

Moving Upstream: Ecosocial and Psychosocial Correlates of Sexually Transmitted Infections Among Young Adults in the United States

Anne L. Buffardi, MSW, Kathy K. Thomas, MS, King K. Holmes, MD, PhD, and Lisa E. Manhart, PhD, MPH

Nearly half of the 19 million new cases of sexually transmitted infections (STIs) reported each year occur among adolescents and young adults aged 15 to 24 years,¹ highlighting the urgent need for effective interventions in this population. However, prevention programs for youths have yielded mixed results. Although many behavioral interventions have increased self-reported condom use,^{2–5} most have failed to delay sexual debut or to increase use of other contraceptive methods.⁶ Only some have reduced laboratory-diagnosed STI,^{2,3,5,7} and decreases in self-reported sexual risk behavior have not been consistently sustained over time.^{8,9} These disappointing findings suggest that antecedent factors not susceptible to interventions that focus on proximal sexual behaviors may be driving individual risk behaviors and disease acquisition among particular subpopulations.

Numerous scholars have described the role of overlapping, macro level social, political, economic, legal, and environmental forces that intertwine with individual biomedical and behavioral risk factors to maintain adverse health conditions within a population.^{10–19} This is captured in the concept of syndemics^{18,19}—“the synergistic interaction of two or more coexistent diseases and resultant excess burden of disease”^{18(p423)}—and in ecosocial theory, which posits that disease is a result of interactions between biological organisms and their social environment.^{12,14} Figure 1 presents a conceptual model of this framework for STI, describing hypothesized relationships between ecosocial conditions in the external environment and individual psychosocial factors, which contextualize sexual risk behaviors and subsequent infection with sexually transmitted pathogens. In one of the few studies that has empirically examined these relationships, Stall et al.²⁰ reported a linear increase in self-reported HIV prevalence and unprotected anal sex among

Objectives. We determined the associations of ecosocial factors and psychosocial factors with having a prevalent sexually transmitted infection (STI), recent STI diagnoses, and sexual risk behaviors.

Methods. Young adults aged 18 to 27 years in the National Longitudinal Study of Adolescent Health (n = 14 322) provided ecosocial, psychosocial, behavioral, and STI-history data. Urine was tested for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* by ligase chain reaction and for *Trichomonas vaginalis*, human papillomavirus, and *Mycoplasma genitalium* by polymerase chain reaction.

Results. Prevalent STI was associated with housing insecurity (adjusted odds ratio [AOR] = 1.3; 95% confidence interval [CI] = 1.00, 1.72), exposure to crime (AOR = 1.4; 95% CI = 1.02, 1.80), and having been arrested (AOR = 1.4; 95% CI = 1.07, 1.84). STI prevalence increased linearly from 4.9% for 0 factors to 14.6% for 4 or more ($P < .001$, for trend). Nearly all contextual conditions predicted more lifetime partners and earlier sexual debut. Recent STI diagnosis was associated with childhood sexual abuse, gang participation, frequent alcohol use, and depression, adjusted for sexual risk behaviors.

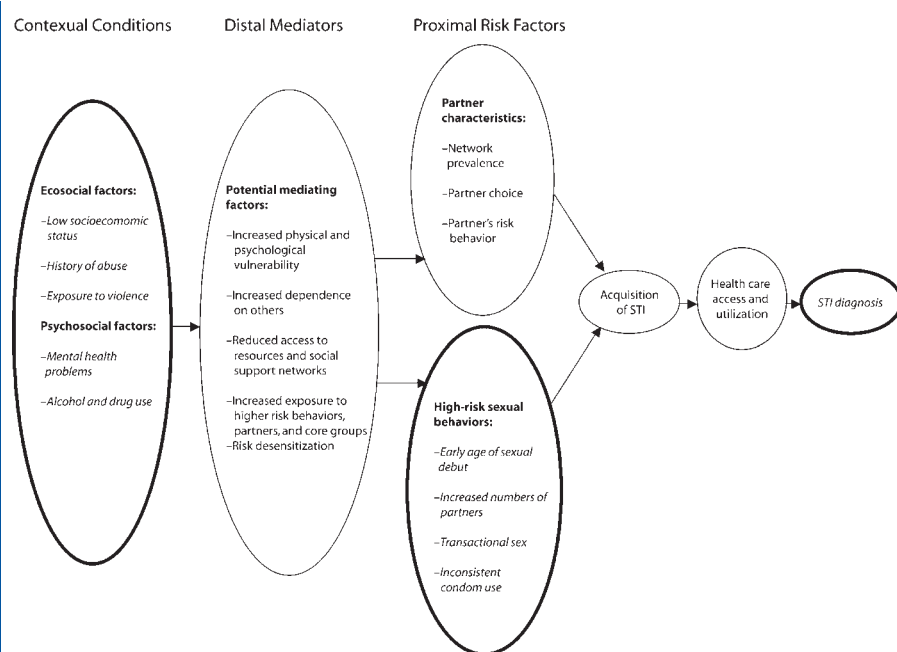
Conclusions. Often present before sexual debut, contextual conditions enhance STI risk by increasing sexual risk behaviors and likelihood of exposure to infection. These findings suggest that upstream conditions such as housing and safety contribute to the burden of STIs and are appropriate targets for future intervention. (*Am J Public Health.* 2008;98:1128–1136. doi:10.2105/AJPH.2007.120451)

men who have sex with men as the number of co-occurring health problems (polydrug use, depression, childhood sexual abuse, and intimate partner violence) accumulated. Our analysis builds on their work by incorporating a laboratory-diagnosed end point for STI and supplementary ecosocial variables.

Although numerous other studies have examined isolated contextual conditions in relation to behavioral or STI outcomes, to our knowledge none has evaluated a comprehensive set of ecosocial and psychosocial components together using objective STI outcomes. Among adolescents,^{21–23} socioeconomic status has been associated with self-reported STI. In previous studies, homeless adults had higher HIV rates compared with those in stable housing.^{24,25} Detained youths, young men who have sex with men, and HIV-positive adults who had or were currently experiencing housing insecurity more often reported unprotected sexual intercourse with multiple partners²⁶ and

transactional sexual intercourse.^{27,28} History of abuse has been associated with laboratory-diagnosed STIs in nonhomeless clinic attendees^{29,30} and homeless adolescents,³¹ and a history of child abuse, including forced sex,^{32–36} and intimate partner violence^{37,38} have been correlated with self-reported STI. Sexual risk behaviors, including early sexual debut, higher lifetime number of partners, and unprotected sexual intercourse have also been associated with child abuse^{30,31,34,36,39–43} and partner violence.^{41,44–46} Adolescents exposed to community violence were more likely to report partner concurrency (i.e., having multiple sexual relationships at the same time) and unprotected sexual intercourse⁴³ than were adolescents with no such exposure.

STI and HIV rates among prisoners are disproportionately high,^{47–49} and youths who had been detained more than once reported more sexual risk behaviors than did undetained youths.⁵⁰ History of incarceration has



Note. Variables measured in our analysis are noted in italics in circles formed by thick lines.

FIGURE 1—Conceptual model of potential pathways to the acquisition and diagnosis of sexually transmitted infections (STIs).

been associated with gonorrhea,^{51,52} HIV infection,⁵³ and partner concurrency.⁵⁴ Gang participation in detention has been associated with laboratory-confirmed STI among adolescent girls⁵⁵ and with high-risk sexual behaviors⁵⁶ in adolescent boys.

In terms of psychosocial influences, data on depression and STI are conflicting. Depressive symptoms have been linked with HIV infection among men who have sex with men⁵⁷ and with STI among homeless youths,⁵⁸ but not among clinic patients⁵⁹ or African American adolescents girls.⁶⁰ In one study of adolescent girls, depression was associated with increased self-reports of STI,⁶¹ whereas another found that depressed young women less often reported a history of STI.⁶² Nearly all studies, however, report a positive association between depression and risky sexual behaviors.^{59,61,63,64}

The link between alcohol use and STIs is well established,⁶⁵ as is the association between drug use and STIs,^{52,66} and drug use and risky sexual behaviors.^{67–75} In analyses of the National Longitudinal Study of Adolescent Health (Add Health), depression was associated with fewer high-risk sexual behaviors

among young women who were not using drugs, but with increased frequency of such behaviors among women experimenting with substance use.⁷⁶ Despite these data on individual psychosocial and ecosocial factors, the effect of multiple contextual conditions on STI risk has not yet been evaluated.

We used data from wave III of Add Health to determine the associations of ecosocial and psychosocial contextual conditions with (1) prevalent STI, (2) self-reported diagnosis of an STI in the previous year, and (3) 4 behavioral risk factors (lifetime number of partners, age at sexual debut, receipt of payment for sex, and correct and consistent condom use). We also sought to determine whether the presence of multiple contextual conditions resulted in a compounded risk of obtaining an STI.

METHODS

Add Health Study Design

The Add Health Study explores the causes of the health-related behaviors of adolescents and their outcomes in young adulthood, focusing on social contextual

influences. Identified through stratified, school-based random sampling, approximately 90 000 US adolescents participated in a school-based survey in 1994, and an in-home sample of 20 748 respondents later completed a more detailed questionnaire; both of these samples were part of Add Health wave I. In wave III, all wave I in-home respondents who could be located received a home visit between July 2001 and April 2002. Those who agreed to participate and provided informed consent ($n = 15\,197$) completed a computer-assisted survey instrument in which extensive data on demographic, social, behavioral, and health characteristics were collected. Of those, 14 012 (92.2%) provided 15 to 20 mL of first-catch urine for STI testing. Urine samples were assayed for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* by ligase chain reaction (Abbott LCx Probe System, Abbott Park, Illinois)⁷⁷ and for *Trichomonas vaginalis* by a research-only polymerase chain reaction–enzyme-linked immunosorbent assay (ELISA).⁷⁸ A subset of 1287 young adult men and 1816 young adult women were tested for *Mycoplasma genitalium*,⁷⁹ and 3262 sexually active women were tested for human papillomavirus (HPV)⁶⁶ by research-only polymerase chain reaction assay.

Ecosocial and Psychosocial Constructs

Wave III of Add Health collected data on 13 contextual factors reflecting 3 ecosocial and 2 psychosocial themes. Ecosocial themes included socioeconomic status (low income, housing insecurity), history of abuse (childhood physical and sexual abuse, intimate partner physical and sexual abuse), and exposure to violence (biological father in jail, victim of or witness to a crime, gang participation, ever having been arrested or in custody). Psychosocial themes included alcohol and drug use and mental health (diagnosis of depression; Table 1). Data from waves I or II were not incorporated because most contextual variables were either not measured (housing insecurity, father in jail, custody, depression) or were too broadly defined (history of forced sex did not clarify whether the abuse was experienced as a child or with an intimate partner).

TABLE 1—Prevalence of Contextual Conditions and Their Univariate Associations With Prevalent Sexually Transmitted Infection (STI) and Diagnoses of STI in the Previous Year Among Adults Aged 18 to 27: Wave III, National Longitudinal Study of Adolescent Health, July 2001–April 2002

Contextual Condition	Overall Prevalence, %	Current STI ^a (n = 11 594)			STI Diagnoses in Prior Year ^b (n = 14 058)		
		Prevalence Among Those With Condition, %	Prevalence Among Those Without Condition, %	OR (95% CI)	Prevalence Among Those With Condition, %	Prevalence Among Those Without Condition, %	OR (95% CI)
Ecosocial factors							
Socioeconomic status							
Low income ^c	15.7	9.6	5.8	1.72** (1.35, 2.19)	7.7	6.0	1.29* (1.01, 1.66)
Housing insecurity ^d	17.5	8.0	6.1	1.35* (1.03, 1.76)	10.3	5.4	2.01** (1.63, 2.46)
History of abuse							
Childhood physical abuse	28.4	6.9	6.1	1.14 (0.94, 1.39)	7.8	5.6	1.41* (1.15, 1.72)
Childhood sexual abuse ^e	4.5	8.6	6.3	1.40 (0.93, 2.11)	13.6	5.8	2.54** (1.88, 3.43)
Intimate partner physical abuse ^f	12.6	8.9	6.0	1.53* (1.12, 2.09)	10.8	6.3	1.83* (1.30, 2.57)
Intimate partner sexual abuse ^g	8.1	6.5	6.4	1.01 (0.70, 1.46)	10.8	6.4	1.77* (1.27, 2.45)
Exposure to violence							
Father in jail	13.9	8.7	6.1	1.48* (1.13, 1.94)	8.7	5.8	1.57* (1.21, 2.02)
Crime victim or witness ^h	10.5	10.3	6.0	1.81** (1.45, 2.27)	7.2	6.1	1.20 (0.93, 1.56)
Gang participation	15.3	8.2	6.1	1.36* (1.10, 1.39)	9.8	5.6	1.82** (1.46, 2.27)
Ever arrested	12.1	8.1	6.2	1.33* (1.04, 1.72)	7.3	6.1	1.22 (0.92, 1.61)
Psychosocial factors							
Alcohol and drug use							
Frequent alcohol use ⁱ	10.1	5.3	6.5	0.80 (0.57, 1.13)	8.4	6.0	1.44* (1.05, 1.98)
Recent drug use ^j	7.2	6.3	6.3	0.99 (0.61, 1.63)	8.8	6.1	1.49* (1.13, 1.96)
Depression ^k	11.6	4.1	6.8	0.59* (0.40, 0.88)	11.3	5.6	2.13** (1.64, 2.76)
Total			6.4			6.3	

Note. OR = odds ratio; CI = confidence interval. Weighted logistic regression was used to examine the associations.

^aCurrent STIs comprised laboratory-diagnosed *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Trichomonas vaginalis*, or *Mycoplasma genitalium*.

^b“Recent diagnosis of STI” comprised self-reported infection with *C trachomatis*, *N gonorrhoeae*, *T vaginalis*, syphilis, genital herpes, genital warts, or human papillomavirus.

^cLow income (n = 14 091) was determined by an affirmative response to the question, “Before you turned 18, did anyone in your household ever receive public assistance or welfare payments?”

^dHousing insecurity (n = 14 281) was determined by an affirmative response to at least 1 of the following questions: “Have you ever run away from home?” “Have you ever been homeless for a week or longer?” and “Have your parents ever ordered you to move out of their house?”

^eChildhood sexual abuse (n = 13 722) was determined by response of “once or more” to the question, “How often has one of your parents or other adult caregivers touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations?”

^fIntimate partner physical abuse (n = 9775) was determined by response of “once or more” to the following question regarding most recent romantic relationship: “How often in the last past year has your partner slapped, hit, or kicked you?”

^gIntimate partner sexual abuse (n = 9774) was determined by response of “once or more” to the following question regarding most recent romantic relationship: “How often in the past year has your partner insisted on or made you have sexual relations with him or her when you didn’t want to?”

^hCrime victim or witness (n = 14 148) was determined by a single positive response to the question, “Which of the following things happened in the past 12 months: you saw someone shoot or stab another person; someone pulled a gun on you; someone pulled a knife on you; someone shot you; someone stabbed you; you were beaten up but nothing was stolen from you; you were beaten up and something was stolen from you.”

ⁱFrequent alcohol use (n = 14 064) was determined by response “3 to 5 days a week” or “every day” to the question, “In the past 12 months, on how many days did you drink alcohol?”

^jRecent drug use (n = 14 041) was determined by response “once or more” to at least 1 of the following: “In the past 30 days, how many times have you used cocaine; crystal meth; illegal drugs such as LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin or prescription medicines not prescribed for you; inject an illegal drug such as heroin or cocaine?”

^kDepression (n = 14 303) was determined by an affirmative response to the question, “Have you ever been diagnosed with depression?”

*P < .05; **P < .001.

Sexually Transmitted Infection and Behavioral Outcomes

Prevalent STI was defined as a positive result from the urine-based assays for *N gonorrhoeae*, *C trachomatis*, *T vaginalis*, or *M genitalium*. HPV was considered separately

because it was assessed only among a subset of sexually active women. Recent diagnosis of an STI was defined as a diagnosis by a health care professional of *C trachomatis*, *N gonorrhoeae*, *T vaginalis*, syphilis, genital herpes, genital HPV infection, or

genital warts in the past 12 months. Lifetime number of sexual partners and age at sexual debut were categorized, whereas receiving payment for sex and correct and consistent condom use were dichotomous (Table 2).

TABLE 2—Multivariate Models of the Independent Association of Contextual Conditions With Prevalent Sexually Transmitted Infection (STI), STI Diagnoses in the Prior Year, and Behavioral Risk Factors Among Adults Aged 18 to 27: Wave III, National Longitudinal Study of Adolescent Health, July 2001–April 2002

Contextual Condition	Prevalent STI (n = 11 594), AOR (95% CI)	STI Diagnoses in Previous Year (n = 14 058), AOR (95% CI)	Lifetime Partners ^a (n = 13 982), AOR (95% CI)	Age at Sexual Debut ^b (n = 14 105), AOR (95% CI)	Been Paid for Sex (n = 14 247), AOR (95% CI)	Condom Use ^c (n = 9528), AOR (95% CI)
Ecosocial factors						
Socioeconomic status						
Low income ^d	...	...	1.22 (1.05, 1.41)	0.80 (0.68, 0.94)	...	...
Housing insecurity ^e	1.31 (1.00, 1.72)	1.44 (1.14, 1.81)	2.04 (1.81, 2.31)	0.51 (0.44, 0.59)	1.95 (1.27, 3.01)	0.71 (0.54, 0.93)
History of abuse						
Childhood sexual abuse ^f	...	1.71 (1.14, 2.57)	1.26 (1.00, 1.59)	0.72 (0.54, 0.95)	2.53 (1.36, 4.71)	...
Childhood physical abuse	...	...	...	...	...	0.71 (0.58, 0.87)
Intimate partner physical abuse ^g	...	1.60 (1.10, 2.31)	...	0.75 (0.65, 0.87)	1.59 (0.99, 2.57)	0.65 (0.42, 0.99)
Intimate partner sexual abuse ^h	...	...	...	...	2.25 (1.47, 3.45)	0.46 (0.28, 0.76)
Exposure to violence						
Father in jail	...	...	...	0.77 (0.65, 0.92)	...	...
Crime victim or witness ⁱ	1.35 (1.02, 1.80)	...	1.42 (1.20, 1.67)	0.64 (0.52, 0.79)	...	...
Gang participation	...	1.83 (1.39, 2.42)	1.36 (1.26, 1.53)	0.87 (0.76, 0.99)	...	0.76 (0.60, 0.95)
Ever arrested	1.40 (1.07, 1.84)	...	2.05 (1.75, 2.40)	0.52 (0.44, 0.61)	2.41 (1.54, 3.77)	0.57 (0.39, 0.83)
Psychosocial factors						
Alcohol and drug use						
Frequent alcohol use ^j	...	2.30 (1.56, 3.38)	2.00 (1.71, 2.32)	...	...	...
Recent drug use ^k	...	1.55 (1.11, 2.18)	1.83 (1.55, 2.16)	0.72 (0.59, 0.89)	...	...
Depression ^l	...	2.00 (1.49, 2.66)	1.45 (1.26, 1.66)	0.73 (0.60, 0.87)	...	...

Note. AOR = adjusted odds ratio; CI = confidence interval. Ellipses indicate that associations were not statistically significant. Weighted multivariate logistic regression was used to examine the associations. All models were adjusted for gender and race/ethnicity in addition to the independently associated ecosocial and psychosocial factors presented in that column. Further adjustment for sexual orientation and age did not appreciably change the estimates, so these factors were not included in any of the multivariate models.

^aLifetime number of partners was categorized as 0, 1, 2 to 5, 6 to 10, 11 to 49, or 50 or more.

^bAge at sexual debut was categorized as 10 to 13, 14 to 15, 16 to 17, 18 to 19, 20 or more, or no sexual debut yet.

^cCorrect and consistent condom use was determined by negative responses to all 4 of the following situations: having a condom break, slip off, put on after intercourse had begun, or taken off before intercourse was completed (answered by the subset of participants who had had sexual intercourse in last 12 months and who reported always using condoms in the last 12 months).

^dLow income (n = 14 091) was determined by an affirmative response to the question, "Before you turned 18, did anyone in your household ever receive public assistance or welfare payments?"

^eHousing insecurity (n = 14 281) was determined by an affirmative response to at least 1 of the following questions: "Have you ever run away from home?" "Have you ever been homeless for a week or longer?" and "Have your parents ever ordered you to move out of their house?"

^fChildhood sexual abuse (n = 13 722) was determined by response of "once or more" to the question, "How often has one of your parents or other adult caregivers touched you in a sexual way, forced you to touch him or her in a sexual way, or forced you to have sexual relations?"

^gIntimate partner physical abuse (n = 9775) was determined by response of "once or more" to the following question regarding most recent romantic relationship: "How often in the last past year has your partner slapped, hit, or kicked you?"

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ⁱCrime victim or witness (n = 14 148) was determined by a single positive response to the question, "Which of the following things happened in the past 12 months: you saw someone shoot or stab another person; someone pulled a gun on you; someone pulled a knife on you; someone shot you; someone stabbed you; you were beaten up but nothing was stolen from you; you were beaten up and something was stolen from you."

^jFrequent alcohol use (n = 14 064) was determined by response "3 to 5 days a week" or "every day" to the question, "In the past 12 months, on how many days did you drink alcohol?"

^kRecent drug use (n = 14 041) was determined by response "once or more" to at least 1 of the following: "In the past 30 days, how many times have you used cocaine; crystal meth; illegal drugs such as LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin or prescription medicines not prescribed for you; inject an illegal drug such as heroin or cocaine?"

^lDepression (n = 14 303) was determined by an affirmative response to the question, "Have you ever been diagnosed with depression?"

Statistical Methods

We performed stratified, weighted analyses to account for Add Health's cluster sampling design and to generate nationally representative estimates, incorporating the school as the primary sampling unit, region of the United States (West, Midwest, South, Northeast) as

the stratification variable, and poststratification sampling weights. Sampling weights were available for 94% of all respondents, resulting in a total sample size of 14 322. We used weighted logistic regression to examine associations between contextual conditions and STI and behavioral outcomes; any factor related to an

outcome at $P < .25$ in univariate analysis was included in the multivariate model and retained if significant at $P < .05$ by manual backwards elimination. Race/ethnicity and gender were considered as potential confounders and included in all multivariate models; further adjustment for sexual orientation and

age did not appreciably change any of the estimates and were not included. Results did not differ significantly when analyses were stratified by race, so combined models are presented. A count score consisted of the number of contextual conditions present for each participant among the total number of ecosocial and psychosocial variables that were related to STI at $P < .25$. Analyses were performed with Stata 8.0 (StataCorp LP, College Station, Texas).

RESULTS

Prevalence of Ecosocial and Psychosocial Factors

Pairwise correlations among each of the 10 ecosocial factors and 3 psychosocial factors were consistently low, ranging from $r = -0.006$ for childhood sexual abuse and frequent alcohol use to $r = 0.318$ for intimate partner physical and sexual abuse, suggesting that each variable represented a distinct construct. The prevalence of these various contextual conditions ranged from 4.5% for childhood sexual abuse to 28.4% for childhood physical abuse, both of which were included in the history of abuse category (Table 1). For the other categories, prevalence was highest for low socioeconomic status, followed (in declining order) by exposure to violence, depression, and alcohol and drug use.

Univariate Analyses

Overall prevalence was highest for laboratory-diagnosed *C trachomatis* (4.2%), followed by *T vaginalis* (2.3%), *M genitalium* (1.0%), and *N gonorrhoeae* (0.4%), for a combined STI prevalence of 6.4%. HPV was detected in 26.9% of tested women. In univariate analyses, all 4 violence indicators were significantly associated with increased odds for prevalent STI, yet depression was associated with decreased odds of prevalent STI; there was no significant association of prevalent STI with alcohol or drug use (Table 1). Having grown up in a low-income household and being the victim of or witness to a crime were most strongly associated with prevalent STI. By contrast, HPV infection was associated with housing insecurity (odds ratio [OR]=1.35; 95% confidence interval [CI]=1.07, 1.72), having been in custody (OR=1.62; 95% CI=1.11, 2.35), and frequent alcohol use (OR=1.62; 95% CI=1.12, 2.35).

The combined prevalence of self-reported STI diagnosis in the last 12 months was 6.3%, comprising *C trachomatis* (2.8%), HPV (1.3%), genital warts (1.3%), herpes simplex virus (1.1%), *N gonorrhoeae* (1.0%), *T vaginalis* (0.7%), and syphilis (0.2%). Eleven of the 13 contextual conditions were associated with increased risk for recent STI diagnosis. Housing insecurity, childhood physical abuse, and depression were most strongly associated with reported STI diagnosis in the prior year; participants who had experienced those factors were more than twice as likely to report an STI diagnosis as those who had not.

Of the 52 possible associations between the 13 contextual conditions and 4 sexual risk behaviors, all but 5 were statistically significant ($P < .05$) in univariate analyses, indicating consistent relationships between ecosocial and psychosocial conditions and higher lifetime number of partners, earlier age at sexual debut, having ever received payment for sex, and inconsistent condom use (data not shown).

Multivariate Analyses of Contextual Conditions and Sexually Transmitted Infection

To determine the independent association of STI with ecosocial and psychosocial factors, we developed 2 multivariate models to assess associations with (1) prevalent STI and (2) STI diagnoses in the previous year, both of which were adjusted for gender and race/ethnicity. Having ever been a witness to or victim of a crime, having ever been arrested, and housing insecurity were associated with increased likelihood of prevalent STI (Table 2), with adjusted ORs of 1.3 to 1.4. Having ever been arrested (adjusted OR=1.60; 95% CI=1.08, 2.32) and frequent alcohol use (adjusted OR=1.64; 95% CI=1.13, 2.39) were independently associated with prevalent HPV infection.

Contextual conditions were more strongly associated with self-reported STI diagnoses in the last year than with prevalent STI, with adjusted ORs ranging from 1.7 to 2.3 for most factors. Housing insecurity was modestly associated with prevalent STI (adjusted OR [AOR]=1.31; 95% CI=1.00, 1.72) and with recent STI diagnosis (AOR=1.44; 95% CI=1.14, 1.72). However, participants who used alcohol frequently or had ever been diagnosed

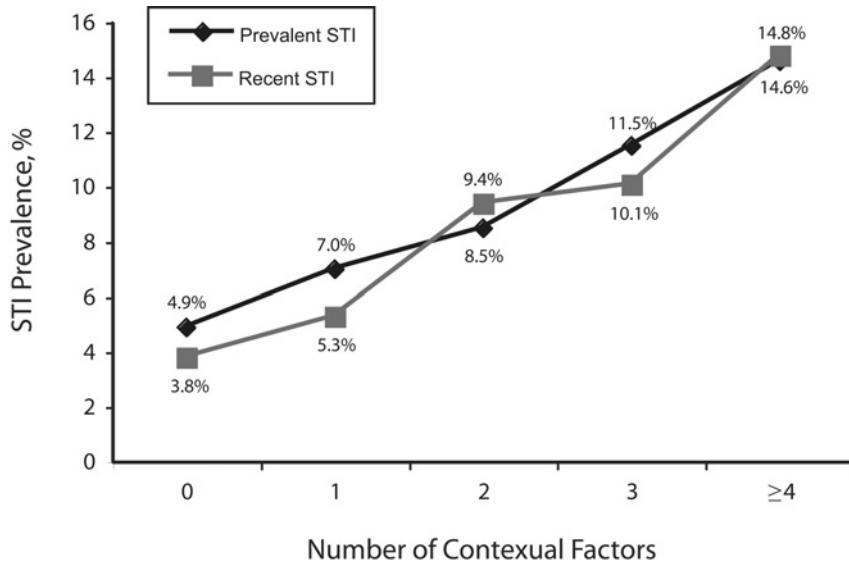
with depression were more than twice as likely to report a previous STI as those not reporting these factors. Risk was only slightly lower for those reporting childhood sexual abuse (AOR=1.71; 95% CI=1.14, 2.59); and gang membership (AOR=1.83; 95% CI=1.35, 2.42), respectively. By contrast, low income, childhood physical abuse, intimate partner sexual abuse, and having a father in jail were not associated with either prevalent or recent STI diagnosis.

Multivariate Analysis of Contextual Conditions and Sexual Risk Behaviors

To assess the association of ecosocial and psychosocial factors with sexual risk behaviors, we developed 4 separate multivariate models. Housing insecurity and having ever been arrested were independently associated with more lifetime partners, younger age at sexual debut, having ever been paid for sex, and decreased odds of correct and consistent condom use (Table 2). Low income, childhood sexual abuse, having ever been a victim of or witness to a crime, gang participation, recent drug use, and depression diagnosis were also significantly associated with a higher lifetime number of partners and younger age at sexual debut. Reported childhood sexual abuse was strongly associated with receiving money for sex (AOR=2.53; 95% CI=1.36, 4.71).

Elevated Risk Associated With Multiple Contextual Conditions

To determine whether the presence of multiple ecosocial and psychosocial factors compounded STI risk, we created and plotted a count score (i.e., a cumulative score computed by adding 1 point for each reported factor) against current and recent diagnosis of STI (Figure 2). As the number of contextual conditions increased, STI prevalence increased in a stepwise fashion, from 4.9% for zero factors to 14.6% for 4 or more factors ($P < .001$). Similarly, the proportion of respondents who reported an STI diagnosis in the previous year increased from 3.8% for zero factors to 14.8% for 4 or more factors ($P < .001$). However, when we examined specific interactions between individual ecosocial conditions and prevalent or recent STI, none were statistically significant.



Note. These STI rates compare with overall rates of 6.4% for prevalent STI and 6.8% for recent STI among participants with a count score (i.e., complete data on contextual conditions).

FIGURE 2—Prevalences of laboratory-diagnosed sexually transmitted infection (STI) and self-reported STI diagnoses in the prior year among young adults aged 18 to 27 years, by the number of contextual conditions present: Wave III, National Longitudinal Study of Adolescent Health, July 2001–April 2002.

TABLE 3—Association of Contextual Conditions and Behavioral Risk Factors With Prevalent Sexually Transmitted Infection (STI) and Recent Diagnoses of STI Among Adults Aged 18 to 27: Wave III, National Longitudinal Study of Adolescent Health, July 2001–April 2002

Contextual Condition or Behavioral Risk Factor	Prevalent STI, AOR (95% CI)	STI Diagnoses in Previous Year, AOR (95% CI)
Housing insecurity	1.23 (0.92, 1.65)	
Witness/victim of crime	1.31 (0.99, 1.72)	
Ever arrested	1.28 (0.98, 1.67)	
Age at sexual debut	0.91* (0.84, 0.99)	
Lifetime no. of partners	1.09 (0.98, 1.21)	1.74* (1.55, 1.95)
Childhood sexual abuse		1.48* (1.00, 2.18)
Gang participation		1.50* (1.13, 1.98)
Frequent alcohol use		1.54* (1.05, 2.24)
Diagnosis of depression		1.54* (1.15, 2.06)
Ever been paid for sex		1.71* (1.12, 2.60)
Condom use		0.41* (0.26, 0.65)

Note. AOR = adjusted odds ratio; CI = confidence interval. Weighted multivariate logistic regression was used to examine the associations. In multivariate analysis, ever been paid for sex and condom use were not independently associated with prevalent STI and so were not included in the final model.

*P < .05.

Multivariate Analysis of Contextual Conditions, Sexual Risk Behaviors, and Sexually Transmitted Infection

Finally, to determine whether contextual conditions or proximate sexual risk behaviors exert a stronger influence on STI risk, we

included ecosocial, psychosocial, and sexual behavior risk factors in the same multivariate model (Table 3). Among the 3 ecosocial factors and 2 behavioral risk factors that were significantly associated with prevalent STI, only age at sexual debut remained independently

associated in the combined model. As age at sexual debut increased, the prevalence of STI decreased by 10% per age category (adjusted OR=0.91; 95% CI=0.84, 0.99). Lifetime number of partners, having been a victim of or witness to a crime, and having been arrested were marginally associated with an increased risk for prevalent STI.

Two ecosocial and 2 psychosocial factors remained positively associated with recent diagnosis of STI in the combined model. Individuals who reported childhood sexual abuse, gang participation, frequent alcohol use, or depression diagnosis were approximately 50% more likely to report STI diagnoses in the past year, with adjustment for lifetime number of partners, payment for sex, and correct and consistent condom use.

DISCUSSION

This is the first population-level study to examine the relationship of a set of ecosocial and psychosocial factors with laboratory-diagnosed STI. Among young adults in the United States, these contextual conditions were associated with prevalent STI and recent STI diagnoses, despite the fact that some of these conditions probably preceded sexual debut. The association between contextual conditions and sexual risk behaviors represents one pathway through which ecosocial and psychosocial factors may increase STI risk. However, even after adjustment for sexual risk behaviors, childhood sexual abuse, gang participation, frequent alcohol use, and diagnosis of depression were associated with increased odds of an STI diagnosis in the prior year, suggesting that the impact of these contextual conditions operates above and beyond their influence on the behaviors included in this analysis. Distal mediators not measured here may include compounded physical and psychological vulnerability, increased dependence on others, and risk desensitization. Alternatively, contextual conditions may foster and maintain high STI prevalence in subpopulations, consistent with the broken windows theory.⁸⁰

Salience of Housing Insecurity

Among the 13 individual conditions considered, housing insecurity and having been arrested were most consistently associated both

with STI outcomes and with high-risk sexual behaviors, consistent with results from other studies.^{24–28,47–49,53} In fact, housing insecurity was the only condition that was significantly associated with both prevalent and recent diagnosis of STI. Thus, interventions for homeless youths may represent a promising avenue for reducing STI risk, in addition to other health conditions. By contrast, childhood physical abuse and having a father in jail appear to be less salient, because neither predicted prevalent or recent STI and each was associated with only 1 high-risk sexual behavior.

Associations of ecosocial and psychosocial factors with STI diagnoses in the previous year were stronger than associations with prevalent STI. This may partially reflect the broader range of STIs included in our measure of recent STI diagnoses, half of which were chronic viral infections (herpes simplex virus and HPV-related conditions). Furthermore, participants with recent STI diagnoses all sought care, either for STI symptoms or routine screening, unlike individuals with prevalent, largely asymptomatic STI at the time of wave-III testing. A biological explanation (e.g., individuals who experience such conditions are more likely to have symptomatic disease) is unlikely. Thus, the difference in contextual conditions associated with prevalent and recent diagnoses of STI is probably driven by health care-seeking behaviors or access to care. It may be that individuals who experience ecosocial conditions have a better perception of their STI risk and therefore more often seek care. Additionally, lifetime history of STI may be a more accurate measure of early or lifetime conditions such as child sexual abuse or depression. Although subject to recall and self-report bias, this outcome should be explored in future analyses. In addition, because of their persistence, viral STIs such as herpes simplex virus may be better biomarkers for lifetime ecosocial factors than the curable STIs we evaluated here.

Our observation that contextual conditions were more consistently associated with high-risk sexual behaviors than with laboratory-diagnosed or recently diagnosed STI suggests that contextual conditions contribute to the acquisition of high-risk behaviors but may not necessarily influence the likelihood that an individual practicing these behaviors will do so with an infected partner. That is, some factors

may be associated with intermediary risk behaviors along the causal pathway, and others may be also associated with placement in a high-risk sexual network in which the consequences of the risk behaviors include infection.

The absence of specific, significant interactions between 2 or more of these contextual conditions was in contrast to the hypothesized presence of syndemics. The interplay among ecosocial and psychosocial factors, sexual risk behaviors, and STI may be more complex than a purely multiplicative relationship. Previous studies describing syndemics have not measured laboratory-diagnosed STI,^{18–20} which could partially account for the difference in earlier results and those presented here. Additionally, there may be other confounding factors not examined here that influence the relationship among contextual conditions and infection.

These findings are limited by the inconsistent timeframes used for each measure, which ranged from childhood experiences with abuse (before sixth grade) to recent interactions with crime (last 12 months), drugs (last 30 days), and last intimate partner. The inability to clearly determine the temporal sequence of events precludes drawing conclusions about causality. Supplemental longitudinal research is needed to explicitly measure ecosocial factors and their long-term impact on subsequent health outcomes, with use of consistent definitions and timeframes (e.g., contextual conditions present before age 15 years).

Finally, loss to follow-up from wave I to III was 24%.⁸¹ Although the poststratification sampling weights developed by Add Health account for bias caused by differential response rates by race and gender, they do not account for bias that may arise if nonrespondents and respondents have other important differences. In wave III, questions on intimate partner sexual and physical violence were asked only of participants who considered their last sexual partner a romantic relationship, increasing the possibility of nonresponse bias for these particular variables.

Addressing Structural Vulnerabilities

The rich Add Health data and large sample size enabled examination of multiple ecosocial and psychosocial factors simultaneously, unlike previous studies that assessed only a few

variables at a time.^{29–31,33,34,36,39} The significant association of contextual conditions with recent diagnosis of STI, even after we controlled for sexual risk behaviors, suggests that reliance on behavior change interventions may be inadequate and that programs should take full advantage of earlier opportunities for primary prevention. Nevertheless, the strong linear relationship between STI outcomes and the number of ecosocial and psychosocial factors experienced by a given individual indicates that adolescents with the greatest vulnerability may be appropriate targets for secondary prevention efforts, including, but not limited to, behavior change interventions.

Overall, these findings suggest that upstream conditions such as housing and safety contribute to the burden of STIs and that the number of these conditions present in an adolescent's environment increases the likelihood for high-risk behavior and exposure to and acquisition of STI. Projects that address structural vulnerabilities such as homelessness and violence or psychosocial susceptibilities may have a positive spillover effect on sexual health, even if an intervention does not target sexual behaviors or STI prevention directly, as was demonstrated by the Seattle Social Development Project.⁸² However, current funding for public health interventions is narrowly focused and limited in time, which precludes the long-term measurement of comprehensive health and safety outcomes. In reaction to studies reporting null results for behavior change interventions, there has been a renewed emphasis on traditional biomedical STI control interventions. The national public health agenda may benefit from broadening, rather than restricting, its conception of health interventions and outcomes to address the physical, economic, and emotional security of adolescents and the environment in which they live. ■

About the Authors

The authors are with the Center for AIDS and STDs, University of Washington, Seattle.

Requests for reprints should be sent to Lisa E. Manhart, PhD, MPH, UW Center for AIDS and STD, 325 9th Ave, Box 359931, Seattle, WA 98104-2499 (e-mail: lmanhart@u.washington.edu).

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Contributors

A. L. Buffardi conceptualized the study, conducted the analyses, and led the writing. K. K. Thomas

conducted the analyses and revised the content. K.K. Holmes assisted with the conceptualization and analyses. L.E. Manhart assisted with conceptualization, analyses, writing, and content revision and supervised the overall study.

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Human Participant Protection

Approval for secondary data analysis of the Add Health data was granted by the institutional review board of the University of Washington.

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