Violence Victimization, Social Support, and Papanicolaou Smear Outcomes: A Longitudinal Study from Adolescence to Young Adulthood

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Abstract

Background: African American youth are among those at greatest risk for experiencing violence victimization. Notably, the mortality rate of cervical cancer for African American women is also twice that of white women. To date, we know of no literature using longitudinal data to examine how violence victimization relates to Papanicolaou (Pap) smear results or cervical cancer in this population. Our study examines how violence victimization during adolescence (age 15 to 18) influences psychological distress, perceived social support, heavy substance abuse, and sexual risk behaviors during emerging adulthood (age 20 to 23), and subsequent Pap smear outcomes during young adulthood (age 29 to 32).

Method: This study is based on 12 waves of data collected in a longitudinal study of 360 African American women from mid-adolescence (ninth grade, mean age = 14.8 years) to young adulthood (mean age = 32.0 years). We used structural equation modeling analysis to examine the hypothesized model.

Result: Violence victimization during adolescence had a direct effect on decreased social support, increased psychological distress, and increased heavy cigarette use during emerging adulthood. Better social support was also associated with fewer sexual partners during emerging adulthood and lower odds of abnormal Pap smear results during young adulthood. The effect of violence victimization on abnormal Pap smear was mediated by social support.

Conclusion: Our results show that violence victimization during adolescence has long-term negative effects through multiple pathways that persist into adulthood. Our findings also suggest that social support may help to compensate against other risk factors. Interventions designed to address the perceived support may help victims cope with their experience.

Keywords: violence victimization, social support, Pap smears, substance use, sexual risk behaviors

Introduction

A GROWING BODY of evidence indicates that violence victimization in adolescence can have lifelong consequences.^{1–3} Quinlivan and colleagues, for example, found that pregnant teenagers with abnormal Papanicolaou (Pap) smears had a sevenfold increased risk of exposure to domestic violence compared to pregnant teenagers with normal Pap smears.⁴ Whether and how violence victimization affects risk of cervical cancer and abnormal Pap smears, however, are not well understood.

Hindin et al. reviewed the most current literature on intimate partner violence (IPV) and proposed three potential pathways through which violence victimization increases the risk for cervical cancer: (1) increased exposure to cervical cancer risk factors (*e.g.*, smoking, stress, risky sexual behaviors, and sexually transmitted infections); (2) poor compliance with cervical cancer screenings; and (3) delay or discontinuation in treatment.⁵ Our study aims to assess longitudinally the first pathway through examining several sociopsychological factors. Most researchers who have noted the association between violence victimization and risk of

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cervical cancer used cross-sectional or retrospective data.⁶⁻⁸ Longitudinal data can improve validity of measuring these pathways. We examine violence victimization broadly as the independent factor to generalize the mechanisms to different types of violence (domestic, IPV, sexual, *etc.*).

African American adolescents are more likely than whites and Hispanics to be victimized by violence, know someone who has been in a fight, or witnessed a violent crime.^{9,10} Cervical cancer rates for African American women also continue to be disproportionately higher than for white women.¹¹ Researchers suggest that more frequent and sustained exposure to violence is associated with behavioral risk factors for cervical cancer (risky sexual behaviors, smoking) and limited access to healthcare services.^{5,12} These behavioral risk factors may explain the cervical cancer disparities among disadvantaged women.

A variety of cervical cancer risk factors have been identified, such as persistent human papilloma virus (HPV) infection,^{13,14} immunosuppression,¹⁵ long-term use of oral contraceptives,¹⁵ having given birth to three or more children,¹⁵ a history of cigarette smoking,¹⁶⁻¹⁹ and increased number of sexual partners.^{20,21} Cigarette use, for example, is a known independent factor that directly increases the development of cervical cancer²² and interacts with HPV to increase the risk of cervical cancer progression.¹⁹ Furthermore, other factors such as substance use and sexual risk behaviors are correlated with socioeconomic status (SES) and neighborhood disadvantages.²³⁻²⁷ Finally, violence victimization and SES in adolescents may co-occur with multiple psychosocial stressors, such as family conflict and violence exposure in the community²⁸ that can effect behavioral risks of cervical cancer as noted above.

With approximately one-third of African American adolescents living in socioeconomically disadvantaged neighborhoods, broader social and environmental factors experienced by this population may be accountable for the higher rates of violence victimization experiences and the long-term negative health outcomes as a result of complex interactions among multiple factors.^{9,10}

Maladaptive coping responses and social support

We draw on the transactional model of stress and coping to guide our conceptualization of how violence victimization may result in some psychosocial precursors during emerging adulthood that may increase the risk of cervical cancer. Under Lazarus and Folkman's framework,²⁹ coping can be considered to be psychological and behavioral adjustments that individuals use to "manage external and internal demands that are appraised as taxing or exceeding the resources of an individual" (p. 141). Stressful life events such as exposure to violence and violence victimization during adolescence can have long-lasting detrimental effects such as feeling distressed and disruption of social relationships.³⁰⁻³²

In a longitudinal analysis of stress in African American youth, Schmeelk-Cone and Zimmerman³³ found that chronic levels of anxiety and depression were associated with antisocial behaviors, social isolation, and less active coping.³³ Psychological distress and substance use are closely linked especially among African American adolescents.^{34,35} In particular, Repetto et al.³⁵ found that among African Americans, depressive symptoms predicted later cigarette, alcohol, and marijuana use, while substance use did not predict later depressive symptoms.

Researchers also found that depression phenotypes may increase vulnerability to alcohol dependence³⁶ and other substance use.³⁷ Some maladaptive coping behaviors in response to emotional distress from violence victimization may include drinking alcohol,³⁸ smoking cigarettes,³⁹ using marijuana and other drugs.^{40,41} These results indicate that violence victimization increases risk of psychological distress, which leads to an increased likelihood of smoking and other substance use as maladaptive coping.

Adolescence is a crucial stage of life when people develop coping skills and strategies that may last into adulthood. It is likely that violence victimization has detrimental effects through influencing two key coping processes: (1) maladaptive coping (*e.g.*, substance misuse and risky sexual behavior) and (2) the lack of coping resources (*e.g.*, social support) to protect against the effects of victimization. Substance misuse may contribute to cervical dysplasia among young women who are already suffering from violence victimization and place them at an increased risk of cervical cancer.

Furthermore, among young women, alcohol, marijuana, and other drug use has been associated with sexual risk behavior, less condom use, and more sex partners.^{42,43} Researchers found that African American adolescent girls with a history of violence victimization engaged in more risky sexual behaviors (*e.g.*, inconsistent condom use, less condom use at last sex, more sex partners, and higher frequency of sex while intoxicated) during a 12-month study period.⁴⁴ In an economically disadvantaged sample of predominantly African American adolescents, researchers also noted that psychological distress, substance abuse, and sexual risk behaviors are associated.⁴⁵ Notably, multiple sexual partners and having unprotected sex are also associated with an increased risk of HPV infections and the development of cervical cancer.^{12,46}

Social support, on the contrary, may be the key element for more adaptive coping.^{29,47} Those with histories of victimization may face increased difficulty transitioning to adulthood, experience more ambiguity around their social status, or have less social support when needed. Researchers found that women who were victimized often experience a lack of tangible support resources, as well as emotional support from family and friends.^{48,49} Social support played a crucial role for young African American women adjusting from violence victimization^{50,51} who reported lower levels of social support and greater psychological distress compared to their non-abused women. In fact, African American women or women with lower SES may be particularly vulnerable to violence victimization due to a lack of coping resources in their community.⁵⁰⁻⁵²

Current study

Pathways connecting violence victimization to cervical cancer risk have been conceptualized,⁵ but the roles of social, psychological, and behavioral factors have not been empirically tested longitudinally. Few researchers have examined these relationships in women of color who are at increased risk of violence victimization or examined mediated pathways for the association of victimization and cervical cancer risk.⁵ Figure 1 depicts our hypothesized model. We expect violence victimization will have an indirect effect on abnormal Pap smear tests through psychological distress, cigarette smoking, and reduction in social support. Consistent

FIG. 1. Conceptual model of the negative effects of violence victimization on social support, psychological well-being, risky behavior, and Pap smear results among African American women. Pap, Papanicolaou.

with other researchers,^{42–44} we account for the correlations between the following variables: heavy cigarette use, heavy alcohol use, and two risky sexual behaviors (inconsistent condom use and multiple sexual partners).

We hypothesize that psychological distress and perceived social support will be associated with heavy alcohol use, heavy cigarette use, and risky sexual behavior, which will be associated with abnormal Pap test results. Because age,⁵³ health insurance coverage,^{12,53} and SES^{12,28,54} are associated with cervical cancer screening and cancer stages, we control for these variables in the models tested.

Methods

Participants

We analyzed 12 waves of data from a longitudinal study of youth from mid-adolescence (ninth grade, mean age = 14.8 years) to young adulthood (mean age = 32.0 years). The original sample ($N = 850$) of the study includes ninth-grade students at wave 1 attending one of four public high schools in Flint, Michigan.

The goal of the original study was to investigate resiliency among youths who were at risk of leaving school before graduation and were at risk for many deleterious outcomes because of low school achievement status. To be eligible for the study, participants had a grade point of 3.0 or lower at the end

of the eighth grade, were not diagnosed by the school as having emotional or developmental impairments, and self-identified as African American, white, or both.⁵⁵ In the current study, we focused on female participants who identified as either African American or mixed African American and white ($n = 360$ at wave 1, 42.3% of the total sample of the original study).

Data collection

Four waves of data were collected during high school years (waves 1 to 4; 1994 to 1997), 4 years after high school (waves 5 to 8; 1999 to 2002), and four more years when respondents were in their late twenties (waves 9 to 12; 2008 to 2012). Each interview lasted 50–60 minutes for each wave of data collection. Participants completed a paper and pencil questionnaire after the interview to collect data on substance use and sexual behavior to ensure more confidentiality for these questions. Before the data collection process, researchers obtained consent from each participant.

The retention rates of the original study were generally high for the first eight waves (90% from waves 1 to 4, 65% from waves 5 to 8) and dropped to 44% for the last four waves due to a longer interval between waves 8 and 9 (almost 6 years). This study was approved by the University of Michigan Institutional Review Board and meets the requirements for the protection of human subjects.

Measures

Adolescence (age 15 to 18; waves 1 to 4)

Violence victimization. Three 5-point Likert items (1=0 times, 5=4 or more times) were included to assess frequency of violence-related victimization in the past 12 months. The three questions were “Had someone threaten to hurt me,” “Had something taken from me by physical force,” and “Had experienced being physically assaulted or hurt by someone.” Cronbach’s α ranged from 0.52 to 0.65 during wave 1 to 4. Each item was recoded into a dichotomous variable of 0 (never being victimized in the past 12 months) and 1 (had been victimized at least once in the past 12 months). A sum of recoded scores was created for each wave (range from 0 to 3) and then a mean of the four high school years was created as an indicator in the final analysis.

Socioeconomic status. We included SES in the model as a control variable. Participants were asked to indicate their father’s and mother’s occupation. We assessed the highest occupational prestige score for either parent by using codes developed by Nakao and Treas.⁵⁶ Scores were constructed from three indices: a prestige rating of a given occupation, the concomitant educational attainment, and income levels for that occupation. Scores for female participants in the study ranged from 29.44 (handlers, helpers, and laborers) to 64.38 (professional). The mean occupational prestige score was 39.06 (SD=9.78), which represented blue-collar employment.

Emerging adulthood (age 20 to 23; waves 5 to 8)

Social support. Three indicators were included to assess social support⁵⁷ during waves 5 to 8: parental support (10 items), peer support (5 items), and significant other’s support (6 items). Using a 5-point Likert scale (1=not true, 5=very true), participants were asked to rate statements such as “I rely on my mother/father for emotional support” and “My friends are good at helping me solve problems.” Participants were asked to first identify their significant other (*i.e.*, spouse, partner, nonromantic friend, housemate, sibling, parent, relative, or other) before responding to the level of the perceived support from this person.⁵⁷

Cronbach’s α ranged from 0.93 to 0.95 for parental support, 0.89 to 0.92 for peer support, and 0.80 to 0.84 for significant other’s support. A mean score was created for each wave and a composite score was then calculated by taking a mean across waves 5 to 8. The three indicators were included in the final model in a latent factor of social support.

Psychological distress. The Brief Symptom Inventory⁵⁸ was used to assess depression (5 items, Cronbach’s α ranged from 0.81 to 0.83) and anxiety (6 items, Cronbach’s α ranged from 0.78 to 0.81) using a 5-point rating scale, 1 (not true) to 5 (very true) with higher scores indicating more psychological distress symptoms. A mean score for depression and anxiety symptom scores was created for each wave by averaging responses on these items. We then created a composite mean of the depressive scores and anxiety scores for waves 5 to 8. Depression and anxiety were included in the final model as a latent psychological distress factor.

Heavy cigarette use. Frequency of cigarette use⁵⁹ was measured by a single item asking participants, “How often

have you smoked in the past 30 days?” We used a similar standard to that used by others (*e.g.*, Refs.^{60,61}) to identify heavy smokers (smoked half packs or more daily) for each wave from waves 5 to 8, and recoded responses of half a pack of cigarettes per day or more as 1, otherwise 0, for each wave. We then created a sum of the dichotomous variable (0/1) for the four waves (range from 0 to 4). The heavy smoking variable was included as a variable in the final analysis.

Heavy alcohol use. Heavy drinking was measured with two items. The first question was “Think back over the *last two weeks*. How many times have you had five or more drinks in a row? (A ‘drink’ is a glass of wine, a bottle of beer, a shot glass of liquor, or a mixed drink.)” The item used a 5-point scale (0=none; 1=once; 2=twice; 3=three to five times; 4=six to nine times; 5=10 or more times). The second item was “When you drink alcoholic beverages, how often do you drink enough to feel pretty high?” This item used a 4-point scale (0=never; 1=a few times; 2=about half of the times; 3=nearly all of the times; 4=on nearly all of the occasions [during the past 2 weeks]).

These two items were combined to construct a measure of heavy drinking that is consistent with measures used previously⁶² and is similar to those in national survey data.^{63,64} We calculated a mean score for each item from wave 5 to 8 and used the mean scores of both items as indicators of the latent factor of heavy alcohol use.

Sexual risk behavior. Participants reported the number of sexual partners they had in the past 12 months.⁶⁵ A mean of the numbers during waves 5 to 8 was calculated to create a variable for number of partners. Participants were also asked to rate how often they used a condom during sexual intercourse in the last 12 months using a 5-point Likert scale.⁶⁵ We recoded the condom use item into a dichotomous variable: 0 (always used a condom during sexual intercourse) and 1 (skipped condom use) for each wave during waves 5 to 8. A composite score was calculated by taking a sum of the scores across the four waves (range from 0 to 4). We kept these as separate variables in our model because factor analysis results indicated these two variables do not load on a single factor.

Young adulthood (age 29 to 32; waves 9 to 12)

Pap smear results. Female participants were asked in each wave between waves 9 to 12 if they had an abnormal Pap smear. Among the total sample of 360 African American women in our sample, 259 had responded to this specific question. One hundred fifty-seven participants (43.6% to the total sample) had answered yes at least once during the wave 9–12 data collection period. The final variable was recoded into a dichotomous (1/0) variable, in which 1 represented a participant who answered “yes” at any wave in waves 9–12 and 0 represented a participant who responded “no” to this question in every wave. One participant answered “don’t know” to this question in wave 9 and one participant refused to respond to this question in wave 10. Both of these responses were recoded as missing.

Health insurance status. Health insurance coverage was included in the study as a control variable. We asked participants to choose the response option that best described their current health insurance situation. Response options

included: “I do not have health insurance,” “I am on Medicaid,” “I am covered by my spouse/partner’s insurance,” “I have private health insurance,” “I have health insurance through work, a union, Genesee Health Plan school, or the military,” and “Other.” Responses were recoded into a dichotomous variable: 1 (has health insurance) and 0 (no health insurance), in which “has health insurance” included all respondents who chose a response option indicative of having health insurance in any of the waves in waves 9–12.

Analytic plan. Using 12 waves of longitudinal data, we tested the model in Figure 1 using structural equation modeling with Mplus. Because the dependent variable (Pap smear results) is binary, we specified a categorical command in the syntax for the Mplus software to enable special estimation procedures. Probit regression was used to model the dichotomous outcome in the analysis. Chi-square goodness of fit statistic, the root mean square error of approximation (RMSEA),⁶⁶ the Tucker–Lewis index (TLI),⁶⁷ and the comparative fit index (CFI)⁶⁸ were used to determine model fit for each model. Finally, to test for mediation, the paths from the independent variables to Pap smear outcomes were estimated for the indirect effects.

Missing data. Percentage of missing data ranged across measures and time points, from a low of 7% missing smoking frequencies during waves 5 to 8 to a high of 28% missing for Pap smear results during waves 9 to 12. To address this issue of missing data and structural equation modeling with categorical variables, we used multiple imputations method implemented in Mplus Version 6 and later.⁶⁹ Asparouhov and Muthén⁶⁹ provided evidence that the WLSMV estimator with five imputed data sets performs well with unbiased estimation when dealing with missing data. They also concluded that increasing the number of imputed data sets from 5 to 50 does not improve the results and therefore five imputed data sets are sufficient for estimating structural equation models with categorical variables and missing data.

Results

Measurement model

We examined a measurement model to ensure the variables included were related to one another before computing the full structural model.⁷⁰ Latent factors were constructed for perceived social support, psychological distress, and heavy alcohol use. Other key constructs included violence victimization, heavy cigarette use, number of sexual partners, inconsistent condom use, Pap smear outcomes, and the three control variables—age, SES, and insurance status (correlation table available on request). We allowed latent factors and key constructs to correlate with each other in the measurement model. The fit indices represent the average results over five imputed data sets (χ^2 [63, $N=360$] = 104.54, CFI = 0.94; TLI = 0.90; RMSEA = 0.02). Table 1 presents standardized factor loadings for the latent factors.

Structural model

Figure 2 illustrates the significant paths in the final structural model with probits. In the structural model, independent factors were allowed to covary. Residuals between endogenous factors were also allowed to covary. The average fit

TABLE 1. LOADINGS FOR LATENT FACTORS IN THE MEASUREMENT MODEL

<i>Latent factor</i>	<i>Standardized loading</i>	<i>SE</i>
Perceived social support		
Parental support	0.698	0.062
Peer support	0.319	0.066
Significant other support	0.607	0.055
Psychological distress		
Depression	1.010	0.048
Anxiety	0.755	0.040
Heavy alcohol use		
Five or more drinks in a row	0.670	0.036
Drink enough to feel high	0.951	0.044

SE, standard error.

indices of the five imputed data sets indicated a good model fit to the data (χ^2 [63, $N=360$] = 101.32; CFI = 0.94; TLI = 0.90; RMSEA = 0.04) with the inclusion of control variables. The model results included a probit regression coefficient for each path, which represents the change in the z-score or probit index for a one unit change in the predictor.⁷¹ Standardized and unstandardized probit regression coefficients and *p*-values in the final structural model are presented in Table 2. Table 2 also includes correlations among the endogenous factors in the model.

As seen in Figure 2, significant paths emerged from violence victimization to social support ($b = -0.23$, $p < 0.01$) and psychological distress ($b = 0.35$, $p < 0.01$). Thus, for a one unit increase in violence victimization during adolescence, the z-score of perceived social support during emerging adulthood decreased by 0.23, and the z-score of psychological distress during emerging adulthood increased by 0.35. Violence victimization also directly predicted heavy cigarette use during emerging adulthood ($b = 0.24$, $p < 0.01$). During emerging adulthood, social support was associated negatively with number of sexual partners ($b = -0.29$, $p < 0.05$). Notably, higher social support was associated negatively with subsequent abnormal Pap smear results during young adulthood ($b = -0.44$, $p < 0.05$).

More psychological distress was associated positively with heavy alcohol use ($b = 0.19$, $p = 0.05$) and heavy cigarette use ($b = 0.16$, $p = 0.08$), with the paths being only marginally significant for a two-tailed test. Similarly, psychological distress also predicted higher levels of inconsistent condom use ($b = 0.28$, $p = 0.06$) with only marginally significant level for a two-tailed test. Finally, heavy cigarette use during emerging adulthood predicted subsequent abnormal Pap smear results ($b = 0.18$, $p = 0.06$) with marginal significance for a two-tailed test. The overall model explained 22.4% of the variance in Pap smear results.

Indirect effects of violence victimization to Pap smear outcomes

To further examine the significance of the key mediators in our structural model, we specified path commands in Mplus to test the indirect effects of violence victimization on Pap results through two paths: (1) violence victimization to social support and then to abnormal Pap results and (2) violence victimization to psychological distress and heavy cigarette use

FIG. 2. The indirect paths from violence victimization during adolescence to abnormal Pap results during young adulthood, after controlling for SES, age, and insurance status. The fit indices represent the average results over five imputed data sets: chi-square (63, $N=360$) = 101.31; CFI = 0.94; TLI = 0.90; RMSEA = 0.04. The *numeric lines* indicate paths' significant level marked as $^{**}p < 0.01$, $^{*}p < 0.05$ (two tailed) and † significant at trend level ($p < 0.10$). *Numbers* indicate unstandardized probit correlation coefficients for each path. Residuals between endogenous latent factors were allowed to covary. CFI, comparative fit index; RMSEA, root mean square error of approximation; SES, socioeconomic status; TLI, Tucker–Lewis index.

use, and then to abnormal Pap results. The first indirect path through social support was significant ($b = 0.10$, $p = 0.032$), while the second path through psychological distress was not significant ($b = 0.01$, $p = 0.223$).

Discussion

Our findings indicate that violence victimization has negative effects on the psychological, social, and physiological well-being of African American women across the transition to adulthood (from age 15 to 32). The results support our hypothesis that the effects of violence victimization during adolescence on abnormal Pap smears in young adulthood are mediated by social support and cigarette use. Notably, once the mediating factors were included in the model, the direct effect between violence victimization in adolescence and later abnormal Pap smears disappeared. Higher levels of perceived social support from parents, peers, and significant others predicted fewer sexual partners during emerging adulthood, and lower odds for subsequent abnormal Pap smear results. It is also notable that the results held when other psychosocial and behavioral risk factors were included in the model.

Although several previously identified risk factors—including violence victimization, heavy cigarette use, and

inconsistent condom use—emerged as significant predictors of abnormal Pap results at the bivariate level, only perceived social support and heavy cigarette use had direct effects on Pap smear outcomes in the final model. We did not, however, find associations between sexual risk behavior (number of partners or inconsistent condom use) and later abnormal Pap results even though they were associated with more smoking behavior. This is in contrast to previous researchers who have reported that sexual behavior is a key risk factor for positive Pap smear results.²⁰ One reason we did not find such effects may be that other markers of sexual behavior not included in this study (*e.g.*, age at first intercourse; sexual behavior of partners) may be better indicators of abnormal Pap screening.

Furthermore, respondents reported fewer than two sexual partners during emerging adulthood, which is not particularly high risk and may explain why we did not find sexual behavior to be a risk factor in our study. In a cross-cultural meta-analysis, Berrington de González and Green found that cervical cancer risks increased substantially as the number of partners increased to six or more.²¹

Our finding that adolescent violence victimization was associated with psychological distress and substance use is consistent with past research findings.^{30,32,51,72} Similarly, our

TABLE 2. MODEL ESTIMATES (LOGITS), *P*-VALUES, AND ODDS RATIO FOR ALL HYPOTHEZED PATHS

<i>Path</i>	<i>Unstandardized probit</i>	<i>Standardized probit β</i>	<i>p (two tailed)</i>
Violence victimization → social support	-0.23	-0.23	<0.001***
Violence victimization → psychological distress (PD)	0.35	0.34	<0.001***
Violence victimization → heavy cigarette use	0.24	0.15	0.003**
Violence victimization → heavy alcohol use	0.15	0.10	0.095 ^a
Violence victimization → number of sexual partners	0.02	0.01	0.795
Violence victimization → inconsistent condom use	0.06	0.03	0.665
Violence victimization → abnormal Pap	0.07	0.04	0.697
Social support → heavy cigarette use	0.06	0.04	0.655
Social support → heavy alcohol use	-0.16	-0.11	0.186
Social support → number of sexual partners	-0.29	-0.17	0.017*
Social support → inconsistent condom use	-0.13	-0.06	0.425
Social support → abnormal Pap smear	-0.44	-0.25	0.013*
PD → heavy cigarette use	0.16	0.10	0.084 ^a
PD → heavy alcohol use	0.19	0.13	0.051 ^a
PD → number of sexual partners	-0.09	-0.05	0.428
PD → inconsistent condom use	0.28	0.13	0.055 ^a
PD → abnormal Pap	-0.01	-0.00	0.970
Heavy cigarette use → abnormal Pap	0.18	0.17	0.056 ^a
Heavy alcohol use → abnormal Pap	-0.05	-0.05	0.738
Number of sexual partners → abnormal Pap	-0.02	-0.02	0.843
Inconsistent condom use → abnormal Pap	0.06	0.07	0.390
Control variables (significant path only)			
SES → abnormal Pap smear	-0.02	-0.19	0.019*
Standardized correlations among residual covariances (significant at 0.05 level only)		<i>r</i>	<i>p</i>
Social support with PD		-0.31	<0.001***
Heavy cigarette use ↔ heavy alcohol use		0.22	<0.001***
Heavy alcohol use ↔ number of sexual partners		0.42	<0.001***
Heavy cigarette use ↔ number of sexual partners		0.13	0.015*
Number of sexual partners ↔ inconsistent condom use		0.13	<0.001***

^aSignificant at trend level ($p < 0.10$).

Pap, Papanicolaou; SES, socioeconomic status.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two tailed).

findings confirm the indirect effects of violence victimization on Pap smear through heavy cigarette use. This finding adds to a growing body of evidence for the long-term effects of victimization during adolescence.¹⁻³ Our findings add to this literature by demonstrating how adolescent violence victimization can have a proximal influence during a key developmental period, which can have persistent and negative effects later in life.

Our results also highlight the challenges facing African American females in high-risk environments. African American adolescents have a higher risk of experiencing violence victimization, relative to their white (and often other non-majority) peers.^{73,74} Urban youth more broadly and urban African American youth in particular are among those at greatest risk for experiencing violence victimization.^{75,76} Our findings also indicate how violence victimization may extend beyond adolescence and manifest in both substance use (*e.g.*, tobacco use, heavy drinking) and mental distress.

The role of social support in mitigating negative effects

Researchers have documented how social support has benefits for individuals across the life span by mediating or moderating the effect of a variety of diseases and lead to

better physical and mental health outcomes.⁷⁷⁻⁷⁹ Our results add to this body of literature by demonstrating the salubrious effect of social support during the transition to adulthood. Social support had a direct negative association with abnormal Pap results, despite a multiyear lag between measurements. This suggests that social support is an enduring social resource, which may be especially vital during key developmental transitional periods. Moreover, we found social support reduced the overall effects of cigarette use for predicting subsequent abnormal Pap results by partially compensating for the negative effect of smoking.

Limitations

Several study limitations should be acknowledged. First, our predictors were based on self-report, which may introduce some measurement bias, especially for sensitive questions such as sexual risk behaviors, alcohol use, and tobacco use. We had several processes in place, however, to address these issues. Interviewers were all trained to build and maintain rapport throughout the data collection process. For sensitive questions, participants completed responses in a self-reported questionnaire placed in sealed envelopes so interviewers could not view responses.

Second, our Pap test results were also self-reported. Notably, however, researchers studying cervical cancer screening have used self-reported data and have shown that self-reports of Pap test results yielded good validity and reliability.^{80–82} Third, our study had significant missing data due to the longitudinal collection period over 18 years. Yet, our multiple imputations for missing data provided unbiased estimations as evidenced by the descriptive statistics of our study variables, which indicated similar results for imputed and original data. In addition, our results were consistent with a subsample that had complete data.

Finally, our measure of heavy drinking did not adjust for respondent sex. As defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA): “binge drinking is a pattern of drinking that brings blood alcohol concentration (BAC) levels to 0.08 g/dL. This typically occurs after four drinks for women and five drinks for men in about two hours.⁸³” One may argue that different criteria may strengthen or weaken the linkage between heavy alcohol use and other factors in our model. Yet, we used two indicators (*i.e.*, had five or more drinks in a row and drink to get high) to construct a latent factor of heavy drinking that may help minimize the potential measurement effect on our study results. Thus, our measure may have included a more stringent assessment of heavy drinking than a sex-adjusted criterion. Nevertheless, our findings suggest that future research that applies a heavy drinking criterion designed specifically for women would be useful.

Conclusions

Despite these limitations, our results contribute new evidence that violence victimization during adolescence has long-term negative effect through multiple pathways across adolescence and early adulthood. Our study also provides an initial effort to understand the mechanism by which violence victimization may affect cervical cancer risk. Our findings suggest that research on the effects of violence victimization on individuals’ psychosocial and physiological well-being throughout the life span, especially among disadvantaged populations, may help expand our understanding of cervical cancer risk and the lingering effects of violence exposure.

Our findings also provide initial evidence that violence victimization can have significant physiological effects beyond the hypothalamic–pituitary–adrenal axis. They also add to the extensive literature on the positive effects of social support by applying it to the long-term physiological effects of violence victimization. Finally, our results suggest that one strategy to prevent cervical cancer (or at least a significant risk factor for it) may be focused on the primary prevention of violence victimization and the secondary prevention of victimization’s deleterious effects through social support interventions.

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Author Disclosure Statement

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