Sociodemographic and Behavioral Factors Associated With Conduct Disorder Symptoms among Adolescents Living in Selected Urban Informal Settlements in Nairobi, Kenya: A Cross-Sectional Analysis

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ABSTRACT

Background: Conduct disorder (CD) symptoms during adolescence are associated with difficulties in social, educational, and behavioral functioning. However, evidence regarding sociodemographic and behavioral characteristics associated with CD symptoms among adolescents living in urban informal settlements in Kenya remains limited.

Objective:- This study examined sociodemographic and behavioral factors associated with conduct disorder symptom scores among adolescents living in selected urban informal settlements in Nairobi, Kenya.

Methods:- A cross-sectional analysis was conducted using baseline data from 147 adolescents participating in a larger quasi-experimental study conducted in two urban informal settlements in Nairobi. Conduct disorder symptoms were assessed using the conduct disorder component of the Conduct Disorder and Oppositional Defiance Scale (CODDS). Sociodemographic and behavioral characteristics included age, gender, current occupation, highest education level, receipt of social support, substance use, and study site. Descriptive statistics and bivariate tests were used to summarize participant characteristics. Univariable and multivariable negative binomial regression models were fitted to examine associations with conduct disorder symptom scores. Results were reported as score ratios (SRs) with 95% confidence intervals (CIs). Variance inflation factors (VIFs) were examined to assess multicollinearity.

Results:- In the multivariable model, having primary education or above was associated with lower CD symptom scores compared with having no formal education completed (adjusted SR [aSR] = 0.51, 95% CI [0.34, 0.77], p = .001). Receiving social support was also associated with lower CD symptom scores (aSR = 0.60, 95% CI [0.41, 0.85], p = .007). Substance use was associated with higher expected conduct disorder symptom scores (aSR = 2.06, 95% CI [1.45, 2.98], p < .001). Age, gender, occupation, and study site were not statistically significant. After adjustment, VIFs ranged from 1.1 to 1.8, indicating no substantial multicollinearity among the predictors.

Conclusion:- In the cross sectional analysis education level, social support, and substance use was statistically associated with CD symptoms. Further longitudinal research is needed to clarify the temporal relationships between these characteristics and conduct disorder symptoms among adolescents in urban informal settlements.

Keywords: Adolescents, conduct disorder symptoms, sociodemographic factors, substance use, social support, informal settlements, Nairobi, Kenya

INTRODUCTION

Adolescence is a critical developmental period characterized by substantial physical, psychological, and social changes. During this period, young people develop social-emotional skills, establish relationships, and develop patterns of behavior that may influence their subsequent health and functioning (World Health Organization [WHO], 2024). Mental health conditions are common during adolescence. Behavioral disorders are among the conditions that can interfere with educational, interpersonal, and social functioning. Conduct disorder (CD) is a disruptive behavioral disorder characterized by a persistent pattern of behaviors that violate the basic rights of others or major age-appropriate social norms, rules, or laws (American Psychiatric Association, 2023). CD symptoms include aggression toward people or animals, destruction of property, deceitfulness or theft, and serious violations of rules. Global evidence indicates that the prevalence of CD varies considerably across populations and settings, underscoring the importance of examining conduct disorder within specific social and cultural contexts (Ayano et al., 2024).

The development and expression of conduct disorder symptoms occur within multiple social contexts. Family relationships, peer interactions, educational experiences, social environments, and substance use may all be relevant to adolescent behavioral functioning. Chinonye et al, 2026 emphasize that adolescents' mental health is influenced by the environments in which they grow, including family, school, and community settings. Evidence from Kenya similarly demonstrates a substantial burden of adolescent mental-health difficulties and highlights the importance of social and environmental circumstances in understanding adolescent mental health (Erskine et al., 2024; Wado et al., 2022). In Nairobi, previous research has documented conduct disorder among adolescents in secondary-school settings, demonstrating that conduct disorder is a relevant behavioral-health concern within the local context (Gitonga et al., 2017; Mbiriri, 2021).

Adolescents living in urban informal settlements may experience multiple and overlapping social and environmental challenges. These may include poverty, exposure to violence, adverse life events, educational disadvantage, family instability, and limited access to appropriate mental-health services. Research conducted among adolescent girls living in Nairobi informal settlements, for example, has documented associations between exposure to violence, adverse life events, and mental-health difficulties (Wado et al., 2022). Such contextual circumstances support the need to examine adolescent behavioral symptoms within the environments in which adolescents live rather than considering individual characteristics in isolation.

Sociodemographic factors such as level of formal education may be relevant to adolescent behavioral functioning because schools provide structured environments for learning, social interaction, development of interpersonal skills, and engagement with supportive adults (Getahun, 2026). Gitonga et al, (2017) highlighted the relevance of school-related factors in understanding conduct-related difficulties. Social support may similarly be associated with adolescent behavioral functioning. Supportive relationships within families, schools, peer networks, and communities can provide emotional and practical resources during adolescence particularly in resource deprived settings. (Mbithi & Abubakar, 2023). WHO guidance emphasizes the importance of safe and supportive environments for adolescent mental health and well-being (WHO, 2025). In addition, Kenyan evidence indicates that social and environmental circumstances are relevant to adolescent mental health, particularly among young people exposed to adversity (Erskine et al., 2024; Ndungwa et al, 2011;Wado et al., 2022).

Adolescence is a period during which patterns of substance use may emerge, and early substance use is associated with subsequent health and psychosocial difficulties (Belfiore et al, 2024). Conduct-related difficulties and substance use may also co-occur during adolescence. Recent research has documented associations between conduct-disorder-related characteristics and substance use, although the direction and mechanisms underlying such relationships may vary across populations and study designs (Kuriakose et al., 2026).

Despite increasing attention to adolescent mental health in Kenya, evidence specifically examining sociodemographic and behavioral characteristics associated with conduct disorder symptom scores among adolescents living in urban informal settlements remains limited. National Kenyan evidence has demonstrated the importance of adolescent mental-health research, while earlier Nairobi studies have documented conduct disorder in school-based populations (Mbiriri, 2021;Erskine et al., 2024; Wado et al., 2022). However, findings

from school-based or nationally representative populations may not fully reflect the circumstances of adolescents living in informal settlements. Examining these associations in the local context can contribute to a more contextually grounded understanding of conduct disorder symptoms and inform areas for assessment and psychosocial intervention.

The present study examined sociodemographic and behavioral factors associated with conduct disorder symptom scores among adolescents living in selected urban informal settlements in Nairobi, Kenya. The analysis focused on age, gender, occupation, education, social support, substance use, and study site. Because the study was cross-sectional, the analysis was designed to identify statistical associations rather than establish causal relationships.

Objective

The objective of this study was to examine sociodemographic and behavioral factors associated with conduct disorder symptom scores among adolescents living in selected urban informal settlements in Nairobi, Kenya.

METHOD

Study Design

This study employed a cross-sectional analysis of baseline data obtained from a larger quasi-experimental study examining effectiveness of multisystemic therapy in reducing symptoms of conduct disorder among adolescents in selected urban informal settlements in Nairobi, Kenya. The present analysis focused specifically on sociodemographic and behavioral factors associated with conduct disorder symptom scores.

Study Setting and Participants

The study was conducted among adolescents living in two selected urban informal settlements in Nairobi County, Kenya. A total of 147 adolescents were included in the baseline analysis for a larger study to evaluate multisystemic therapy(MST in reducing conduct disorder symptoms.. Of these, 68 participants were from the control site and 79 were from the intervention site. The present analysis include all 147 participants screened for CD symptoms. This approach allowed the analysis to examine variation in conduct disorder symptom scores across the full baseline population.

Measures

Sociodemographic and Behavioral Characteristics

Information on participants' sociodemographic and behavioral characteristics was collected using a structured sociodemographic questionnaire. Variables included age, gender, current occupation, highest education level, receipt of social support, substance use, and study site. For regression analysis, the reference categories were female for gender, employed/self-employed for occupation, no formal education completed for education, no social support for social support, no substance use for substance use, and control for study site.

Conduct Disorder Symptoms

Conduct disorder symptoms were assessed using the conduct disorder component of the Conduct Disorder and Oppositional Defiance Scale (CODDS). The CODDS is a symptom-screening instrument used to assess conduct-disorder (CD) and oppositional defiant disorder (ODD) symptoms among adolescents. The instrument comprises 26 items, with items 1–9 assessing ODD symptoms and items 10–26 assessing CD symptoms. Responses are scored according to the specified response categories, with higher scores indicating greater severity of conduct-related behavioral problems. In this study, a CD score of ≥4.5 was used as the study-defined cut-off for a positive screen for conduct-disorder For the present analysis, the conduct disorder symptom score was used as the outcome variable. Thus, the findings describe factors associated with variation in conduct disorder symptoms.

Data Analysis

Data was analyzed using R statistical software. Descriptive statistics were used to summarize participant characteristics. Continuous variables were summarized using medians and interquartile ranges (IQRs), while categorical variables were summarized using frequencies and percentages. The Wilcoxon rank-sum test was used to compare continuous variables between the Control and the intervention sites, while Pearson's chi-square test was used to compare categorical variables.

Because the conduct disorder symptom score was a count-type outcome, negative binomial regression was used to examine associations between the symptom score and the explanatory variables. Univariable negative binomial regression models were initially fitted for each explanatory variable. A multivariable negative binomial regression model was then fitted including age, gender, current occupation, highest education level, receipt of social support, substance use, and study site. Results from the regression models were presented as score ratios (SRs) with corresponding 95% confidence intervals (CIs). An SR below 1 indicated a lower expected conduct disorder symptom score relative to the reference category, whereas an SR above 1 indicated a higher expected score.

Variance inflation factors (VIFs) were examined to assess multicollinearity among predictors. Model fit was assessed using the likelihood-ratio test and information criteria, including the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Statistical significance was assessed at $p < .05$. The multivariable analysis included 147 observations. Missing data were assessed before analysis, and the reported model was based on the observations available for all variables included in the model.

RESULTS

Characteristics of study participants

A total of 147 adolescents were included in the analysis, comprising 68 participants from the control and 79 from the intervention site. The median age was 16 years in both sites. There was no statistically significant difference in age between the two sites, $p = .600$.There was a statistically significant difference in gender distribution between the two sites, likelihood ratio x^2 (7) = 39.05, $p<0.001$. The control site had a higher proportion of female participants, whereas Intervention site had a higher proportion of male participants.

There were no statistically significant differences between the two sites in current occupation, education level completed, receiving social support, substance use, or conduct disorder symptom scores. The median conduct disorder symptom score was 8.00 (IQR = 2.00–12.00) in the control site and 4.00 (IQR = 2.00–13.00) in the intervention site, $p = .876$.

Table 1 Characteristics of Study Participants by Study Site

Characteristic	**Control n = 68**	**Intervention n = 79**	***p***
Age, median (Q1, Q3)	16.00 (15.0, 17.0)	16.00 (14.0, 18.0)	.600
Gender, n (%)			< .001
Female	55 (80.9)	30 (38.0)	
Male	13 (19.1)	49 (62.0)	
Current occupation, n (%)			.618
Employed/self-employed	17 (25.0)	17 (21.5)	
Student	51 (75.0)	62 (78.5)	

Highest education, n (%)			.195
None	23 (33.8)	35 (44.3)	
Primary or above	45 (66.2)	44 (55.7)	
Receives social support, n (%)			.631
No	16 (23.5)	16 (20.3)	
Yes	52 (76.5)	63 (79.7)	
Substance use, n (%)			.775
No	53 (77.9)	60 (75.9)	
Yes	15 (22.1)	19 (24.1)	
Conduct disorder symptom score, median (Q1, Q3)	8.00 (2.0, 12.0)	4.00 (2.0, 13.0)	.876

Note. Q1 = first quartile; Q3 = third quartile. Wilcoxon rank-sum test was used for continuous variables and Pearson's chi-square test for categorical variables.

Univariable associations with Conduct Disorder symptom cores

Univariable negative binomial regression was conducted for each explanatory variable. Education, social support, and substance use were statistically significantly associated with conduct disorder symptom scores. Participants with primary education or above had a lower CD symptom score than participants with no completed formal education (SR = 0.56, 95% CI [0.40, 0.78], $p < .001$). Participants who reported receiving social support also had lower expected symptom scores than those who did not report receiving social support (SR = 0.54, 95% CI [0.36, 0.79], $p = .002$).

In contrast, participants who reported substance use had higher expected conduct disorder symptom scores than those who did not report substance use (SR = 2.16, 95% CI [1.50, 3.17], $p < .001$).Age, gender, occupation, and study site were not statistically significantly associated with conduct disorder symptom scores in the univariable analyses.

Table 2:- Univariable Negative Binomial Regression of Factors Associated With Conduct Disorder Symptom Scores

Predictor	**Reference category**	**SR**	**95% CI**	***p***
Age	—	0.97	[0.88, 1.06]	.510
Gender: Male	Female	0.94	[0.67, 1.34]	.745
Occupation: Student	Employed/self-employed	0.85	[0.56, 1.25]	.413
Education: Primary or above	None	0.56	[0.40, 0.78]	< .001
Social support: Yes	No	0.54	[0.36, 0.79]	.002
Substance use: Yes	No	2.16	[1.50, 3.17]	< .001
Study				

Note. CI = confidence interval; SR = score ratio.

Multivariable associations with CD symptom scores

In the multivariable negative binomial regression model, education level, social support, and substance use remained significantly associated with CD symptom scores after adjustment for age, gender, occupation, and study site. Participants with primary education or above had approximately half CD symptom score compared to participants with no completed formal education (adjusted SR = 0.51, 95% CI [0.34, 0.77], p = .001). Participants who reported receiving social support had lower expected CD symptom scores than those who reported no social support (adjusted SR = 0.60, 95% CI [0.41, 0.85], p = .007). Participants who reported substance use had approximately twice the expected CD symptom score of those who reported no substance use (adjusted SR = 2.06, 95% CI [1.45, 2.98], p < .001).

Age (adjusted SR = 1.01, 95% CI [0.91, 1.13], p = .811), male gender (adjusted SR = 0.86, 95% CI [0.60, 1.22], p = .375), student occupation (adjusted SR = 1.34, 95% CI [0.88, 2.05], p = .184), and the intervention site (adjusted SR = 0.89, 95% CI [0.63, 1.26], p = .501) were not statistically significantly associated with CD symptom scores.

The model included all 147 observations. The likelihood-ratio test indicated that the fitted model provided a statistically significant improvement over the intercept-only model, $\chi^2(7) = 39.05$, p < .001. The log-likelihood was −442.10, with an AIC of 902.0 and BIC of 929.0. VIFs ranged from 1.1 to 1.8, indicating no evidence of problematic multicollinearity.

Table 3 Multivariable negative binomial regression of factors associated with CD symptom scores

Characteristic	**Adjusted score ratio (95% CI)**	***p***	**VIF**
Age	1.01 (0.91–1.13)	.811	1.8
Gender			1.3
Female	Reference		
Male	0.86 (0.60–1.22)	.375	
Current occupation			1.5
Employed/self-employed	Reference		
Student	1.34 (0.88–2.05)	.184	
Highest education level			1.7
None	Reference		
Primary or above	0.51 (0.34–0.77)	.001	
Receives social support			1.1
No	Reference		
Yes	0.60 (0.41–0.85)	.007	
Substance use			1.2

No	Reference		
Yes	2.06 (1.45–2.98)	<.001	
Study site			1.2
Control	Reference		
Intervention	0.89 (0.63–1.26)	.501	

Note. CI = confidence interval; VIF = variance inflation factor. Model based on n = 147 observations; log-likelihood = −442.10; AIC = 902.0; BIC = 929.0; likelihood-ratio $\chi^2(7) = 39.05$, $p < .001$.

DISCUSSION

This study examined sociodemographic and behavioral characteristics associated with conduct disorder symptom scores among 147 adolescents living in two selected urban informal settlements in Nairobi. In the adjusted negative binomial model, education level, reported social support, and substance use were significantly associated with CD symptom scores. Age, gender, occupation, and study site were not statistically significantly associated with the outcome after adjustment. Education was significantly associated with CD symptom scores. Participants with primary education or above had a lower expected symptom score than those with no formal education. This finding may reflect the relevance of continued engagement with education to adolescent behavioral functioning, although the cross-sectional design does not permit determination of the direction or mechanism of this association. Educational engagement may also be related to other unmeasured social and family characteristics that were not examined in the present analysis.

Reported social support was also associated with lower CD symptom scores. Adolescents who reported receiving social support had lower expected symptom scores than those who did not. Social support may provide interpersonal resources that are relevant to adolescent behavioral adjustment. However, because social support and CD symptoms were measured at the same time, the finding should be interpreted as an association rather than evidence that social support reduces conduct disorder symptoms. Substance use demonstrated the strongest positive association in the adjusted model. Adolescents reporting substance use had approximately twice the expected CD symptom score compared with those reporting no substance use. This finding is consistent with literature describing an association between substance use and externalizing behavioral symptoms among adolescents. Nevertheless, the cross-sectional design prevents establishing whether substance use preceded, followed, or developed concurrently with conduct-related symptoms. The association may also reflect shared underlying social or behavioral factors.

Gender was significantly different between the two study sites descriptively, with a greater proportion of male participants in the intervention site and a greater proportion of female participants in the control site. However, gender was not significantly associated with CD symptom scores after adjustment. Similarly, the absence of a statistically significant association between study site and CD symptom scores suggests that the observed differences in symptom scores were not explained by site after adjustment for the characteristics included in the model. This finding should nevertheless be interpreted cautiously because the study involved only two sites and therefore provides limited information about variation across other informal settlements.

Age and occupation were also not statistically significantly associated with CD symptom scores in the adjusted analysis. The absence of statistical significance should not be interpreted as evidence that these characteristics have no relationship with conduct-related symptoms in other populations. Rather, it indicates that this study did not detect statistically significant associations after accounting for the variables included in the model. The relatively low VIF values provide no indication of problematic multicollinearity among the predictors. This supports interpretation of the adjusted associations as estimates obtained from a model without substantial overlap among the included explanatory variables.

Limitations

These limitations should be considered when interpreting these findings.

First, the cross-sectional nature of the analysis prevents conclusions regarding temporality or causality. In particular, the associations involving substance use, social support, and education cannot establish whether these characteristics preceded or followed conduct disorder symptoms. Second, the study was conducted in selected urban informal settlements in Nairobi, and the findings may not be generalizable to adolescents in other geographical or socioeconomic settings.

Third, the study involved two sites only. Although study site was included as a covariate in the regression model, the design does not provide sufficient clusters to support a robust multi-level estimation of between-site variation. Finally, the CODDS was used as a measure of conduct disorder symptoms and screening status rather than as a substitute for a comprehensive clinical diagnostic assessment. Accordingly, the findings should be interpreted in relation to symptom scores and should not be taken as estimates of clinically confirmed conduct disorder.

CONCLUSION

Among adolescents living in the two selected urban informal settlements in Nairobi, education, social support, and substance use were statistically associated with CD symptom scores after adjustment for age, gender, occupation, and study site. Adolescents with primary education or higher and those reporting social support had lower symptom scores, while those reporting substance use had higher symptom scores.

These findings indicate that conduct-related symptoms among adolescents may be considered within their broader educational, social, and behavioral contexts. Further longitudinal research involving larger and more diverse populations is needed to clarify the temporal relationships among educational participation, social support, substance use, and conduct-related symptoms.

RECOMMENDATIONS

Based on the findings of this study, the authors recommend that future research should use longitudinal designs to examine temporal relationships between substance use, educational engagement, social support, and conduct disorder symptoms; include multiple study sites and larger samples to improve the ability to examine contextual and geographical variation and further investigate the relationship between substance use and conduct disorder symptoms, including the type, frequency, and timing of substance use.

Declarations

Ethical Approval

Ethical approval for the larger study was obtained from the Daystar University Institutional Scientific and Ethics Review Committee (DU/ISERC-2026/00002G), with research authorization from the National Commission for Science, Technology and Innovation (NACOSTI). Participation was voluntary, and we followed appropriate informed consent and adolescent assent procedures in accordance with the approved study protocol.

Data Availability

The data supporting the findings of this study are not publicly available because of ethical and confidentiality considerations but may be made available from the corresponding author upon reasonable request and subject to applicable ethical requirements.

Author contributions

Judith Osok (JO) conceptualized,conducted the study, and manuscript preparation. The co-authors Dr. Caroline Mrukunga (CM) and Dr. Roseline Olumbe (RO) contributed to supervision, methodological guidance,

interpretation of findings, and critical review of the manuscript. All authors reviewed and approved the final manuscript

Conflict of Interest

The authors declare no conflict of interest.

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