior change, demographic factors, such as gender and ethnicity, the setting in which the intervention will be implemented, and unique determinants of risk for a particular population.

Interventions designed for adolescents, sometimes referred to as age- or developmentally-appropriate interventions, have been reported frequently in the literature, yet it is often unclear what makes these interventions uniquely appropriate for youth. The operationalization of “developmentally appropriate” appears to vary greatly and includes interventions that are simply implemented with youth, those that include cultural icons or argot that are familiar to youth, and interventions with non-traditional components that appeal to youth (e.g., game show format). Other interventions include components that have been shown to be effective with youth (e.g., communication skills training), or are consistent with developmental theory (e.g., address future consequences of risky sex). Such variability has led to confusion about what is “developmentally-appropriate.” Therefore, we propose that a useful way to describe developmentally-appropriate interventions is to consider those aspects of intervention design, content, and delivery that are associated, empirically or theoretically, with the unique risk reduction needs of youth. In contrast, interventions that may be appealing to youth, but lack an empirical or theoretical backing, may not be truly developmentally appropriate.

Developmentally-appropriate interventions are needed because patterns of adolescent sexual behavior differ from adults. Adolescents lack real-life experiences and interpersonal skills needed to implement many HIV risk reduction actions, such as negotiating for safer sex.

Furthermore, several developmental transitions affect the onset of sexual activity, and subsequent risk behaviors. In the sections that follow, we review the empirical evidence and theoretical guidance regarding the need for developmentally-appropriate interventions.

Adolescent Sexual Behavior and Relationships

In contrast to most adults, adolescents are less likely to be sexually active (12) but, when they do engage in sex, it is often risky. Early onset of sexual behavior (before age 16) has been identified as a risk factor for HIV/STDs and pregnancy (13–15). Early sexual debut is risky because younger teens are less likely than older teens (or adults) to use condoms at first sexual intercourse (16). On average, girls begin menarche when they are 12–13 years old and the median age at first intercourse is 17 (17). Girls who initiate sex at an early age tend to have older partners and less egalitarian relationships. Greater age differences between adolescent partners have been associated with less frequent condom use (18). Conversely, delaying sex until later in adolescent years reduces risk considerably. Students who initiate sex later are more likely to use condoms (19). Interventions tailored for sexually-inexperienced youth, or young teens who are recently sexually active, can promote risk reduction before patterns of sexual risk behaviors are established.

Adolescent relationships differ from adults. That is, adolescents tend to have a series of short-term, monogamous relationships (i.e., serial monogamy) in which condoms are seldom used; thus over the course of a few months or years, adolescents often have multiple sexual partners (4). Moreover, due to the brevity of their relationships, adolescents know their partners for a shorter period of time. Sexual communication and negotiation with new partners in short-lived relationships may contribute to the difficulty adolescents' encounter in practicing safer sex.

Patterns of adolescent condom use also differ from adults. Condom use among teens is sporadic (20) and consistent condom use is rare. One factor associated with consistent condom use is having used condoms at first intercourse (21). Indeed, one study found that youth who reported using condoms at their first intercourse were 20 times more likely to use condoms in the future (22). Such findings indicate the importance of intervening with youth before the initiation of sexual activity.

Influence of Adolescent Developmental Transitions on Sexual Behavior

Adolescent sexual risk behavior is influenced by several developmental transitions. These transitions are viewed best within a biopsychosocial framework that includes biological, psychological, and social development (23).

Biological influences—The timing of physical development, especially in girls, is associated with risk behavior; that is, early maturing females initiate sex at a younger age (24), have higher rates of substance use, and are more likely to have older, and riskier, male partners (25–27) -- characteristics that put them at greater risk for STDs/HIV (13–14). Adolescent females are physiologically more susceptible to some STDs than adult women (28), and having an STD makes transmission more likely (4).

Psychological influences—Adolescence is also associated with changes in cognitive and emotional domains, as well as developing interpersonal skills. Changes in these domains have implications for sexual risk-taking and reducing risk. For example, there is evidence that adolescents, particularly younger teens (under age 14), may not have developed the cognitive maturity required to understand and implement some risk reduction strategies. Adolescents' ability to reason, consider probabilities, and envision multiple behavior alternatives is essential to make decisions about sexual relationships (29). Cognitive functioning affects adolescents' ability to appraise their risk for HIV and to enact protective behaviors. The development of

abstract reasoning allows youth to consider hypothetical situations and future consequences of their actions (30), but youth who are less proficient at abstract thinking are less likely to use condoms (31), or to consider long-term implications of having unprotected sex (32).

Egocentric thinking (i.e., the belief that one is different from others) influences teens' ability to apply knowledge about HIV/STDs to their own behavior (33). Youth with more egocentric thinking have been found to have greater numbers of sexual partners (34). Some developmental theorists argue that adolescent egocentrism is related to poor risk perception, due to the inability to recognize similarities of oneself to others (35). Moreover, many adolescents are unduly optimistic, and often believe that risks do not apply to them; thus, some perceive themselves to be invulnerable to the potential negative consequences that might result from their actions, and their perception of risk is often biased. Lower perceived risk among adolescents is a robust finding that has been replicated for negative sexual health outcomes, including HIV (19,36–37), other STDs (38), and unintended pregnancy (39).

Decision-making ability improves during adolescence. Younger adolescents (10 to 13) tend to make sexual decisions based on immediate gratification, rather than on long-term consequences (40), and they are not able to generate alternatives or identify possible consequences as readily as adults. Adolescents may choose to engage in risky sex, for example, because of peer pressure or to engage in “adult” behavior as a means of asserting their independence. Even as youth develop the ability to reason abstractly and consider “cause-and-effect” relationships, they have had little experience in applying these skills to decision-making (35). Furthermore, decision-making ability is reduced in novel or emotionally-laden situations (41–42), such as sexual encounters where arousal levels are high.

Cognitive immaturity, then, may limit adolescents' ability to apply their knowledge to their own behavior, to appraise their risk for HIV/STDs, and to execute the skills necessary for safer sex. In this sense, adolescents' thinking processes may impede their ability to learn risk reduction skills unless skills are presented in ways that adolescents can easily understand. Therefore, adolescents, particularly younger teens, may require extensive instruction in order to protect themselves. They may also benefit from additional training in risk appraisal, decision-making, problem-solving, and considering immediate and long-term consequences of risky sex.

A second dimension of psychological development that affects sexual risk taking is adolescents' experience in coping with intense emotions, such as those resulting from physical maturation and newly formed attachments with peers and dating partners. For many youth, it is difficult to predict the emotional sequelae of initiating sexual activity or communicating with partners about safer sex. Emotionally charged situations can hinder adolescents' ability to exercise their capacity for sexual decision-making and to protect themselves. Interventions can assist youth in anticipating, identifying, and managing the emotions associated with sexual activity and taking actions to prevent HIV/STDs.

Adolescents also lack life experience and skills compared to adults. The extant evidence indicates that interventions including skills-training are effective for adolescents (5–7,9). However, implementing behavioral self-management or interpersonal skills in the absence of life experience can be challenging. Accordingly, it is important that interventions prepare youth for risk situations and provide opportunities for skills-building in sexual communication, negotiation for safer sex, and skills to refuse unwanted or unprotected sex.

Social influences—Increasing autonomy during adolescence extends the range of social influences that impact sexual risk behavior. Evidence shows that peers influence adolescents' attitudes, values, and sexual risk behavior. Having peers who engage in risk behaviors is

associated with initiating sexual intercourse and other risk behaviors, such as alcohol and substance use (19,43). Similar rates of sexual activity, as well as feelings associated with sexual intercourse and intentions to engage in sex, are found among peer friendship groups (44). Younger teens appear to be susceptible to peer pressure for risk behaviors (45), and perceptions of peer norms impact sexual behavior. Adolescents use condoms less frequently when they perceive that their friends do not use condoms (46), and conversely, are more likely to use condoms when they believe that their friends use them (47). Deciding to postpone sexual activity is also influenced by peers. Interventions that address peer norms and peer pressure may be especially important for younger teens.

Parents continue to be important, and parent-adolescent discussions about sex can protect teens from other influences that might encourage risky sex. Whitaker and Miller (48) found that parent-adolescent discussions about sex were associated with less risky behavior and less influence of peers for sex. Teens who talked with their parents about sex were also more likely to discuss sexual risk with their partners (49). Parental monitoring is associated with less involvement in sexual and other risk behaviors for minority youth (47,50–51). The perceived absence of parental monitoring has also been associated with STD diagnosis, decreased condom use, risky sexual partners, and increased substance use (52). The timing of communication appears to be critical. Ideally, communication should occur before the initiation of sexual behavior (29,53). Thus, encouraging parent-teen communication, and assisting parents in monitoring teens' behavior, may be especially important for the prevention of HIV/STDs as well as unintended pregnancy (54).

Summary—Adolescents have different HIV prevention needs than adults. However, because of the variability among youth with respect to cognitive and social maturity, and sexual experience, interventions need to be tailored to meet the unique needs of younger versus older youth, or sexually-naïve versus experienced teens. HIV prevention interventions also need to be matched to the cognitive level of adolescents, and to improve behavioral skills for risk reduction, decision-making, planning, and problem-solving. Similarly, interventions need to address – and leverage – the important social influences of peers and parents on risk behavior.

Developmentally-Appropriate Features of Adolescent Sexual Risk Reduction Interventions

The second aim of this paper is to review sexual risk reduction interventions to (a) identify developmentally-appropriate features, and (b) when possible, to examine the relationship between the developmental appropriateness and sexual risk outcomes. Computer searches using Medline, PsycInfo, and Cinahl identified studies that evaluated adolescent risk reduction interventions that (a) were published before February 2003, (b) included adolescents 11 to 18 years old; (c) used a RCT design; and (d) measured sexual behavior outcomes. We limited our review to RCTs because this design eliminates many threats to internal validity (55), and improves the ability to infer causation to the intervention for effects observed (56). We examined RCTs to determine if they contained components tailored to the unique developmental needs of adolescents. Consistent with a biopsychosocial model, we considered an intervention to be developmentally-appropriate if the conceptual model underlying the intervention, and the intervention components, explicitly targeted the unique biological, psychological, and social determinants of adolescent sexual behavior.

First, to determine if studies addressed biological correlates and development, we assessed interventions that were targeted to a specific age range, or to youth prior to the onset of sexual activity. Second, to address psychological development, we assessed how interventions adapted their content to adolescents' cognitive development level (e.g., illustration of abstract concepts in concrete ways, activities in risk appraisal and decision-making). Within the

psychological level of analysis, we also considered interventions that provided behavioral skills training in areas where adolescents often lack experience (e.g., condom application skills). Third, we reviewed how interventions were tailored to address the important factors in adolescents' social development (e.g., communication and negotiation skills, relationships with peers, family, and sexual partners). We also noted studies that measured developmental factors and those that provided process outcomes.

A total of 25 interventions were reviewed from 24 studies (one study reports findings from two interventions and two independent samples) (57). At least one developmentally-appropriate feature was found in all 25 interventions. These studies are identified and summarized in Table 1. Table 2 displays the developmentally-appropriate intervention features found in the 25 interventions. We categorized the features according to the area of development they addressed. Many intervention activities address multiple domains of development, making it difficult to precisely categorize features into bio-psycho-social domains; thus our categorization scheme is a heuristic rather than a rigid classification.

Interventions that Addressed Biological Development

Behavioral interventions cannot alter physical development, but they can anticipate biological changes during adolescence. Age, onset of menarche, and initiation of sexual activity are important changes that impact sexual risk behavior. Prevention interventions can be designed for all ages, but greater care is needed for younger adolescents, who are less experienced in decision-making, communication, and sexual relationships. Studies with pre- and young adolescents have the ability to reach youth prior to sexual initiation. Moreover, studies that target young adolescents will also reach youth who have initiated sex at an early age (i.e., under age 16); a group that has been shown to be at elevated risk for unplanned pregnancy and STDs (13–15).

A strength of this literature is that 11 studies (46%) delivered interventions to preadolescents (9–12 years) (58–59) or younger adolescents (13–15 years) (40,60–67). Sample characteristics are provided in Table 1. Studies with pre-adolescents were effective in delaying the onset of sex (58) and improving condom use among sexually-active youth (58–59). Studies with young adolescents were effective in increasing condom use (40,61,67), reducing unprotected sex (62–63), and reducing the frequency of sex (66–67).

Two outcomes are unique to youth: (a) postponing the onset of sexual activity, and (b) encouraging abstinence among youth who have previously been sexually active. Five studies measured delayed onset of sex as an outcome variable for youth who had not initiated sexual activity prior to receiving the intervention (58,60,65,67–69). Among these, two studies effectively delayed onset of sex for one year or longer (60,67). Six studies measured abstinence (58,60,67,70–72) and only one found short-term effectiveness in promoting abstinence (58). These findings show that once youth initiate sex, it is difficult to return to abstinence. A limitation of this literature is that researchers failed to measure onset of menarche, a developmental transition with strong implications for sexual risk behavior.

Last, studies designed for adolescents can address changes in physical development with extended interventions that allow researchers to monitor key transitions, such as entering puberty and initiating sexual activity. Studies extended their interventions by providing “booster” sessions to participants up to one year later (40,60,69,73). For example, Levy et al. (40) provided five booster sessions to participants one year after receiving the initial intervention. Given that many youth initiated sexual activity during that year, some intervention experiences (i.e., condom negotiation skills) may have been more meaningful as they transitioned to becoming sexually active. The study by Coyle et al. (69) is noteworthy because their school-based intervention was delivered in ten sessions during both the 7th and 8th grades.

Students who received the intervention had fewer occasions of unprotected sex and improved condom use at 31-month follow-up compared to controls.

All studies that provided booster sessions were effective in reducing sexual risk behavior later (40,60,69,73), suggesting that extending the delivery of interventions is a promising strategy for reaching youth during development periods. The use of extended interventions is different from interventions with a longer “dose.” Prior reviews have shown that intervention dose is not necessarily related to effectiveness (5,9).

Interventions that Addressed Psychological Development

Cognitive development—Table 2 summarizes the intervention strategies used to adapt intervention content to adolescents’ cognitive maturity level. Addressing adolescents’ level of cognitive development may be an important moderator of intervention efficacy.

One strength of this literature is the attention given to assisting youth in recognizing their risk for HIV/STDs. The provision of exercises on perceived vulnerability or individualized risk appraisal is developmentally-appropriate because these exercises may counter adolescents’ overly optimistic beliefs of invulnerability and help them to connect long-term negative consequences to present risk behaviors; a difficult task for youth with less sophisticated abstract thinking.

Many studies also measured changes in risk perception (59,61,64,69–71,74–76), yet only about half demonstrated more accurate risk appraisals at follow-ups (64,69–71,76). Nearly all of the studies that showed improvements in risk perception also achieved reductions in sexual risk behavior at follow-up (69–71,76). However, differences in measurement of risk perception may impact findings. Measures varied from having one (75–76) to three items (70), assessing risk for AIDS only (71), to assessing risk for HIV, STDs, and pregnancy (59). Further, some measures specified perceptions of risk based on respondents’ recent sexual behavior (70,76), whereas others assessed perception of risk by age 25 (59). Although evidence from these studies suggests that improving perceptions of risk is important for reducing risk behavior, greater use of standardized measures in the future will verify the importance of risk perception.

Cognitive development during adolescence also involves learning to manage the emotions associated with developing relationships with peers and partners. Strategies to manage the emotions associated with sexual activity were included in several interventions that assisted youth in accepting the negative feelings that may be associated with abstinence or safer sex, such as fear of rejection, anxiety, and embarrassment (70,77). Metzler et al. (77) taught participants how to accept and cope with negative feelings that were associated with achieving their risk reduction goals; they also measured participants’ willingness to accept negative emotions associated with risk reduction. Nevertheless, no differences were found at follow-up and the authors acknowledged difficulty in establishing a valid measure of this construct. However, both studies were effective in reducing the number of sexual partners at follow-up (70,77).

Other interventions used cognitive restructuring techniques to replace negative thoughts and feelings about risk reduction with more positive health-protective beliefs (58,63,67). None of these studies provided a process measure to evaluate the contribution of cognitive restructuring, however, all three interventions were effective in reducing sexual risk by improving condom use (58,67) and reducing the frequency of unprotected sex (63). These approaches are relevant because adolescents lack experience in coping with new and intense emotions associated with sexual relationships. The ability to anticipate and accept unpleasant feelings may offset the difficulties adolescents experience in making decisions in new and emotionally intense sexual situations.

Interventions recognized adolescent cognitive functioning in other ways, such as providing activities to (a) clarify teens' personal values for sexual behavior (59,67,71,78), (b) consider future goals and the impact of risky sex on goal attainment (58,64), (c) encourage risk reduction goal-setting (59,70,76–77), (d) promote active decision-making skills (40,59,64–67,71,73, 77–78), and (e) identify and prepare for risky situations (57,64–65,67) (see Table 2).

The “Becoming a Responsible Teen” intervention (67) used a comprehensive approach to address adolescents' thought processes relevant to enacting risk reduction behaviors. This group-based intervention included exercises to identify risky situations and personal triggers for risk, problem-solving strategies, sexual decision-making in consideration of adolescents' personal values, risk perception, behavioral self-management techniques, and cognitive restructuring of negative beliefs and feelings associated with practicing risk reduction. The intervention was effective in reducing sexual activity and increasing condom use among sexually-active youth, and in delaying the onset of sex among sexually-naïve youth (67). These findings suggest that interventions addressing cognitive factors associated with risk taking may be especially effective. Inclusion of process measures would provide evidence of this relationship.

Limitations were noted with respect to tailoring interventions for adolescents' cognitive maturity. First, only one-third of interventions provided multiple intervention exercises that were cognitively appropriate for adolescents (58–59,64–65,67,70,76–77). Second, only two interventions included exercises to assist teens in considering their risk behavior in context of their future goals (58,64). Such exercises may personalize the long-term effects of sexual risk behavior. Third, only one intervention illustrated abstract concepts with concrete, real-life examples to be consistent with adolescents' limited ability to consider hypothetical situations in the future (59). Last, only one study measured a marker of cognitive development. Cognitive complexity was measured and was found to moderate intervention effects (31). Youth who had higher cognitive complexity reported greater reductions in risk behavior at follow-up.

Adolescents' behavioral experience—Psychological development during adolescence encompasses cognitive development and the acquisition of new behaviors. The importance of condom application skills in risk reduction is reflected by the fact that 15 interventions provided condom skills training (31,57–58,62–64,67,69–71,73–75,77,79). Ostensibly, condom use skills are requisite for practicing risk reduction, especially for adolescents who have limited sexual experience. However, empirical support for condom application skills is mixed. Two studies measured condom application skills by directly observing participants place a condom on a penis model (70,75). These studies produced mixed findings: improvements in condom application skills were not associated with increased condom use (75) and non-significant findings for condom use skills were associated with risk reduction outcomes in another study (70).

Interventions that Addressed Social Development

A strength of this literature is that interventions addressed key social influences on adolescent sexual risk behavior. The types of activities are provided in Table 2 and include peer, partner, and parent influences on sexual behavior.

Sexual communication—Many studies provided communication skills training, which is appropriate for adolescents because of their lack of experience in handling sexual situations. Twenty-one of 25 interventions (84%) provided some type of sexual communication skills training (31,40,57–60,62–67,69–71,73,75–79). Specifically, ten of the interventions (40%) provided sexual communication and assertiveness skills (60,64–67,70,75,77–79), 14 interventions (56%) provided negotiation skills training (31,40,57–59,62–63,65,69–71,73,

75–76), and three interventions (12%) taught skills to refuse unprotected or wanted sex (40, 61, 75). These skills are not always included in adult interventions (80) and are appropriate for youth with limited experiences.

Six studies (25%) measured sexual communication behavioral skills with video- or audio-taped role-play scenarios (64, 67, 70, 75–77). Participants were rated on their ability to refuse to engage in risky sex, to give a reason for refusing to engage in risk-related activities, and to suggest a low-risk alternative. All six studies demonstrated significant improvements in behavioral skills at follow-up. Importantly, five of the six studies were also effective in reducing sexual risk behavior at follow-up (67, 70, 75–77).

Peer influence on sexual behavior—Investigators described interventions with exercises and skills-training to assist youth in resisting peer pressure to have sex or to have risky sex (58, 61, 64–65, 67, 75). These interventions had youth provide risk reduction information to peers as a means of reducing peer pressure for risky sex. However, only two studies measured skills to resist peer pressure (67, 75). Both studies increased skills, and the intervention delivered to African American youth was effective in reducing sexual risk (67). However, improvements in skills were not associated with sexual risk reduction in a sample of incarcerated males. Additional barriers to risk reduction in this setting may account for these inconsistent findings (75).

Many interventions were designed to improve peer norms for condom use or abstinence by using peer educators or models (57–58, 60, 65, 69, 75). Six of seven studies that measured peer norms for condom use (40, 57, 59, 65, 69, 71) or abstinence (60) showed improved peer norms at follow-ups (40, 59, 60, 65, 69, 71). Among the six studies that improved peer norms for risk reduction, five also achieved reductions in sexual risk behavior at follow-up, including delayed onset of sex (60) and improved condom use (40, 59, 69, 71). Given the importance of peers, it is not surprising that promoting positive peer norms for risk reduction is associated with lower risk behavior.

The strategies used to address peer norms in two studies are promising. Stanton et al. (59) delivered their prevention intervention to youth in existing friendship groups to improve peer norms for risk reduction. Youth who attended intervention sessions with their friends improved rates of condom use. In addition, friendship groups who attended the intervention together improved condom use compared to friendship groups that attended a control intervention. This type of design allows the intervention to directly influence peer norms.

The Safer Choices curriculum (68–69) used multiple, and interrelated, approaches to address social influences of sexual behavior. This school-based intervention influenced social norms for risk reduction by addressing social influences at home (e.g., homework with parents, activities and newsletters for parents), school (e.g., peer leaders, teams and clubs at schools), and within the community (e.g., encouraged youth to use local sexual health services). Findings 2.5 years later showed that youth who received the Safer Choices curriculum reported improved parent-teen communication, improved attitudes and social norms for condom use, and had increased condom use and less unprotected sex relative to youth in a standard HIV curriculum (69). Interventions that address the multiple sources of social influence on sexual risk behavior may have greater impact.

Parental influence on sexual behavior—Several interventions included activities to improve parent-youth communication about sex. Studies by Coyle et al. (69) and Levy et al. (40) had participants complete homework assignments with their parents. Other interventions encouraged youth to talk to their parents about sex (60), provided educational material to parents to foster communication with their children (40, 61, 69), and offered meetings and

newsletters for parents (69). Three studies included a measure of parent-teen communication (60–61,69). Two of these found no change after the intervention, whereas the study by Coyle et al. (69) demonstrated improved parent-teen communication nearly three years after the intervention. Providing multiple strategies to foster communication may be more effective. None of these studies, however, measured parental monitoring, an aspect of the parent-youth relationship that is associated with less sexual risk (50,52).

Conclusions and Recommendations

This review clarified a rationale for developmentally-appropriate interventions to reduce adolescent sexual risk behavior, reviewed the HIV risk reduction literature to examine how interventions have incorporated developmentally-appropriate features, and examined the relationship between developmental features and risk outcomes. In this section, we summarize and provide recommendations for the design and evaluation of developmentally-appropriate interventions (see Table 3).

Ample evidence documents that developmental transitions during adolescence impact risk behavior. Early onset of sexual activity is associated with lack of condom use, more partners, and greater risk for STDs and unplanned pregnancy. Moreover, adolescence is associated with emerging cognitive abilities, such as the ability to think abstractly, recognize long-term consequences of risk behavior, and make decisions regarding sexual situations. Adolescents' cognitive immaturity, combined with their relative lack of experience warrants a strong focus on skills development in interventions. Finally, peers and parents influence sexual risk-taking. Peer norms and peers' behavior can either encourage or discourage risky sexual behavior, but parental monitoring and communication usually buffer peer pressure for risky sex.

Although many risk reduction interventions have been designed for adolescents, we found several gaps in this literature. First, despite recommendations for the need to tailor interventions, there are few guidelines regarding what aspects of intervention design, delivery, or content are developmentally-appropriate. Second, although many risk reduction interventions for youth have been implemented, the outcomes have been inconsistent; also, few effective studies have been replicated and the essential features or components of effective interventions remain unknown (9). Third, although adolescent sexual risk behavior is influenced by developmental forces, most of the theories that have been applied to adolescent HIV prevention interventions were developed for adults. The constructs in such models may apply to youth, but such theories do not emphasize the developmental determinants of sexual risk. Even though developers of adolescent interventions have incorporated developmental factors into interventions, the inclusion of developmental factors has not been explicitly grounded in theory. Modifying existing models to be more developmentally-appropriate will advance intervention development, implementation, and evaluation.

We reviewed 24 RCTs that evaluated 25 HIV-risk reduction interventions for adolescents and identified aspects of intervention content and format that are empirically- or theoretically-associated with sexual risk behavior. A strength of this literature is the focus on younger adolescents. Interventions targeted to younger adolescents are important because they can: (a) provide prevention interventions prior to the onset of sexual activity; (b) have the ability to influence peers' perceptions and can indirectly influence peer norms; (c) promote condom use at first intercourse, which has been shown to predict future condom use; (d) intervene at a time when female adolescents are physiologically most vulnerable to some STDs; (e) promote healthy sexual practices before risk behavior becomes established and more difficult to change; and (f) intervene during important developmental transitions, such as initiating sexual activity.

Evidence shows that (a) cognitive maturity is associated with sexual risk (31,34); (b) adolescents have difficulty using higher cognitive, reasoning, and decision-making abilities in situations that are novel or emotionally-arousing (42); (c) youth are less likely to consider long-term consequences of risky sex. Although all studies adapted interventions for adolescents' cognitive maturity level, there have been few interventions that employed multiple strategies appropriate for youth. Therefore, we recommend using multiple strategies compatible with adolescent cognitive ability, including managing emotions associated with sexual risk reduction (see Table 2).

Sexual decision-making can be enhanced by addressing both the immediate and long-term consequences of risk behavior. For example, focusing on the present impact of having risky sex with the adolescents' values and considerations can be useful (34). Interventions should reflect the variation in cognitive skills of younger and older adolescents (81). For example, abstract reasoning improves with age, which suggests that interventions tailored for young adolescents (under 14 years) need to ensure that abstract concepts (e.g., risk appraisal, long-term consequences) are addressed in clear, concrete terms (59). We recommend including measures of cognitive functioning, future-time perspective, and decision-making in formative research.

Efforts to improve risk perception in these studies were inconsistent. It may be difficult to change risk perception due to adolescents' inclination to be egocentric and optimistic. Because changes in risk perception can result from one's engagement in risk behaviors, as well as from the effects of attending an intervention, measurement of this construct is needed. Interpretation of results can be clarified by measuring participants' accuracy in appraising their risk based on recent sexual risk behavior. We recommend linking risk perception to actual behavior, and reporting findings for sexually-inexperienced versus experienced youth. Improvements in risk perception measures will yield stronger inferences regarding the importance of risk perception in fostering behavior change.

A strength of this literature is the attention devoted to social factors. Interventions have prompted positive peer norms for abstinence and safer sex, used peer models, fostered social support for risk reduction, and provided exercises to assist teens in coping with peer pressure. Improvements in peer norms for safer sex and sexual communication skills were strongly associated with reductions in sexual risk behavior. A shortcoming, however, is that few studies measured social factors as outcomes. When possible, interventions can address the interrelated social influences on risky sex, by using multiple strategies to address social pressures, such as changing peer norms, providing peer models, and providing interventions to peer groups (59), parents and teens (51), and families (82).

Consistent with previous reviews (5–6,8), we found that interventions with a focus on sexual communication, assertiveness, and negotiation skills were effective in reducing sexual risk behavior (67,77). An exception, however, is that condom use skills were rarely measured and inconsistently associated with risk reduction outcomes. These findings suggest that communication skills should be emphasized to assist youth in negotiating for condom use and coping with partner pressure to have risky sex. Similarly, interventions that assist adolescents in making decisions consistent with their goals are encouraged.

Furthermore, adolescents' cognitive abilities are less developed than adults and it may be difficult for teens to imagine themselves in hypothetical situations where skills would be implemented. Findings from this review highlight the importance of providing multiple opportunities for skills training that are consistent with adolescents' cognitive level. Measurement of behavioral skills was limited; when feasible, investigators are encouraged to

include measures of skills so that the types of skills, the means to teach them, and the timing of skills training can be better understood.

Longer-term interventions, through the use of booster sessions may reinforce skills acquisition as youth's relationships change. We found that two interventions with booster sessions reached youth across developmental transitions (e.g., prior to and after initiating sexual activity) and were effective in reducing sexual risk. If these preliminary findings hold up across other studies, it suggests that interventions may need to be designed, and funded, to be delivered over time as youth mature, rather than providing multiple intervention sessions in a single-shot intervention.

Two outcomes that have been rarely assessed, but are critical for adolescents, are delay of onset of sexual activity and abstinence. Measuring onset of sexual activity is important because sexual initiation: (a) normatively occurs during adolescence and therefore is a unique outcome for this age group; and (b) is a risk factor for STDs/HIV and unplanned pregnancy, especially for girls. Studies were more effective in delaying the onset of sex than in encouraging abstinence among youth who had already initiated sex. Intervening with younger adolescents, before they initiate sex, can promote preventive behaviors before risk behaviors are established.

Sexual risk behavior among adolescents has led to an epidemic of STDs among teenagers, increased HIV infections, and unplanned pregnancies. The vulnerability of adolescents, combined with inconsistent findings from existing prevention interventions, accentuates the need to develop new, and more effective, risk reduction interventions. Given the mixed outcomes from intervention studies, we call for the continued development of multifaceted interventions that address biological, psychological, and social influences on sexual behavior. Moreover, studies that compare different intervention strategies and identify effective components are needed. Needed also are studies that measure process outcomes of developmental factors. Findings from this review identify promising directions for interventions that are developmentally-appropriate for adolescents.

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Table 1
Key Characteristics of 24 RCTs Evaluating Interventions to Reduce Adolescent Sexual Risk Behavior

Study	Sample	Setting	Intervention conditions	Bio.	Psy.	Soc.	Assessments
Aaron et al. (60)	7th grade students <i>N</i> = 522 Age <i>M</i> = 12.8 yrs. Female = 52% Young adolescents <i>N</i> = 215 Age range = 12–15 yrs. Female = 50%	Junior high school	E: Postponing sexual intercourse C: No treatment	X		X	Pre, 3, 9, and 15 months
Boekeeloo et al. (61)	Female = 52% High school youth <i>N</i> = 3,869 Age range = 14–18 yrs. Female = 53%	Primary care office	E: Assess HIV/STD prevention C: Standard care		X	X	Pre, post, 3, and 9 months
Coyle et al. (69)	Sexually active teens <i>N</i> = 168 Age range = 15–19 yrs. Female = 0%	Public high school	E: Safer choices curriculum C: Standard HIV curriculum	X	X	X	Pre, 7, 19, and 31 months
DeLamater et al. (74)	Sexually active teens <i>N</i> = 562 Age range = 14–18 yrs. African American males <i>N</i> = 168 Age range = 15–19 yrs. Female = 58%	STD clinic	E: Health educator intervention E: Videotape intervention C: Standard care		X X	X	Pre, post, 1, and 6 months
Gillmore et al. (57) ^d	Sexually active teens <i>N</i> = 168 Age range = 14–19 yrs. Female = 58%	Health clinic	E: Video and comic book C: Comic book			X	Pre, post, 3, and 6 months
Gillmore et al. (57) ^d	Sexually active teens <i>N</i> = 228 Age range = 13–18 yrs. Female = 46%	Juvenile detention center	E: Group skills training E: Video and comic book C: Comic book		X	X X	Pre, post, 3, and 6 months
Jennmott et al. (62)	African American males <i>N</i> = 157 Age <i>M</i> = 14.6 yrs. Female = 0%	Public high school	E: AIDS intervention C: Career opportunities intervention	X		X	Pre, post, and 3 months
Jemmott et al. (58)	African American youth <i>N</i> = 659 Age <i>M</i> = 11.8 yrs. Female = 53%	Public middle schools	E: Safer sex intervention E: Abstinence intervention C: Health promotion		X X	X X	Pre, post, 3, 6, and 12 months
Jemmott et al. (63)	African American youth <i>N</i> = 496 Age <i>M</i> = 13.2 yrs. Female = 54%	Public middle schools	E: HIV intervention C: Health education control		X	X	Pre, post, 3, and 6 months
Kipke et al. (64)	Minority, inner-city youth <i>N</i> = 87 Age range = 12–16 yrs. Female = 55%	After school program	E: AIDS risk reduction and skills training intervention C: Wait-list control		X	X	Pre and 1 month
Kirby et al. (65)	Adolescents with STD <i>N</i> = 1,657 Age <i>M</i> = 12.3 yrs. Female = 54%	Public middle schools	E: Project SNAPP skills, knowledge for AIDS and pregnancy prevention C: Existing curriculum	X	X	X	Pre, 5, and 17 months
Levy et al. (40)	African American youth <i>N</i> = 2,392 Age range = 7th grade Female = 51%	Public junior high school	E: Youth AIDS prevention project C: Existing AIDS education	X	X	X	Pre and 12 months
Mansfield et al. (72)	Adolescents with STD <i>N</i> = 90 Age <i>M</i> = 17.6 yrs. Female = 92%	Hospital adolescent clinic	E: AIDS education and counseling C: Standard care		X		Pre and 2 months

Study	Sample	Setting	Intervention conditions	Bio.	Developmental area Psy. Soc.	Assessments
Metzler et al. (77)	Sexually-active teens N = 339 Age range = 15–19 yrs. Female = 68% Urban, minority youth N = 1,061 Age range: 7–8th graders Female = 53% Female adolescents with <i>Chlamydia</i> N = 209 Age range = 14–19 yrs. Female = 100% High-risk minority youth N = 151 Age range = 13–24 yrs. Female = 52%	Public STD clinics	E: Monogamy, abstinence, condoms (MAC) choice C: Standard care	X	X	Pre, 3, and 6 months
O'Donnell et al. (66)	Urban, minority youth N = 1,061 Age range: 7–8th graders Female = 53%	Middle schools Community sites	E: Reach for health and community youth service E: Reach for health C: Existing curriculum E: Behavioral intervention C: Standard care	X	X	Pre and 6 months
Orr et al. (31)	Female adolescents with <i>Chlamydia</i> N = 209 Age range = 14–19 yrs. Female = 100% High-risk minority youth N = 151 Age range = 13–24 yrs. Female = 52%	STD and family planning clinics	E: Individualized intervention C: Standard education	X	X	Pre and 6 months
Rotheram-Borus et al. (70)	Female = 100% High-risk minority youth N = 151 Age range = 13–24 yrs. Female = 52%	Social service agency	E: 7-session HIV intervention E: 3-session HIV intervention C: No treatment	X	X	Pre and 3 months
Shrier et al. (73)	Female adolescents with a STD N = 123 Median age = 17.2 yrs. Female = 100% Delinquent and abused youth N = 358 Age <i>M</i> = 14.7 yrs. Female = 44% Incarcerated youth N = 361 Age <i>M</i> = 15.8 yrs. Female = 0%	Hospital adolescent clinic	E: Individualized intervention C: Standard education	X	X	Pre, 1, 3, 6, and 12 months
Slonim-Nevo et al. (79)	Female = 100% Delinquent and abused youth N = 358 Age <i>M</i> = 14.7 yrs. Female = 44% Incarcerated youth N = 361 Age <i>M</i> = 15.8 yrs. Female = 0%	Child welfare residential centers	E: Skills-training intervention C: Discussion only	X	X X	Pre, post, and 9 to 12 months
St. Lawrence et al. (75)	Female = 44% Incarcerated youth N = 361 Age <i>M</i> = 15.8 yrs. Female = 0%	Correctional facility	E: Abbreviated BART (Becoming a Responsible Teen) C: Anger management	X	X	Pre, post, 6 months after release
St. Lawrence, Brasfield et al. (67)	African American youth N = 246 Age range = 14–18 yrs. Female = 72%	Publicly-funded health center	E: BART ("Becoming a Responsible Teen") intervention C: Education control	X	X	Pre, 2, 6, and 12 months
St. Lawrence, Jefferson et al. (76)	Youth in treatment for substance abuse N = 34 Age range = 13–17 yrs. Female = 26% African American early adolescents N = 383 Age range = 9–15 yrs. Female = 44% Urban, minority youth N = 1,201 Age range = 12–20 yrs. Female = 58%	Residential treatment facility	E: Behavioral skills training intervention C: HIV education	X	X	Pre and 2 months
Stanton et al. (59)	African American early adolescents N = 383 Age range = 9–15 yrs. Female = 44% Urban, minority youth N = 1,201 Age range = 12–20 yrs. Female = 58%	Public housing development	E: Decision-making AIDS intervention C: AIDS prevention intervention	X	X	Pre, 6, and 12 months
Walter and Vaughan (71)	Inner-city minority adolescent females N = 60 Age range = 14–17 yrs. Female = 100%	Public high schools	E: AIDS-preventive curriculum C: No treatment	X	X	Pre and 3 months
Workman et al. (78)	Inner-city minority adolescent females N = 60 Age range = 14–17 yrs. Female = 100%	Parochial high school	E: HIV Prevention C: Womanhood intervention	X	X	Pre and 1 week

Note. Bio = biological; C = control/comparison intervention; E = experimental intervention(s); M = mean; NR = not reported; Psy = psychological; Pre = pre-intervention/baseline; Post = post-intervention; RCT = randomized controlled trial; Soc = social; X = experimental intervention addressed this area of development; yrs. = years.

^a Study is listed twice because it reports on evaluations of two samples with different intervention comparisons.

Table 2
Strategies Used to Developmentally Tailor Interventions

Area of development		Intervention strategies (exemplar studies ^a)
Biological		<ul style="list-style-type: none"> • Provide “booster” sessions to extend the delivery of the intervention (40,60,69,73) • Delivered interventions to same-age or same-grade groups (40,60,65,79) • Provided interventions to youth prior to initiation of sexual activity (40)
Psychological	Cognitive	<ul style="list-style-type: none"> • Addressed accurate risk appraisal and perceived susceptibility for HIV/STDs (31,61,64, 67,69–70,72,74,77,78) • Provided skills to manage negative emotions and thoughts associated with practicing risk reduction (i.e., cognitive restructuring) (58,63,67,70,76–77) • Decision-making activities and skills (40,59,64–67,71,73,77,78) • Assisted youth in clarifying their personal values about sex (59,67,71,78) • Provided exercises on goal-setting and planning for risk reduction (59,70,76–77) • Provided problem-solving activities (65,67,76,79) • Assisted youth in identifying past risky situations, triggers, and anticipating future risk situations (57,64–65,67) • Taught behavioral self-management skills (e.g., avoid risky situations) (58,61,67,77) • Encouraged youth to set future goals and to consider the impact of sexual risk behavior on achieving goals (58,64)
Social	Behavior	<ul style="list-style-type: none"> • Addressed future consequences of sexual risk behavior (65) • Illustrated abstract concepts with concrete and personalized examples (59) • Taught condom application and use skills (31,57,58,62–64,67,69–71,73–75,77,79)
	Peers	<ul style="list-style-type: none"> • Used peer educators or models (40,57–58,60,65,67,69,73–74,79) • Provided multiple strategies to influence peer norms (59,65,69,71,74) • Taught skills to reduce peer pressure for initiating sex or having risky sex (61,64–65,67, 75) • Structured intervention groups with peers (i.e., same age cohort/friends) (59,79) • Fostered social reinforcement for making positive risk reduction changes (64,67,70,76)
	Partners	<ul style="list-style-type: none"> • Taught skills to refuse unprotected or unwanted sex (40,75) • Taught sexual communication/assertiveness skills (60,64–67,70,76–79) • Taught skills to negotiation for condom use/safer sex/abstinence (31,40,57–59,62–63,65, 69–71,73,75–76)
	Parents	<ul style="list-style-type: none"> • Fostered parent-teen communication about sex/ provided parent education (40,69) • Provided parent education (69)
	Community	<ul style="list-style-type: none"> • Influenced the school environment (e.g., safer sex assemblies, clubs) (60,69) • Emphasized the cultural importance of reducing one’s sexual risk (58,67,74) • Included community service, knowledge of community resources (66,69)

^aStudies that used each intervention strategy.

Table 3**Recommendations for Designing and Evaluating Developmentally-Appropriate Sexual Risk Reduction Interventions**

Research design	<ul style="list-style-type: none"> • Include developmental factors in theoretical models • Target sexually-inexperienced youth for interventions • Include parents, families, and peer groups for interventions • Assess cognitive ability in formative research • Use longitudinal designs and intervention “booster” sessions • Measure cognitive functioning, behavioral skills when feasible, and social factors addressed in the intervention. • Improve assessment of risk perception by linking it to actual risk behavior (i.e., accurate risk appraisal)
Intervention design	<ul style="list-style-type: none"> • Measure initiation of sex as an outcome variable for sexually-inexperienced youth • Use multiple intervention strategies that are compatible with adolescents’ cognitive abilities • Illustrate abstract concepts, such as risk appraisal, with clear, personalized examples • Teach techniques to cope with emotions and feelings associated with practicing risk reduction • Provide multiple opportunities for behavioral skills training • Emphasize sexual communication, negotiation, and decision-making skills • Facilitate skills maintenance by providing booster sessions • Address peer norms and peer pressure • Include activities to involve parents in the intervention • Provide integrated prevention messages to reduce risk for HIV, STDs, and unintended pregnancy