

# A Review of STD/HIV Preventive Interventions for Adolescents: Sustaining Effects Using an Ecological Approach

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**Objective** Behavioral intervention programs to reduce adolescent sexual risk behaviors have shown statistically significant reductions in the short-term; however, longer-term follow-up has demonstrated that effects diminish. One criticism has been the reliance on individual-level models. We review the research that has shaped this narrow perspective and propose that a broader, ecological perspective is needed to amplify and extend the efficacy of sexual risk reduction interventions. **Methods** We summarize adolescent sexual risk research and outline intervention research that is suggestive of an ecological perspective. Examples from the published literature that have investigated antecedents or conceptualized preventive interventions using a multilevel approach are provided. **Results** Adolescents are exposed to diverse sources of influence transecting different levels of causation. To adequately prevent, reduce, and maintain the likelihood of adolescents' adopting sexual risk behaviors, intervention programs should be designed to address these myriad levels of causation. This approach has been implemented in Brazil and was shown to be effective. **Conclusion** Research should cross manifold levels of causation so that programs will be more effective at promoting adolescents' adoption and maintenance of STD/HIV preventive behaviors.

**Key words** adolescents; ecological; sexual health; STD/HIV prevention.

Sexually transmitted diseases (STDs) are the most common infectious disease in the United States affecting not only adults, but sexually active youth. Although comprising only one quarter of the sexually active population, adolescents ages 15–24 years account for nearly half of all new STDs, including HIV. As a result, sexually active youth ages 15–19 years experience the highest STD rates of any age group in the United States with prevalence rates for some subgroups (e.g., African American female adolescents) reaching epidemic proportions (Cates, Herndon, Schulz, & Darroch, 2004). Left untreated, STD infections may lead to serious complications including infertility, chronic pain, cervical cancer, or death. From an economic and social standpoint, STDs also exact a significant toll on society in terms of economic costs associated with detection and treatment (Chesson, Blandford, Gift, Tao, & Irwin, 2004). The lifetime medical costs of STDs acquired by American youth ages 15–24 in the year 2000 were estimated at

\$6.5 billion (Cates et al., 2004). In addition to STD morbidity and mortality, and their associated costs, it is important to also consider the association between psychological antecedents and STD acquisition as well as potential adverse psychological reactions to STD diagnosis and treatment.

Because of these high rates coupled with the associated mortality and morbidity, both physical and psychological, the risk of acquiring an STD is one of the most substantial and immediate threats to the health and well-being of adolescents. In fact, The Institute of Medicine considers STDs an epidemic among teens and has called for the development of a national STD prevention strategy (Eng & Butler, 1997). Thus, preventing STD and HIV infection represents an urgent clinical and public health priority (DiClemente, 2001; Eng & Butler, 1997; Ruiz, Gable, & Kaplan, 2001). In this article, we identify and briefly review antecedents to adolescents' STD/HIV risk. Next, we discuss previous

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preventive approaches and highlight the strengths and weaknesses in those approaches. Subsequently, we articulate directions for future research to address gaps in the literature, while proposing an integrated strategy that targets the social ecology of the STD epidemic among adolescents.

### **Antecedents of STD/HIV Risk**

Multiple sexual partners, frequent sexual encounters, and low prevalence of consistent condom use can increase the risk of STD/HIV acquisition. Indeed, there has been ample research articulating the association between these factors and STD/HIV acquisition (Aral & Holmes, 1999; Eng & Butler, 1997; Rosenberg, Gurvey, Adler, Dunlop, & Ellen, 1999). The primary challenge confronting practitioners is identifying and understanding the antecedents to these sexual risk behaviors. A vast body of empirical research has been devoted to this task. Essentially, this research forms the basis for the development of effective behavioral interventions that seek to minimize sexual risk behavior through modifying important antecedents. In Table I, we have listed the empirical antecedents to adolescents' sexual risk behavior and to acquisition of sexually transmitted disease garnered from an extensive review of the literature. The body of literature cited in Table I was drawn from myriad studies involving adolescent samples (aged 13–24 years) representing a diverse range of race/ethnicities, gender, and socioeconomic status. The highlighted antecedents and their associations with sexual risk behavior, sexually transmitted disease, or both are illustrated in the table.

In reviewing the table, the results show a broad range of factors related to sexual risk and protective behaviors, and include individual characteristics such as personality traits, psychological states, self-efficacy, and individual cognitions; relational factors such as length of relationship and age of partner; familial characteristics such as parental monitoring and support; community factors such as school connectedness, poverty, and condom availability; and societal factors such as media exposure. In viewing the constellation of factors, from a preventive perspective, it is very important to recognize that many are amenable to modification.

Understanding the complex web of influences that affects adolescents' STD/HIV-associated risk behavior is critically important to the design and implementation of risk reduction interventions and public health and prevention education policy, as well as for informing

clinical practice and counseling guidelines. If we review Table I, although it appears to represent an extensive list of antecedents linked empirically to adolescents' sexual behavior, understanding how these factors interact and compete is a formidable challenge. Historically, the STD epidemic has been viewed largely as an individual-level phenomenon where much effort has been focused on understanding the factors located towards the top of Table I. Subsequently, many intervention efforts have targeted individual-level factors as a means of achieving significant behavioral change. Merely examining these individual-level determinants in isolation provides a limited perspective on a complex issue and, furthermore, precludes a more in-depth understanding of how higher-level variables (e.g., family, peers, school, community, and society) may be independently associated with STD risk behaviors in the presence of these other individual-level factors.

Subsequently, many intervention efforts have targeted individual-level factors as a means of achieving significant behavioral change. In the past two decades, there have been scores of programs designed to enhance adolescents' STD/HIV-preventive knowledge, foster positive attitudes toward condom use, develop norms supportive of abstinence and condom use, teach skills to foster self-efficacy and motivate adolescents to adopt preventive behaviors, and to decrease risk behaviors. Typically, these programs have used small-group educational formats and recruited participants through clinics, schools, and communities. In general, the weight of empirical evidence indicates that small-group interventions emphasizing cognitive decision making and behavioral skills were effective in reducing sexual risk behaviors (Centers for Disease Control and Prevention, 1999; Robin et al., 2004). One review, for example, examined 23 randomized clinical trials (RCTs) conducted with adolescents and that used sexual behavior change as an outcome. Of these interventions, 13 (57%) achieved significant risk reduction effects. No studies found the reverse effect; that is, in no case did the experimental intervention do worse than the control intervention. Across studies, frequency of unprotected sex was reduced in 75% of studies that measured this outcome, condom use improved in 53% of studies, and number of sex partners was reduced in 27% of the studies. The lowest rates of behavior change were found for abstinence, which was improved in only 14% of studies that measured it (Pedlow & Carey, 2004). These findings have been confirmed by another recent meta-analysis of HIV reduction interventions for youth (Jemmott & Jemmott, 2000).

**Table 1.** Antecedents to Sexual Risk Behavior and STD/HIV Acquisition Among Adolescents

Variable	Outcome	References
Perceived risk infection	Higher, less risk behavior	(Ben-Zur, 2003; Boone & Lefkowitz, 2004; Boyer et al., 2000; Reitman et al., 1996; Sieving et al., 1997; Zimet et al., 1992)
Self-efficacy	Higher, less risk behavior, lower STD rate	(Boone & Lefkowitz, 2004; Catania, Coates, Greenblatt, & Dolcini, 1989; Crosby et al., 2001b; Crosby et al., 2002a; Crosby et al., 2003b; DiClemente et al., 2001b; Gebhardt, Kuyper, & Greunsven, 2003; Jemmott, Jemmott, Spears, Hewitt, & Cruz-Collins, 1992b; Kalichman et al., 2002; Reitman et al., 1996; Rosenthal, Moore, & Flynn, 1991; Salazar et al., 2004; Sieving et al., 1997; Sionean et al., 2002; Walter et al., 1992; Weisman, Nathanson, & Ensminger, 1989)
Impulsivity	Higher, more risk behavior, greater STD rate	(Breakwell, 1996; Brown, DiClemente, & Park, 1992; Donohew et al., 2000; Kahn, Kaplowitz, Goodman, & Emans, 2002; Malow, Devieux, Jennings, Lucenko, & Kalichman, 2001; Pack, Crosby, & St. Lawrence, 2001)
Sensation-Seeking	Higher, more risk behavior	(Brown et al., 1992; Donohew et al., 2000; Kahn et al., 2002; Kowaleski-Jones & Mott, 1998; Stanton, Li, Cottrell, & Kaljee, 2001)
Self-esteem	Lower, more risk behavior, (+) STD diagnosis	(Gardner, Frank, & Amankwaa, 1998; Kowaleski-Jones & Mott, 1998; Spencer, Zimet, Aalsma, & Orr, 2002; Taylor-Seehafer & Rew, 2000)
Self-concept	Positive, less risk behavior	(Breakwell & Millward, 1997; Salazar et al., 2004)
Depression	Higher, more risk behavior, (+) STD diagnosis	(DiClemente et al., 2005; Salazar et al., 2006; Shrier, Harris, & Beardslee, 2002; Shrier, Harris, Sternberg, & Beardslee, 2001; Whitbeck, Yoder, Hoyt, & Conger, 1999)
Personal control	Greater, less risk behavior	(Hernandez & DiClemente, 1992; Millstein & Moscicki, 1995)
Condom attitudes	Negative, more risk behavior	(Catania et al., 1989; Fisher, Fisher, & Rye, 1995; Hingson, Strunin, Berlin, & Heeren, 1990; Jemmott, Jemmott, & Hacker, 1992a; Jemmott et al., 1992b; Kalichman et al., 2002; Norris & Ford, 1994a; Pack et al., 2001; Robertson & Levin, 1999; Sieving et al., 1997; Weisman, Nathanson, & Ensminger, 1989)
Condom use expectancies	Positive, less risk behavior	(Carvajal, Garner, & Evans, 1998; Hingson et al., 1990; Murphy, Rotheram-Borus, & Reid, 1998; Norris & Ford, 1994b; Sieving et al., 1997)
Length of relationship	Longer, more risk behavior	(Crosby et al., 2000; Fortenberry, Tu, Harezlak, Katz, & Orr, 2002; Plichta, Weisman, Nathanson, Ensminger, & Robinson, 1992)
Age of Partner	Older, more risk behavior, higher STD rate	(Begley et al., 2003; Boyer et al., 2000; Boyer, Tschann, & Shafer, 1999b; DiClemente et al., 2002c; Miller, Clark, & Moore, 1997)
Partner communication	More frequent, less risk behavior	(Catania et al., 1989; Crosby et al., 2002a; DiClemente et al., 2001a; Lindberg, Ku, & Sonenstein, 1998; Maxwell, Bastani, & Warda, 1999; Salazar et al., 2004; Sieving et al., 1997; Weisman, Plichta, Nathanson, Ensminger, & Robinson, 1991; Whitaker, Miller, May, & Levin, 1999; Wilson, Kastrinakis, D'Angelo, & Getson, 1994)
Dating violence	Victim, more risk behavior, higher STD rate	(Howard & Qi Wang, 2003; Howard & Wang, 2003a, b; Silverman, Raj, Mucci, & Hathaway, 2001; Valois, Oeltmann, Waller, & Hussey, 1999; Wingood, DiClemente, McCree, Harrington, & Davies, 2001b)
Family support	Greater, less risk behavior, lower STD rate	(Crosby et al., 2001a; Crosby, DiClemente, Wingood, & Harrington, 2002b; Crosby, Wingood, DiClemente, & Rose, 2002c; DiClemente et al., 2001c; Fisher & Feldman, 1998; Henrich, Brookmeyer, Shrier, & Shahar, 2006; Jaccard, Dittus, & Gordon, 1996; Moore & Chase-Lansdale, 2001; Resnick et al., 1997; Small & Luster, 1994; Voisin, 2002; Voisin, DiClemente, Salazar, Crosby, & Yarber, 2006)
Family structure	Single parent, more risk behavior	(Blum et al., 2000; Crosby et al., 2001a; Moore & Chase-Lansdale, 2001; Ramirez-Valles, Zimmerman, & Newcomb, 1998; Thomas, Reifman, Barnes, & Farrell, 2000)
Parental monitoring	Greater, less risk behavior, lower STD rate	(Crosby et al., 2003a; DiClemente et al., 2001c; Doljanac & Zimmerman, 1998; Li, Stanton, & Feigelman, 2000; McNeely et al., 2002; Rodgers, 1999; Romer et al., 1999; Voisin et al., 2006; Williams et al., 2002)
Parental attitudes	Positive, less risk behavior, lower STD rate	(Dittus, Jaccard, & Gordon, 1999; Jaccard et al., 1996; McNeely et al., 2002)
Parental communication	Greater, less risk behavior	(Crosby et al., 2002c; DiClemente et al., 2001a; Dilorio, Kelley, & Hockenberry-Eaton, 1999; Dittus et al., 1999; Dutra, Miller, & Forehand, 1999; Holtzman & Rubinson, 1995; Jaccard et al., 1996; Miller, Forehand, & Kotchick, 2000; Miller, Levin, Whitaker, & Xu, 1998; Romer et al., 1999; Whitaker & Miller, 2000; Whitaker et al., 1999; Williams et al., 2002)

(continued)

**Table I.** Continued

Variable	Outcome	References
Peer norms	Supportive, less risk behavior	(Bachanas et al., 2002; Boyer et al., 2000; Boyer et al., 1999b; Crosby et al., 2000; DiClemente, 1991; DiClemente et al., 1996; Doljanac & Zimmerman, 1998; Millstein & Moscicki, 1995; Shafer et al., 1991; Voisin et al., 2006; Walter et al., 1992; Whitaker & Miller, 2000)
Perceived barriers	Greater, more risk behavior	(Basen-Engquist & Parcel, 1992; Crosby, Salazar, & DiClemente, 2004; Crosby et al., 2000; Sieving et al., 1997)
Social support	Greater, less risk behavior, lower STD rate	(Henrich et al., 2006; St Lawrence, Brasfield, Jefferson, Alleyne, & Shirley, 1994)
Social capital	Greater, less risk behavior	(Crosby, Holtgrave, DiClemente, Wingood, & Gayle, 2003c)
School connectedness	Greater, less risk behavior	(Resnick et al., 1997; Voisin et al., 2005, 2006)
Condom availability	Greater, less risk behavior	(Furstenberg, Geitz, Teitler, & Weiss, 1997; Guttmacher et al., 1997)
Gang involvement	Greater, more risk behavior, higher STD rate	(Bjerregard & Smith, 1993; Koniak-Griffin, Nyamathi, Vasquez, & Russo, 1994; Ohene, Ireland, & Blum, 2005; Voisin et al., 2004; Wingood et al., 2002)
Community STD rates	Greater, higher STD rates	(Bunnell et al., 1999; Ellen, Aral, & Madger, 1998; Jennings, Glass, Parham, Adler, & Ellen, 2004; Jennings & Ellen, 2003)
Community violence	Exposure, more risk behavior	(Voisin, 2003, 2005)
Media	Exposure to sexual content, more risk behavior, higher STD rates	(L'Engle, Brown, & Kenneavy, 2006; Pardun, L'Engle, & Brown, 2005; Wingood et al., 2003; Wingood et al., 2001a)
Race	Minority, more risk behavior, higher STD rates	(Blum et al., 2000; Boyer et al., 2000; Boyer et al., 1999a; Joesoef, Kahn, & Weinstock, 2006; Ku, Sonenstein, & Pleck, 1993; Mott, Fondell, Hu, Kowaleski-Jones, & Menaghan, 1996; Vanderschmidt, Lang, Knight-Williams, & Vanderschmidt, 1993)
Gender	Female, higher STD rates	(Boyer et al., 2000; Fullilove, Fullilove, Bowser, & Gross, 1990; Joesoef et al., 2006; Katz, Fortenberry, Tu, Harezlak, & Orr, 2001; Orr, Johnston, Brizendine, Katz, & Fortenberry, 2001)
Poverty	Greater, more risk behavior, higher STD rates	(Aral, 2001; Sionean et al., 2001; Sionean & Zimmerman, 1999)

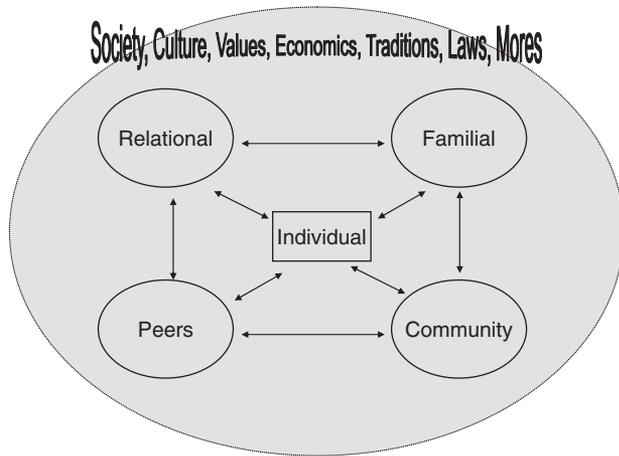
Although there is ample evidence to support the efficacy of individual-level approaches; there is also substantial evidence indicating that intervention effects tend to diminish over time. Thus, while efficacious in promoting the adoption of STD/HIV-preventive behaviors in the near-term, individual-level interventions appear to be insufficient in sustaining newly adopted preventive behavior changes over protracted periods of time. In fact, a recent meta-analysis of randomized HIV prevention trials indicated that the effects of interventions diminish substantially, often back to baseline levels as a direct function of time from intervention-to-follow-up (Pedlow & Carey, 2004). Unfortunately, for behavior change to be meaningful, it must be enduring. Thus, as individual-level interventions lack sufficient impact to sustain behavioral change, there is a critical need to modify the current STD/HIV prevention paradigm for adolescents.

### The Importance of an Ecological Approach

The development of an intervention approach that promotes consistent, sustained behavior change

represents an important challenge to STD/HIV prevention science (DiClemente, Wingood, & Crosby, 2003). Researchers and practitioners have recognized the importance of a perspective that expands investigational and intervention effort beyond the individual-level. A diverse array of factors exists that represent a web of causality influencing adolescents' risk taking. Thus, we cannot hope to optimize changes in adolescents' sexual behavior without addressing both the proximal and distal environmental influences that influence adolescents' decision-making process and, in turn, their likelihood of engaging in risky sexual behavior (Maton, 2000).

Emerging evidence suggests that certain environmental factors may also have an equal if not greater effect than individual-level factors on adolescents' sexual risk behaviors and ultimately on the prevention of STD and HIV transmission (Rotheram-Borus, 2000). Referring back to Table I, if we expand our perspective beyond the top half of the table, then perhaps we can envision how these discrete individual, interpersonal, social, and economic influences are embedded within a cultural context superimposed over traditions, values, and patterns



**Figure 1** Multiple influences underlying adolescent sexual-risk behavior.

of social organization. Figure 1 illustrates the individual embedded within the proximal context of an environment defined by peers, community, family, and sexual and dating relationships. Further, the figure illustrates that these proximal influences are embedded within the distal influences of society such as economics, tradition, norms, laws, and mores. In essence, the distal elements influence the proximal elements, which mutually influence each other as well as the adolescent; thereby making the adolescent the victim or the benefactor of these larger influences. Not surprising, few studies have attempted to understand wholly the complexity of these interactions let alone conceptualize interventions to modify them. What is needed is a complementary approach that addresses these multiple spheres of influence as well as the interaction among spheres.

As a useful and familiar heuristic framework for understanding these proximal and distal influences, Bronfenbrenner (1979) defined this social ecology of human development as involving the study of mutual transactions between human beings, and the properties of the environmental systems in which they interact. The goodness-of-fit between the person and the environment influences whether outcomes are successful or strained. He identified four system levels: (a) the *Microsystem*—the roles and characteristics of the developing individual, (b) the *Mesosystem*—the settings with which the developing person interacts, (c) the *Exosystem*—settings with which the individual does not interact but nevertheless have an effect on the persons' development, and the (d) the *Macrosystem*—cultural values and larger societal factors that influence the individual. Because adolescents interact simultaneously in several social spheres

such as—family, peer, neighborhood systems—that can either serve to restrain and/or promote individual behaviors.

Applying an ecological approach to adolescent sexual risk behavior would entail first examining their sexual behaviors within the context of their social and physical environments, and then designing concurrent interventions aimed at multiple relevant, modifiable levels. The use of an ecological approach may provide a more efficacious strategy for influencing numerous leverage points of long-term behavior change and address the issue of the limited sustainability of intervention effects observed in STD/HIV prevention science.

Indeed, it is quite noteworthy that applying an ecological approach to adolescents' sexual risk behavior is quite consistent with the growing tendency of health promotion programs (of all types and for people of all ages) to be based on expansive theoretical models that greatly exceed constructs that comprise the individual-level (DiClemente, Crosby, & Kegler, 2002a).

## Intervention Approaches that Transcend Multiple Levels

### *Mesosystem Approaches*

By definition, engaging in sexual risk and protective behaviors involve two people. Adolescents' sexual relationships, therefore, represent one aspect of the *Mesosystem*. In referring to Table I, we understand that relationship dynamics between adolescents and their sex partners may be an important point for intervention. Activities designed to enhance the quality and frequency of communication between partners, help adolescents select partners similar in age, teach condom negotiation skills as well as sexual refusal skills, and reduce dating violence and date rape perpetration may be effective in achieving behavioral change. Although some of these factors have been addressed previously with activities in small-group interventions, these efforts have traditionally focused entirely on one of the partners rather than the dyad. A dyadic intervention would address these salient relational influences associated with STD/HIV risk and protective behaviors, while also transferring the burden to initiate STD-protective behaviors from one person to the dyad. This is particularly important for adolescent females who are in power imbalanced relationships with their male partners (Begley, Crosby, DiClemente, Wingood, & Rose, 2003; DiClemente, Crosby, & Wingood, 2002b; Gollub, 1995; Wingood et al., 2002). Additionally, this type of intervention holds great promise for enhancing not only the adoption of STD-preventive behaviors by the dyad, but also, in the event of

dissolution, not unexpected among adolescents, there may be a generalization of recently adopted STD-preventive behaviors to new relationships. Unfortunately, a review of the literature indicated only one dyadic STD/HIV preventive intervention, which was designed for inner-city Latino teen parenting couples. Its efficacy has not been reported as of yet (Lesser et al., 2005).

Another aspect of adolescents' Mesosystem and one related to their engaging in STD/HIV risk and protective behaviors is the family. Table I suggests that familial factors are critical in keeping adolescents safe. Particularly important is parental monitoring. Emerging evidence suggests that adolescents who perceive that their parents or parent figure know where they are and who they are with outside of school or work are substantially less likely to engage in sexual risk behaviors or to have an STD (Crosby et al., 2003a; DiClemente et al., 2001c; Doljanac & Zimmerman, 1998; Li et al., 2000; McNeely et al., 2002; Rodgers, 1999; Romer et al., 1999; Voisin et al., 2006; Williams et al., 2002). Furthermore, parents' influence can also buffer adolescents' against the influence of peer norms that encourage risky sexual behaviors—one example of the interaction of multiple influences (Fisher & Feldman, 1998). Acknowledging the importance of family-level interventions, the National Institute of Mental Health has established a consortium of family grants specifically designed to enhance parent-adolescent interactions surrounding STD/HIV prevention (Pequegnat et al., 2001).

Family-level interventions typically promote increased communication between adolescents and parents about STD/HIV prevention (Stanton et al., 2001). These interventions may also attempt to increase parental monitoring of adolescents and adolescents' perceptions of enhanced parental monitoring, as well as foster a sense of increased family support. Although promising in that family-level interventions go beyond the individual-level only, the preliminary evidence suggests that intervention effectiveness has been modest (DiIorio, Resnicow, Denzmore, & et al., 2000; Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999; Jemmott et al., 2000; Stanton et al., 2000).

Moving beyond the relationship and the family levels, most adolescents also interact greatly with their schools and community through myriad social activities, programs, sports, or exposure to other institutions such as their church. Not surprising, research has identified several community-level influences on adolescents' risk and protective behaviors (Table I). One important

community-level influence is adolescents' perception of social norms.

Social norms theory (Perkins & Berkowitz, 1986) posits that behavior is influenced by the pervasive and underlying social norms surrounding a behavior. Moreover, the influence exerted by social norms is based on people's perception of those norms and perceptions may not accurately reflect actual norms. The influence of perceived peer norms on behavior is also emphasized by the theory of reasoned action (Fishbein, 2000). Peer norms surrounding sexual behaviors and condom use have been shown to be robust influences on both risky and protective sexual behavior. When adolescents perceive that friends and similar-aged teens engage in risky sexual behavior, even if their perception is skewed, then they are more likely to adopt those same behaviors. In contrast, perceiving that your friends and other teens abstain from sex or practice safer sex would influence you to adopt those protective behaviors. Furthermore, if adolescents feel a strong sense of connection to their schools, live in communities with a high degree of social capital, and have access to condoms, then they will be more likely to engage in protective behaviors (Kirby, 2001).

Programs targeting these significant community-level influences represent an important strategy for STD/HIV prevention. Such programs would strive to evoke significant changes within the community sphere. One example of a community-level approach is the Prevention Marketing Initiative (PMI) (Kennedy, Mizuno, Hoffman, Baume, & Strand, 2000). PMI targeted adolescents less than 20 years of age. The goals of the intervention were to increase adolescents' awareness of STDs, enhance condom use and abstinence, promote parent-adolescent discussions, provide information about STD-related prevention services, and change adolescents' perceptions of norms supportive of STD-preventive behaviors. Using a comprehensive approach, intervention activities crossed multiple levels, affecting individual-level factors, familial factors, and social norms. Evaluation of programmatic impact, conducted in five sites, observed marked increases in STD-preventive behavior (Kennedy et al., 2000).

Another community-level approach is clinic-based screening programs. These programs target adolescents' Mesosystem. Recent studies observed that offering repeated STD screening and treatment in clinical settings effectively reduced adolescents' Gonorrhea and Chlamydia incidence rates (Burstein et al., 1998; Cohen, Nsuami, Martin, & Farley, 1999); however,

screening programs to be maximally effective need to access a substantial portion of the target population.

In addition to screening programs, other, less intensive strategies, such as setting aside specific clinic hours for adolescents may enhance accessibility to health care, and thereby have an effect on adolescents' sexual behavior and sexual health (Akinbami, Gandhi, & Cheng, 2003; Hock-Long, Herceg-Baron, Cassidy, & Whittaker, 2003; Jaccard, 1996). If clinics are not accessible during hours when adolescents are free to visit them, then a barrier is created that reduces the likelihood that adolescents will attend them. Because the STD rates of the community impact the STD rates of the adolescent, another community-level approach that could also prove to be effective is to target not adolescents per se, but rather their sexual networks (Rothenberg, 2001). A sexual network approach is unique in that it increases case findings through "contact tracing" using developmentally appropriate techniques. For example, interviewing one adolescent who tests positive for an STD can serve as the starting point for locating, interviewing, and screening other adolescents within the same network (Rothenberg et al., 1998). This approach also provides an opportunity to promote safer sex behaviors through the education of key members of these sexual networks. Conversely, networks can also exert a positive impact on adolescents' behavior. For example, influencing key venues in adolescents' social networks, such as community and school organizations, so that they feel a greater sense of connection, feel more supported, and have ready access to needed resources such as extracurricular activities, condoms, and sexual education could also positively impact adolescents' sexual behavior.

### **Exosystem**

Because adolescents do not interact in the Exosystem, exerting influence on their STD/HIV preventive behavior would be accomplished indirectly. For example, the workplace of adolescents' parents would be one setting that holds promise for reducing adolescent risk behaviors (Schuster et al., 2001). One problem with community-based and school-based family-level interventions is recruiting parents to participate. Parents who work have multiple demands and serious time constraints placed on them making it difficult for them to participate in intervention programs offered in the community in the evening or on weekends. By placing the intervention at the workplace, this problem can be overcome and hopefully "they will come." In fact,

Eastman and colleagues (2005) examined whether or not worksite-based parenting programs to promote healthy adolescent sexual development would be attended by parents. In their focus groups with employed parents of adolescents they found both parents and employers were supportive of the content that would provide desired education and skills for effectively communicating with and understanding their adolescents.

Although theoretically feasible and practically viable, unfortunately, there is a paucity of worksite-based parenting programs in the literature. One study described the implementation of a 1 hr seminar in the workplace ("Project F.A.C.T.S.") that trained parents to communicate effectively with their adolescents about sexuality. The evaluation results showed that following the seminar, more parents reported that they felt they were the primary sexuality educator of their children; more parents indicated that they talked with their children about sex; more parents felt sex discussions should take place openly and more parents discussed sex education of their children with another parent (Caron et al., 1993). Another study described a workplace educational parenting program that although not designed to address adolescent sexual risk, it did focus on adolescent substance abuse through two 1 hr sessions held at lunchtime over the course of 12 weeks. The results showed that overall, there were relatively high attendance rates (74%) and low drop-out rates (16%). Parents who were in the high dosage group (i.e., >80% attendance level), reported significant decreases in child behavior problems, more positive child behavior, less parental punitiveness, less parental irritability, higher levels of knowledge pertaining to child development, less stress and depression, less work-family conflicts, higher levels of substance abuse knowledge, and less tolerant attitudes toward a friend's substance use and toward substance abuse in general (Felner et al., 1994).

In addition to educational programs implemented at the workplace, changes to workplace policies may also have a significant effect on adolescents' STD/HIV behaviors. Policies that enable parents to incorporate more flextime or to telecommute hold the potential to increase the ability of parents to monitor their adolescents better, to have more time to engage in family activities, and to communicate with their adolescents more often. Indeed, it may be that societal-level practices such as flexibility in the workplace and generally improved living conditions could become precursors of parents' increased vigilance regarding their adolescents' health and well-being. To this end, community programs that

promote the mental health of adults may indirectly benefit adolescents and therefore may help reduce their sexual risk behaviors. Evidence presented in Table 1 suggests that by enhancing the frequency of communication between parents and their adolescents and also increasing parental monitoring would be associated with less risky behavior and reduced rates of STDs.

### **Macrosystem**

The most distal influence of adolescents' STD/HIV-related behaviors is the society in which all of the other influences are embedded. By society, we mean cultural norms and traditions, large-scale policies and laws, economic conditions, and the political climate. One specific pervasive Macrosystem characteristic that plays a distinct role in shaping cultural norms and traditions and also, through agenda-setting, and can influence policy and law is the media (Thornburgh & Lin, 2002). Whether it is the Internet, movies, television, music videos, or books, research has increasingly demonstrated that media play a significant role in socialization including the socialization of adolescents and therefore impacts their sexual risk and protective behavior. For example, studies have found that greater exposure to rap music videos and X-rated movies were associated with having multiple sex partners, more frequent sexual intercourse, and testing positive for an STD (Wingood et al., 2001a, 2003). Because of this influence, the media also represent a promising vehicle for the delivery of persuasive health-promoting messages. Mass media campaigns targeting adolescents have been popular in the Netherlands and in Switzerland. Evaluation of a nationwide mass media campaign implemented in Norway indicated that the campaign was effective in changing attitudes and practices relevant to safer sex behaviors (Traeen, 1992). In addition, trend analyses of ongoing evaluations of media-based interventions in Switzerland have observed marked reductions in sexual risk behaviors (Hausser & Michaud, 1994).

It is important to note, however, that media campaigns that target a specific subgroup of the population such as adolescents differs significantly from a media campaign that targets the general population. In other words, if the Macrosystem represents culture, which comprises the general "majority" culture and the varying subcultures of specific age, gender, race, and ethnic groups, then we must consider whether targeting the general populations' cultural norms through a media campaign will be the optimal strategy for influencing the cultural norms of specific subgroups; although it may

result in more widespread societal change. We must consider which Macrosystem approach will be more effective. Moreover, achieving social change through Macrosystem approaches may not be evident in the short-term. Indeed, although effecting social change may result in sustaining behavior change in the long-term, because of modifying the larger culture in which the subgroups exist, other factors may necessitate targeting subgroups so that shorter-term gains can be achieved.

Societal-level changes can also be made by initiating changes to policy. Policies that promote increased accessibility to and acceptability of STD/HIV prevention and control services for adolescents can have a profound effect on their sexual health. For example, managed care organizations that provide time and incentives for clinicians to screen, counsel and educate adolescents at-risk for or diagnosed with STDs could have a tremendous impact on the reproductive rate of the STD epidemic (DiClemente & Brown, 1994; Kamb et al., 1998). Health care policy should also insure that adolescents receive services for STD prevention, testing, and treatment despite income disparities. These types of policies should exempt adolescents from obtaining parental consent for treatment.

### **Applied Investigational Research Example**

In a study of detained female adolescents, Voisin et al. (2006) used an ecological approach to investigate the micro-, meso-, and macro-antecedents to sexual risk behavior. Sexual risk behavior was measured as an index covering six different risk behaviors: sex without a condom, sex while high on alcohol or drugs, sex with a partner who was high on alcohol or drugs, sex with two or more people at the same time, traded sex for drugs, and traded sex for money. Total scores for each participant ranged from 0 to 6. The ecological variables, which were included in their contextual analysis and their subsequent contribution in the regression equation, are shown in Table II (Voisin et al., 2006). Although together these variables accounted for 51% of the variance in the index of sexual risk behavior, we can see that one of the largest contributors was substance use—a Microsystem variable. Yet, even accounting for the Microsystem variables, several of the Mesosystem variables and one of the Macrosystem variables made a significant contribution. Had the authors not used an ecological approach and focused entirely on the Microsystem, which has been the predominant investigational paradigm, they would have missed the relative importance of Mesosystem and

**Table II.** Ecological Factors Associated with STD Risk Behaviors Among Detained Female Adolescents

Independent variable	Beta
Microsystem	
Risk-taking attitudes	.15*
Mood/Behavioral disorders	.09
Substance use	.29***
Mesosystem	
Parental monitoring	-.21**
Familial support	-.17**
Risky peer norms	.17*
School/Teacher connectedness	-.12*
Macrosystem	
Gender roles/Male dominance	.14*
Community violence	.05
Media influences	.03

\*\*\* $p < .001$ , \*\*  $p < .01$ , \* $p < .05$ .

Macrosystem variables in explaining adolescents' sexual risk behavior. These results have important implications for future research. Essentially, future studies may benefit from including higher ecological variables system variables in their assessments and implementing more sophisticated contextual analyses. For example, statistical techniques that go beyond traditional linear or logistic regression analyses such as generalized estimating equation or hierarchical linear modeling may be more appropriate for multilevel data. Further, the analysis presented in the Voisin et al. (2006) did not include mediation or moderation analyses. Conceptualizing more complex and ecological models coupled with more sophisticated statistical techniques will lead to more precision in identifying significant antecedents, which will in turn lead to improved and targeted preventive interventions.

### Applied Ecological Intervention Example

Perhaps one of the most poignant examples of an effective ecological approach to HIV prevention occurred in Brazil. Indeed, the Brazilian response to the AIDS pandemic has been described as both comprehensive and progressive (Berkman, Garcia, Munoz-Laboy, Paiva, & Parker, 2005). At the heart of the approach was a community grassroots movement designed to destigmatize AIDS and demand change and support from law makers. In other words, change came from the bottom up. Brazilians mobilized and were able to achieve significant social changes through advocacy, the organization of political parties, trade unions,

and nongovernmental organizations in collaboration with the government. In fact, the government implemented one of the "most explicit of any governmental information campaign in the world" (p. 1168). Longstanding and entrenched cultural values related to sexual behaviors (e.g., premarital sex is morally wrong) began to erode and values supporting open and honest discussion emerged especially regarding the stigma surrounding HIV and AIDS. Indeed, condom sales and distribution rose dramatically in the general population and especially among young people. Subsequently, sexual risk reduction education programs became more acceptable and were implemented across diverse venues and among diverse populations such as with sex workers and young people. In addition, HIV testing became more socially acceptable and treatment for AIDS was viewed as a basic human right. More important were the effects observed in the incidence rates for HIV—they were much lower than projected and mortality rates decreased by 50% (Berkman et al., 2005).

This example is unique. Brazil is one of the few countries that experienced a decline in incidence HIV infection and in mortality as a result of social change efforts at the Macrosystem level. This approach while effective was different from traditional interventions that have been discussed or published in that the change resulted from unified efforts stemming from a concerned and disenfranchised citizenry. Thus, this effort may not be easily replicated in other communities or countries; however, we can learn from the Brazilian experience by focusing on certain aspects that could be replicated elsewhere such as the media campaign messages, the implementation of sexual risk reduction programs for many subgroups, and the promotion of HIV testing and treatment.

### Future Research

Although the ecological framework described in this article is intuitively appealing, currently, there is a dearth of empirical data that supports whether intervening across multiple ecological levels is effective in sustaining behavioral change over time relative to adolescents' sexual risk behavior. These interventions may draw upon two or more of the ecological levels outlined in this article. For example, testing a small group educational sexual risk reduction program (i.e., Microsystem) in conjunction with a media campaign (i.e., Macrosystem) vs either intervention in isolation would constitute a test of whether crossing multiple levels works to sustain

behavioral changes. Thus, future research that incorporates designs to test single level interventions against multilevel interventions is warranted. Moreover, future research could investigate the utility of applying ecological frameworks to a broad range of pediatric issues such as enhancing adjustment to cancer, preventing obesity, promoting exercise, and adhering to medication regimes for asthma or diabetes. Finally, future research should also investigate developmental differences among the various stages that constitute adolescence. Different combinations of the four ecological levels may be more or less effective as a function of the developmental trajectory.

The central premise of the proposed ecological approach is that none of its levels should function in isolation from the others. Indeed, we suggest that designing effective STD/HIV prevention and control programs can best be achieved by taking full advantage of the “synergy” among the levels that constitute the ecological model. This synergy can amplify and complement isolated intervention approaches, thereby optimizing and sustaining favorable effects. Although this approach requires intensified efforts and resources, its returns warrant implementation.

Although expanding investigational and preventive efforts beyond one level may seem daunting, the possibilities are not endless. When thinking about the number of combinations to focus on when conceptualizing research designs there are approximately 60 potential combinations of factors chosen two at a time from each of five levels of influence. This observation accentuates the point that intervention efforts can and should be creatively tailored to meet the unique needs of adolescents within various environments that influence their sexual-risk and protective behaviors.

In essence, a need exists to link STD/HIV-prevention resources into an efficient network. This network, for example, would consist of key members from families, the community, schools, health providers, local government agencies, and nongovernmental agencies or community-based organizations. For example, multiple access points (i.e., recreation centers, after-school programs, and physicians’ offices) could be used as opportunity sites for providing STD/HIV-prevention information and motivating adolescents to adopt relevant health-promotion skills. A key related question is how to go about this in a cost-effective way, while determining what programs work best for various subgroups of adolescents.

Finally, it is important to note that an ecological approach is proactive. To create “synergy,” this approach

necessitates complementing the traditional medical model of STD/HIV prevention with theory-guided practice grounded in the developmental context of adolescents’ lives. From this perspective, adolescents’ STD/HIV risk behavior should not be conceptualized as “individual deficits,” but rather more appropriately and favorably viewed as a reflection of their relational, familial, community, and societal environments. Viewed in this manner, it is important to note that the ecological approach could easily be applied to a multitude of other health-related issues that are relevant to adolescents (e.g., pregnancy prevention, the prevention of substance abuse, and avoiding unintentional injury).

### **Role of Pediatric Psychologists in STD Prevention**

Pediatric psychologists have an integral role to play in preventing adolescents’ STD risk behavior. At each level of the ecological framework, pediatric psychologists can be actively involved in the design, implementation, or evaluation of STD prevention programs. At the Microsystem level, pediatric psychologists, working in clinical venues or community health centers, can provide screening direct risk-reduction or psychological counseling, and, if needed, can provide a referral for more detailed psychological evaluation and specialized counseling for adolescents identified with psychological antecedents (i.e., depression, impulsivity, sensation seeking, and substance use) associated with STD acquisition. At the Mesosystem level, pediatric psychologists can work closely with institutions, such as families, to develop programs to enhance parents’ ability to supervise their adolescents’ behavior or enhance parent–adolescent communication. Both of these factors have been empirically demonstrated to reduce STD-associated risk behaviors and STD acquisition. Depending on their service agency, pediatric psychologists may recommend periodic parental counseling and longterm follow-up with parents and/or families to monitor the familial relationship and its impact on adolescents’ STD-associated risk behaviors. In addition, some pediatric psychologists may be affiliated with school systems. In their role as a consultant or staff of a school system, they can assist in the design or implementation of school-based STD prevention programs. These programs would be implemented in schools by teachers, nurses, psychologists, or counselors who have undergone in-service training by pediatric psychologists. At the Macrosystem level, pediatric psychologists can work with broader societal agencies,

as consultants to media, for example, in addressing gender bias and reducing power inequities in heterosexual relationships that can facilitate the adoption of STD-associated risk behaviors among young women. The array of opportunities for pediatric psychologists to intervene across the ecological levels is broad. However, adequate systems for financing and provider reimbursement are essential to facilitate provision of these preventive services.

## Conclusion

This review proposes an ecological framework for understanding the myriad of influences that affect adolescents' risk for acquiring and STD. As a consequence, developing intervention strategies across the levels of the ecological framework may, ultimately, provide the preventive synergy that yields more effective and sustainable STD prevention interventions.

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