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From Interpersonal Vulnerability to Behavioral Risk: A Multilevel Model of Adolescent Suicide Attempts in a School-Based Population

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Abstract
Adolescent suicide attempts represent a critical public health concern shaped by interacting behavioral, interpersonal, and institutional risk factors. This study examined multilevel determinants of suicide attempts among 30,226 secondary school adolescents in the Northern Samar Division of the Philippines using a quantitative cross-sectional design aligned with the World Health Organization (WHO) Global School-based Student Health Survey (GSHS) framework [1]. Data were collected through an anonymous structured online survey assessing substance use, dietary behaviors, peer and family connectedness, school engagement, lifestyle regulation, and bullying victimization. Hierarchical binomial logistic regression was conducted to estimate adjusted associations, with model performance evaluated using deviance statistics, pseudo-R^2, and area under the receiver operating characteristic (ROC) curve. Suicide attempts were reported by 14.10% of respondents. The final model demonstrated strong explanatory capacity (Nagelkerke R^2 = .259) and good discrimination (AUC = .795), with overall classification accuracy of 75.3%. Substance-related variables showed significant associations, particularly lifetime cannabis use (OR = 5.56, $p < .001$), frequent alcohol use (OR = 1.85, $p < .001$), and high sugar-sweetened beverage consumption (OR = 1.81, $p < .001$). Relational factors were among the strongest predictors, with adolescents reporting rare or no parental understanding showing nearly threefold increased odds (OR 3.0, $p < .001$). Lifestyle dysregulation variables, including short sleep duration (<5 hours; OR = 1.93, $p < .001$) and high sedentary time (OR = 1.68, $p < .001$), were also significant. Bullying victimization, particularly cyberbullying (OR = 2.19, $p < .001$), independently predicted suicide attempts. These findings support an integrated vulnerability model in which substance exposure, relational disconnection, behavioral dysregulation, and victimization jointly elevate suicide risk. Multicomponent school-based prevention strategies addressing these domains are essential for reducing adolescent suicide attempts.

Keywords: *adolescent suicide attempts; school-based mental health; bullying victimization; substance use; parental connectedness; hierarchical logistic regression.*

1. Introduction

Suicide remains a major global public health concern, with more than 720,000 deaths annually, and it ranks among the leading causes of death in adolescents and young adults [2]. For every suicide death, there are many more attempts, and a prior attempt is one of the strongest predictors of future suicide mortality [2]. Adolescents in low- and middle-income countries (LMICs) bear a disproportionate burden, accounting for nearly three-quarters of global suicide deaths [2]. Within this context, population-based surveillance platforms such as the Global School-based Student Health Survey (GSHS) provide essential epidemiological infrastructure for identifying modifiable behavioral and psychosocial determinants of suicide attempts in school-attending youth [1]. The GSHS was designed to assess clustered health-risk behaviors among adolescents across multiple domains—including substance use, violence and injury, sedentary behavior, physical activity, social support, and mental health—using standardized school-based sampling [1]. Analyses of GSHS data from diverse LMIC settings consistently demonstrate that suicidal ideation and attempts co-occur with bullying, loneliness, substance use, physical fighting, and reduced parental or peer support [3, 4]. Using Nepal GSHS data, Pandey et al. [3] found that loneliness, bullying victimization, and alcohol use were significantly associated with suicide attempts among adolescents. A multi-country Southeast Asian GSHS analysis similarly reported that being female, bullied, seriously injured, physically fighting, lonely, and highly sedentary were associated with suicidal behaviors, while parental and peer support demonstrated protective effects [4]. These findings reinforce the need for multilevel modeling approaches that capture co-occurring behavioral and relational risks rather than examining single exposures in isolation. Theoretically, suicide attempts in adolescence are best understood within integrated vulnerability frameworks. The Interpersonal Theory of Suicide posits that suicidal behavior occurs when thwarted belongingness and perceived burdensomeness co-exist with acquired capability for self-harm [5]. Acquired capability develops through repeated exposure to painful and provocative experiences, leading to increased pain tolerance and fearlessness about death [5]. Bullying victimization, physical injury, and substance use may plausibly contribute to this process by increasing exposure to fear-inducing or pain-related experiences. Complementing this model, the stress–diathesis framework conceptualizes suicidal behavior as the product of stressors activating underlying biological or psychological vulnerabilities [6]. In this framework, distal vulnerabilities (e.g., emotional dysregulation, impulsivity) interact with proximal stressors (e.g., bullying, conflict, academic strain) to precipitate suicidal behavior. Empirical evidence increasingly supports the central role of relational connectedness within these frameworks. School connectedness has been shown to moderate the association between mental health symptoms and suicide attempts in early adolescents, with stronger connectedness attenuating risk even in the presence of depressive or aggressive symptoms [7]. Analysis of Argentina's 2018 GSHS data demonstrated that school, parental, and peer connectedness significantly mitigated the association between bullying victimization and suicidal behaviors [8]. These findings align with the belongingness component of the Interpersonal Theory of Suicide and suggest that connectedness operates not merely as a correlate but as a buffering mechanism. Large-scale surveillance data from high-income settings reinforce that suicide attempts among adolescents are shaped by interacting interpersonal, behavioral, and institutional factors. In the United States, the 2023 Youth Risk Behavior Survey reported that 9.5% of high school students had attempted suicide in the preceding 12 months, with higher prevalence among female students and sexual minority youth [9]. School connectedness, parental monitoring, and supportive environments were consistently associated with lower prevalence of suicide attempts across demographic groups [9]. Cross-national analyses from the Health Behaviour in School-aged Children (HBSC) study show that suicide attempts remain a significant concern across multiple European countries, with strong associations observed between attempts and bullying victimization, loneliness, substance use, and low family support [10, 11]. In Nordic and Western European cohorts, school connectedness and parental communication have been repeatedly identified as protective against suicide attempts even after adjusting for depressive symptoms and socioeconomic factors [11, 12]. In Asia, adolescent suicide attempts are similarly embedded within relational and behavioral risk clusters. Multi-country analyses using WHO-GSHS data across South and Southeast Asia report 12-month suicide attempt prevalence ranging between 3% and 13%, with consistent associations between attempts and bullying, physical injury, substance use, loneliness, and sedentary behavior [3, 4]. A regional analysis of eight Southeast Asian countries found that being bullied, seriously injured, physically fighting, and reporting low parental support were significantly associated with suicide attempts, while peer and family connectedness demonstrated protective effects [4]. These findings are consistent with emerging data from East Asian settings showing that interper-

sonal stressors and academic pressure interact with behavioral dysregulation to elevate suicide attempt risk among adolescents [13]. In the Philippine context, adolescent suicide represents a persistently documented public health emergency. National data indicate that 404 students died by suicide during the 2021–2022 school year, with 2,147 additional suicide attempts recorded within the same period [14]. The Philippine Department of Education reported nine suicide deaths among students in the Northern Samar Division in calendar year 2025. Philippine-specific studies using GSHS and community-based datasets consistently identify behavioral, interpersonal, and institutional risk factors as central contributors to adolescent suicide attempts [15, 16]. The critical shortage of school guidance counselors—with a documented ratio of one counselor per 13,400 students in public schools, far below the recommended 1:500 ratio [17]—substantially constrains the institutional capacity for early identification and intervention, compounding existing structural vulnerabilities. Accordingly, the present study applied a multilevel analytic framework aligned with WHO-GSHS domains to examine determinants of suicide attempts among school-attending adolescents. Guided by the Interpersonal Theory of Suicide [5] and the stress–diathesis model [6], this study tested whether substance and dietary behaviors, peer and family connectedness, bullying victimization, physical injury, sedentary behavior, sleep duration, physical activity, and school engagement independently and jointly predict suicide attempts. By integrating these domains within a single hierarchical logistic regression framework, the study aimed to provide theory-informed, surveillance-driven evidence to support comprehensive school-based suicide prevention strategies in the Philippines and comparable LMIC settings.

2. Methodology

2.1 Study Design

This study employed a quantitative, cross-sectional analytic design to examine factors associated with suicide attempts among school-attending adolescents. Data were collected through a structured online survey administered to secondary school students in the Northern Samar Division of the Department of Education, Philippines. The survey instrument was aligned with the GSHS core modules to ensure standardized measurement of health behaviors, interpersonal connectedness, school engagement, lifestyle practices, and bullying experiences [1]. The analysis focused exclusively on suicide attempts within the past 12 months as the dependent variable and examined predictors included in the final fully adjusted multivariable model (Model 5).

2.2 Participants and Data Collection

Participants were adolescents enrolled in Grades 7 to 12 in participating secondary schools. The survey was administered electronically through a secure online platform during scheduled school hours. Students completed the questionnaire using school-provided or personal digital devices under teacher supervision. Participation was voluntary and anonymous. The sample comprised both male and female students across early to late adolescence (approximately ages 12 to 20 years), with representation from rural (barangay) and urban (town proper) schools across Grades 7 through 12. Both regular students and those with alternative enrollment histories (e.g., repeater, balik-aral) were included in the final sample of N = 30,226.

2.3 Measures

Dependent Variable Suicide attempts were assessed using the standardized GSHS mental health module item: "During the past 12 months, how many times did you actually attempt suicide?" [1]. Responses were dichotomized for analysis (0 = no attempt; 1 = at least one attempt), consistent with the analytic approach used in prior Philippine GSHS studies [15, 16].

Independent Variables Independent variables were grouped into five conceptual domains based on the final regression model. All items were drawn from standardized GSHS questionnaire modules [1]:

1. **Substance and Dietary Behaviors:** Alcohol use (past 30 days), lifetime episodes of drunkenness, sugar-sweetened beverage consumption (past 7 days), and lifetime cannabis use.
2. **Peer and Family Connectedness:** Number of close friends and parental or guardian understanding of problems and worries (past 30 days).
3. **School Engagement:** Missed classes without permission (past 30 days) and Physical Education (PE) attendance frequency.
4. **Physical Activity and Lifestyle Regulation:** Days physically active for at least 60 minutes (past 7 days), daily sedentary time outside of schoolwork and sleep, and average nightly sleep duration.
5. **Bullying and Victimization:** Serious injury due to bullying (past 12 months), bullying on school property (past 12 months), and cyberbullying (past 12 months).

2.4 Statistical Analysis

Data were cleaned and screened prior to analysis. Descriptive statistics were computed to summarize respondent profiles and the distribution of suicide attempts and all predictors. Weighted prevalence estimates were calculated where applicable to reflect the complex two-stage cluster sample design of the GSHS and to produce population-representative estimates for school-attending adolescents [1]. Binomial logistic regression analysis was conducted to estimate the adjusted associations between independent variables and suicide attempts [18]. A hierarchical modeling approach was applied, culminating in Model 5, the fully adjusted model including all behavioral, interpersonal, school-related, lifestyle, and bullying variables simultaneously, consistent with the multilevel analytic strategy used in prior GSHS-based studies of adolescent suicide attempts [19, 20]. Estimates were reported as log-odds coefficients and converted to adjusted odds ratios (AORs) with 95% confidence intervals. Statistical significance was set at $p < .05$. Model fit was evaluated using deviance statistics, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and pseudo-R^2 measures [18].

2.5 Ethical Considerations

The study adhered to ethical standards for research involving minors and was aligned with GSHS data use policies, which mandate voluntary participation, anonymity, and protection of respondent privacy [1]. Institutional approval was secured before data collection. Participation was voluntary, responses were anonymous, and no personally identifying information was collected. Students were informed of the sensitive nature of suicide-related questions and were provided information on available school counseling and support services, consistent with ethical guidelines for school-based suicide research involving adolescents [21].

3. Results

A hierarchical binomial logistic regression analysis was conducted to examine factors associated with suicide attempts among 30,226 adolescents. Suicide attempts were reported by 14.10% of respondents.

3.1 Hierarchical Model Fit

Model fit was evaluated using deviance, AIC, BIC, McFadden's pseudo-R^2 (R^2McF), Nagelkerke's pseudo-R^2 (R^2N), and the omnibus likelihood ratio chi-square test [18]. All analyses were conducted on a weighted sample of N = 30,226. As presented in Table 2, all five models were statistically significant (all $p < .001$), and each successive model demonstrated improved fit over its predecessor. Model 1 (substance and dietary behaviors) yielded R^2McF = .092, R^2N = .129, $^2(14) = 2{,}258.704$. Model 2 (peer and family connectedness added) improved to R^2McF = .131, R^2N = .182, $^2(21) = 3{,}225.496$. Model 3 (school engagement added) yielded R^2McF = .140, R^2N = .193, $^2(32) = 3{,}444.058$. Model 4 (physical activity and lifestyle regulation added) yielded R^2McF = .159, R^2N = .218, $^2(40) = 3{,}905.890$. The fully adjusted Model 5 (bullying and victimization added) achieved the strongest fit: deviance = 19,878.90, AIC = 19,978.90, BIC = 20,394.72, R^2McF = .192, R^2N = .259, $^2(49) = 4{,}711.930$, $p < .001$. AIC and BIC declined monotonically from Model 1 to Model 5, confirming that each additional domain improved predictive parsimony beyond the cost of added parameters [18].

Table 1. Sociodemographic Profile of Study Participants (N = 30,226)

Characteristic	Frequency	% of Total
School Location		
Rural (Barangay)	20,928	69.20%
Urban (Town proper)	9,298	30.80%
Total	**30,226**	**100%**
Grade Level		
Grade 12	2,784	9.20%
Grade 11	2,128	7.00%
Grade 10	6,720	22.20%
Grade 9	5,661	18.70%
Grade 8	6,177	20.40%
Grade 7	6,756	22.40%
Total	**25,314**	**100%**
Sex		
Female	17,639	58.40%
Male	12,587	41.60%
Total	**30,226**	**100%**
Age Group		
20 and above	227	0.80%
18–19	1,504	5.00%
16–17	7,192	23.80%
14–15	13,032	43.10%
12–13	8,271	27.40%
Total	**30,226**	**100%**
4Ps Beneficiary Status		
No	17,185	56.90%
Yes	13,041	43.10%
Total	**30,226**	**100%**
Enrollment Status		
Balik-aral	547	1.80%
Regular student	29,269	96.80%
Repeater	410	1.40%
Total	**30,226**	**100%**

3.2 Sequential Model Comparisons

Sequential model comparisons were conducted using likelihood ratio chi-square difference tests to evaluate whether each additional predictor domain produced statistically significant improvement over the preceding model [18]. As presented in Table 3, all four pairwise comparisons were statistically significant (all p < .001). The addition of peer and family connectedness variables (Model 2 vs. Model 1) yielded the largest incremental improvement, $^{2}(7) = 966.792$, p < .001, followed by the addition of bullying and victimization variables (Model 5 vs. Model 4), $^{2}(9) = 806.039$, p < .001.

3.3 Omnibus Likelihood Ratio Tests

Omnibus likelihood ratio tests were computed for each predictor in the fully adjusted model to assess its independent contribution after controlling for all other variables [18]. As shown in Table 4, all 14 predictors were statistically significant (all p .002). Among substance and dietary behavior predictors, lifetime cannabis use demonstrated the strongest association, $^{2}(3) = 435.829$, p < .001. Among relational predictors, parental or guardian understanding produced the largest chi-square value in the entire model, $^{2}(4) = 547.900$, p < .001. Sleep duration ranked third overall, $^{2}(4) = 276.431$, p < .001. Among victimization predictors, cyberbullying produced the strongest association, $^{2}(3) = 211.264$, p < .001.

3.4 Classification Performance and Predictive Accuracy

At the optimal cut-off of 0.15—the point of sensitivity–specificity intersection—the final model achieved overall accuracy of .753, specificity of .766, and sensitivity of .670 (Table 5). The sub-default cut-off is methodologically justified: when outcome prevalence is low to moderate, the conventional 0.50 threshold systematically underclassifies attempters by concentrating predicted probabilities below that boundary [18].

The ROC curve (Figure 2) showed clear separation from the diagonal reference line, and the AUC was .795. By established benchmarks, AUC values between .70 and .80 indicate acceptable discrimination and values .80 indicate excellent discrimination [18], placing the final model at the upper boundary of acceptable and approaching excellent predictive performance.

3.5 Logistic Regression Estimates by Predictor Domain

3.5.1 Substance and Dietary Behaviors

Substance-related variables showed strong associations with suicide attempts (Table 6). Compared with non-drinkers, adolescents who consumed alcohol on 10 or more days in the past month had significantly higher odds of suicide attempts (OR = 1.85, p < .001). Lifetime drunkenness of 10 or more episodes was associated with elevated odds (OR = 1.88, p = .001). Cannabis use exhibited the strongest substance-related association; adolescents reporting 10 or more lifetime uses had more than fivefold increased odds (OR = 5.56, p < .001). Frequent consumption of sugar-sweetened beverages was also associated with increased odds in a graded pattern, with those drinking three or more times per day showing 1.81 times higher odds (p < .001).

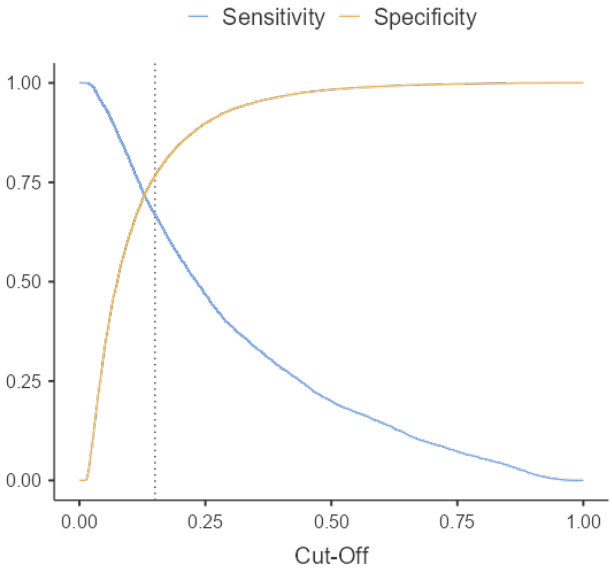

Figure 1. Optimal Cut-Off Plot

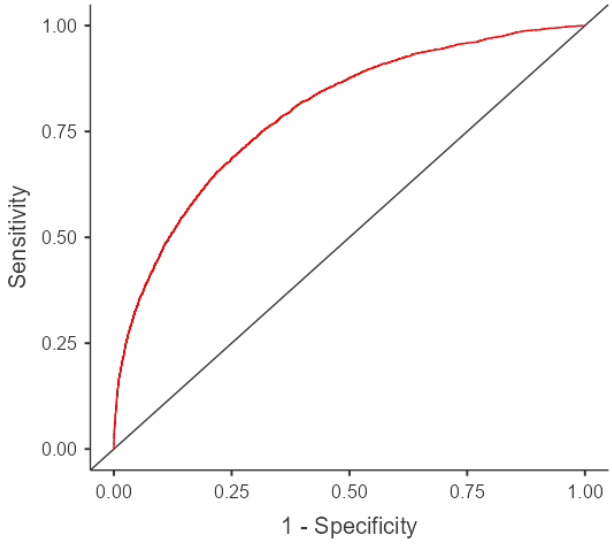

Figure 2. Receiver Operating Characteristic (ROC) Curve

3.5.2 Peer and Family Connectedness

Relational factors demonstrated robust effects (Table 7). Adolescents with fewer close friends had elevated

Table 2. Hierarchical Model Fit Measures (N = 30,226)

Model	Deviance	AIC	BIC	R^2McF	R^2N	^{2}	df	p
1	22,332.12	22,362.12	22,486.87	0.092	0.129	2,258.70	14	<.001
2	21,365.33	21,409.33	21,592.29	0.131	0.182	3,225.50	21	<.001
3	21,146.77	21,212.77	21,487.21	0.140	0.193	3,444.06	32	<.001
4	20,684.93	20,766.93	21,107.91	0.159	0.218	3,905.89	40	<.001
5	19,878.90	19,978.90	20,394.72	0.192	0.259	4,711.93	49	<.001

Note. R^2*McF = McFadden's pseudo-*R^2*;* R^2*N = Nagelkerke's pseudo-*R^2*. All models estimated on N = 30,226.*

Table 3. Sequential Model Comparisons

Model (From)	Model (To)	^{2}	df	p
1	2	966.792	7	<.001
2	3	218.562	11	<.001
3	4	461.832	8	<.001
4	5	806.039	9	<.001

odds relative to those with three or more friends. Perceived parental understanding showed a strong gradient effect: compared with adolescents who reported always being understood by parents or guardians, those who reported rarely or never being understood had approximately threefold higher odds of suicide attempts (ORs 3.0, p < .001).

3.5.3 School Engagement

Indicators of school disengagement were associated with increased risk (Table 8). Missing school for six or more days without permission was linked to higher odds (OR = 1.33, p = .002). Lower levels of physical activity were associated with increased odds, while reduced participation in Physical Education showed modest risk elevations.

3.5.4 Lifestyle Regulation

Lifestyle regulation variables displayed clear gradients (Table 9). Greater sedentary time (5–6 or 7 hours per day) was associated with substantially higher odds (ORs = 1.68 and 1.62, respectively; both p < .001). Short sleep duration was strongly associated with suicide attempts; adolescents sleeping fewer than five hours per night had nearly twice the odds compared with those sleeping nine or more hours (OR = 1.93, p < .001).

3.5.5 Bullying and Victimization

Victimization variables were independently associated with suicide attempts (Table 10). Being bullied on school property six or more times was associated with 1.70 times higher odds (p < .001), while frequent online bullying (six or more times) was associated with more than doubled odds (OR = 2.19, p < .001). Experiencing serious injury due to bullying four or more times was also significantly associated with increased odds (OR = 1.42, p < .001).

4. Discussion

4.1 Model Performance and Predictive Adequacy

The hierarchical logistic regression results support the utility of a multilevel framework for examining adolescent suicide attempts. Sequential model comparisons confirmed that each predictor domain contributed statistically significant incremental fit beyond prior specifications (all p < .001), and the fully adjusted Model 5 achieved the strongest overall specification across all indices. The monotonically declining AIC and BIC across all five transitions confirm that successive improvements reflected genuine explanatory increments rather than overfitting [18]. The R^2McF of .192 approaches the .20 threshold indicative of excellent fit in logistic regression [22], and the complementary R^2N of .259 further reflects meaningful explanatory gain; both values are consistent with those reported in comparable multilevel GSHS-based analyses of adolescent suicide attempts [19, 20, 23].

The largest incremental improvement was produced by the relational connectedness domain (^{2}(7) = 966.792), underscoring the centrality of parental and peer support as protective factors—consistent with the Interpersonal Theory of Suicide [5] and GSHS-based evidence that relational connectedness is among the strongest modifiable determinants of adolescent suicide attempt risk [19, 20, 24]. The victimization domain produced the second-largest increment (^{2}(9) = 806.039), reflecting the well-documented role of bullying and interpersonal violence in elevating risk through cumulative psychological distress [23, 15]. Lifestyle regulation contributed substantially (^{2}(8) = 461.832), consistent with evidence that sleep and sedentary behavior independently predict suicidal outcomes [23], while school engagement yielded the smallest but still significant increment (^{2}(11) = 218.562) [20, 17].

The AUC of .795 provides the most robust, threshold-independent indicator of discriminative performance. By established benchmarks, this approaches the ex-

Table 4. Omnibus Likelihood Ratio Tests for Fully Adjusted Model (Model 5)

Predictor	^{2}	df	p
Alcohol use (past 30 days)	33.925	4	<.001
Lifetime drunkenness	59.934	3	<.001
Sugar-sweetened beverage consumption (past 7 days)	76.463	4	<.001
Lifetime cannabis use	435.829	3	<.001
Number of close friends	107.220	3	<.001
Parental or guardian understanding of problems and worries	547.900	4	<.001
Missed classes without permission (past 30 days)	32.745	3	<.001
Days physically active for 60 minutes (past 7 days)	73.589	4	<.001
Physical Education (PE) attendance frequency	17.073	4	0.002
Daily sedentary time (outside schoolwork and sleep)	109.350	4	<.001
Average nightly sleep duration	276.431	4	<.001
Serious injury due to bullying (past 12 months)	58.114	3	<.001
Bullying on school property (past 12 months)	69.715	3	<.001
Cyberbullying (past 12 months)	211.264	3	<.001

Table 5. Classification Performance of the Final Model (Cut-off = 0.15)

Accuracy	Specificity	Sensitivity	AUC
0.753	0.766	0.670	0.795

Note. AUC = area under the ROC curve. Cut-off value set to 0.15 (sensitivity–specificity intersection).

cellent discrimination threshold of .80 [18], and is consistent with the classification capacity typical of population-level behavioral surveillance models [19, 20]. A sensitivity of .670 at the 0.15 threshold means approximately one-third of true attempters would be missed, underscoring that the model is suited for population-level epidemiological inference rather than individual-level clinical screening.

4.2 Multiple Factors Associated with Suicide Attempts among Adolescents

The findings collectively indicate that multiple behavioral, relational, school engagement, lifestyle, and victimization factors are associated with suicide attempts among adolescents. These results extend a substantial body of international and regional evidence demonstrating that adolescent suicidal behavior is not a unidimensional phenomenon but arises from the convergence of interacting risk and protective factors across behavioral and psychosocial domains [25, 26, 27, 28]. In the Philippines, suicide attempts among school-attending adolescents represent a persistently documented concern, with national data showing stable and elevated prevalence across successive survey cohorts [29, 30]. Philippine-specific studies consistently identify behavioral, interpersonal, and institutional risk factors as central contributors to adolescent suicide attempts [16, 31], underscoring the need for evidence-based, school-embedded prevention frameworks adapted to the local context [17, 32, 21]. Liu et al. [33] further demonstrated through a systematic review and meta-analysis that suicide and nonsuicidal self-injury in children and adolescents share common behavioral and psychosocial correlates, supporting the use of integrated multilevel frameworks in both research and prevention. Substance use behaviors were strongly associated with increased suicide attempt risk. Alcohol exposure was linked to higher odds of suicide attempts, consistent with evidence that alcohol consumption impairs emotional regulation, increases impulsivity, and weakens behavioral control among adolescents [20, 16]. Multi-country analyses using GSHS data similarly demonstrate that alcohol use is significantly associated with suicide attempts, particularly at higher exposure levels [19, 34]. Cannabis use showed a particularly strong relationship with suicide attempts, consistent with regional and Philippine evidence identifying cannabis exposure as an important behavioral predictor of suicidal behavior [20, 16]. These patterns can be interpreted through the stress–diathesis framework, which explains that suicidal behavior results from the interaction between underlying vulnerabilities and environmental stressors, with substance use functioning as both a maladaptive coping mechanism and a disinhibiting factor [6]. Family-based longitudinal research further demonstrates that substance abuse disorders, alongside mental health conditions and adverse family environments, constitute some of the most robust predictors of early-onset suicidal behavior [35, 36]. The association between frequent sugar-sweetened beverage consumption and suicide attempts may reflect broader behavioral risk clustering among adolescents, as unhealthy dietary behaviors often co-occur with substance use, psychological distress, and other health-risk behaviors [1, 20]. Beyond behavioral exposures, relational connectedness

Table 6. Adjusted Odds Ratios for Substance Use and Dietary Behaviors

Predictor	Category	OR	95% CI	p
Alcohol use (past 30 days)				
	(Reference: 0 days)			
	1–2 days	1.37	[0.97, 1.95]	0.076
	3–5 days	1.24	[0.83, 1.86]	0.293
	6–9 days	1.45	[0.85, 2.49]	0.176
	10+ days	1.85*	[1.31, 2.62]	<.001
Lifetime drunkenness				
	(Reference: 0 times)			
	1–2 times	1.28	[0.87, 1.87]	0.208
	3–9 times	1.03	[0.66, 1.51]	0.944
	10+ times	1.88*	[1.29, 2.75]	0.001
Sugar-sweetened beverages (past 7 days)				
	(Reference: Did not drink)			
	<1 time/day	1.11	[0.94, 1.30]	0.214
	1 time/day	1.26*	[1.07, 1.46]	0.002
	2 times/day	1.28*	[1.09, 1.50]	0.002
	3+ times/day	1.81*	[1.55, 2.11]	<.001
Cannabis use (lifetime)				
	(Reference: 0 times)			
	1–2 times	1.35	[0.82, 2.20]	0.237
	3–9 times	1.80	[0.98, 3.33]	0.431
	10+ times	5.56*	[3.45, 8.93]	<.001

Note. * p < .05. OR = adjusted odds ratio; CI = confidence interval.

Table 7. Adjusted Odds Ratios for Peer and Family Connectedness

Predictor	Category	OR	95% CI	p
Close friends				
	(Reference: 3 or more)			
	2 friends	1.63*	[1.33, 2.01]	<.001
	1 friend	1.13	[0.90, 1.43]	0.386
	0 friends	1.63*	[1.33, 2.01]	<.001
Parental or guardian understanding				
	(Reference: Always)			
	Most of the time	1.00	[0.85, 1.19]	0.955
	Sometimes	1.52*	[1.36, 1.71]	<.001
	Rarely	2.99*	[2.62, 3.42]	<.001
	Never	2.97*	[2.63, 3.36]	<.001

Note. * p < .05. OR = adjusted odds ratio; CI = confidence interval.

emerged as a critical factor. Limited peer relationships were associated with higher suicide attempt risk, consistent with international evidence showing that adolescents with fewer close friends experience reduced social support and increased social isolation [19, 20]. Philippine studies using GSHS datasets similarly report that weak peer connectedness is associated with higher suicide attempt risk [15, 16, 37]. Lower levels of parental understanding were strongly associated with suicide attempts, with nearly threefold increased odds among those reporting rare or no parental understanding. Previous GSHS-based analyses identify parental support as one of the most important protective factors against adolescent suicide attempts because it promotes emotional security, coping capacity, and help-seeking behavior [20, 24]. Family-based longitudinal research further demonstrates that the absence of supportive parental relationships is among the strongest interpersonal predictors of early-onset suicide attempts [36]. These findings align directly with the Interpersonal Theory of Suicide, which highlights that interpersonal disconnection and unmet belongingness needs increase vulnerability to suicidal behavior [5]. School engagement indicators showed meaningful associations with suicide attempts. Frequent truancy was associated with higher suicide attempt risk, suggesting that persistent school disengagement may weaken institutional attachment and reduce access to supportive environments. Multi-country GSHS evidence indicates that truancy is linked to higher sui-

Table 8. Adjusted Odds Ratios for School Engagement Indicators

Predictor	Category	OR	95% CI	p
Truancy (missed classes without permission)				
	(Reference: 0 days)			
	1–2 days	1.11	[0.93, 1.33]	0.255
	3–5 days	1.02	[0.81, 1.25]	0.896
	6+ days	1.33*	[1.11, 1.59]	0.002
Physical activity (past 7 days)				
	(Reference: 7 days)			
	5–6 days	0.72*	[0.61, 0.84]	<.001
	3–4 days	0.69*	[0.60, 0.79]	<.001
	1–2 days	0.73*	[0.63, 0.82]	<.001
	0 days	1.10	[0.94, 1.29]	0.218
PE attendance frequency				
	(Reference: 4+ days/week)			
	3 days/week	1.10	[0.97, 1.25]	0.144
	2 days/week	1.13*	[1.01, 1.26]	0.035
	1 day/week	1.21*	[1.10, 1.33]	<.001
	Did not attend	1.14	[0.96, 1.34]	0.136

Note. * p < .05. OR = adjusted odds ratio; CI = confidence interval.

Table 9. Adjusted Odds Ratios for Lifestyle Regulation Variables

Predictor	Category	OR	95% CI	p
Daily sedentary time (outside schoolwork/sleep)				
	(Reference: <1 hour)			
	1–2 hours	1.08	[0.95, 1.23]	0.214
	3–4 hours	1.21*	[1.07, 1.37]	0.002
	5–6 hours	1.68*	[1.48, 1.91]	<.001
	7+ hours	1.62*	[1.41, 1.86]	<.001
Average nightly sleep duration				
	(Reference: 9+ hours)			
	8 hours	1.23*	[1.08, 1.41]	0.003
	7 hours	1.01	[0.87, 1.16]	0.931
	5–6 hours	1.48*	[1.29, 1.69]	<.001
	<5 hours	1.93*	[1.67, 2.23]	<.001

Note. * p < .05. OR = adjusted odds ratio; CI = confidence interval.

cide attempt risk due to reduced adult supervision and increased exposure to psychosocial stressors [20, 24]. In the Philippine context, the severe shortage of school-based guidance counselors has been identified as a structural factor that constrains schools' capacity to identify and support students at risk [32]. In contrast, physical activity demonstrated a protective relationship, consistent with literature showing that regular physical activity contributes to emotional regulation, stress reduction, and improved psychological well-being [1]. Participation in Physical Education was also associated with lower suicide attempt risk, supporting school-based prevention frameworks emphasizing that structured school activities strengthen institutional connectedness and promote supportive peer interactions [1, 21, 17]. Lifestyle regulation factors also contributed substantially to suicide attempt risk. Prolonged sedentary behavior was associated with increased suicide attempts, consistent with evidence that excessive sedentary time contributes to psychological distress through reduced physical activity, impaired emotional regulation, and increased social isolation [1, 23]. Shorter sleep duration was strongly associated with suicide attempts; umbrella-level evidence identifies sleep disturbance as one of the most consistent lifestyle predictors of suicidal behavior because it disrupts emotional regulation, cognitive functioning, and stress response systems [23]. These findings are consistent with the stress–diathesis model, which suggests that physiological stressors such as sleep deprivation can weaken emotional resilience and increase vulnerability to suicidal behavior [6]. Victimization experiences were strongly and independently associated with suicide attempts. Repeated injury due to bullying, bullying on school property, and cyberbullying all showed significant associations. Cross-national analyses across both European and LMIC contexts consistently identify bullying victimization as a robust predic-

Table 10. Adjusted Odds Ratios for Bullying and Victimization

Predictor	Category	OR	95% CI	p
Serious injury due to bullying (past 12 months)				
	(Reference: 0 times)			
	1 time	1.02	[0.86, 1.19]	0.805
	2–3 times	1.04	[0.86, 1.26]	0.659
	4+ times	1.42*	[1.19, 1.69]	<.001
Bullied on school property (past 12 months)				
	(Reference: 0 times)			
	1–2 times	1.20*	[1.01, 1.41]	0.035
	3–5 times	1.09	[0.90, 1.32]	0.376
	6+ times	1.70*	[1.43, 2.02]	<.001
Cyberbullying (past 12 months)				
	(Reference: 0 times)			
	1–2 times	1.23*	[1.03, 1.47]	0.024
	3–5 times	1.10	[0.89, 1.36]	0.389
	6+ times	2.19*	[1.84, 2.62]	<.001

Note. * p < .05. OR = adjusted odds ratio; CI = confidence interval.

tor of suicidal behavior [38, 27]. Cyberbullying demonstrated the strongest victimization association, reflecting the persistent, pervasive, and socially visible nature of online victimization, which intensifies emotional distress and social isolation [23, 1]. Philippine GSHS analyses likewise report that bullying-related victimization significantly increases suicide attempt risk [15, 16, 29]. These findings support the Interpersonal Theory of Suicide, which suggests that repeated experiences of interpersonal harm increase psychological vulnerability and contribute to suicidal behavior [5]. In the Philippine context, the decriminalization of suicide and suicide attempts—advocated in recent WHO policy guidance [39]—represents an important structural enabler for removing barriers to help-seeking among victimized adolescents who may fear stigma or legal consequences.

5. Contributions and Limitations

This study provides empirical evidence on the multilevel predictors of suicide attempts among adolescents using school-based health surveillance variables. The findings demonstrate that suicide attempts are associated with multiple domains of adolescent life, including substance use behaviors, relational connectedness, school engagement, lifestyle regulation, and victimization experiences. By examining these variables simultaneously within a hierarchical logistic regression framework, the study provides a comprehensive picture of how behavioral, relational, institutional, and lifestyle factors intersect in shaping suicide attempt risk. The results reinforce GSHS-based evidence that adolescent suicide risk is multidimensional and influenced by clusters of behavioral and psychosocial exposures [1, 19, 20, 23].

Several limitations should be acknowledged. First, the study relied on self-reported survey data, which may be subject to recall bias or social desirability bias, particularly for sensitive behaviors such as substance use, bullying, and suicide attempts. Second, the cross-sectional nature of the data limits the ability to establish causal relationships; the results, therefore, indicate statistical associations rather than causal effects. Third, the findings reflect school-based adolescent populations and may not fully represent adolescents who are out of school or absent during survey administration. Finally, some variables represent broad behavioral categories and may not capture the full complexity of underlying psychological or contextual mechanisms associated with suicide attempts.

6. Recommendations

Schools should strengthen comprehensive suicide prevention efforts by improving attendance monitoring, reinforcing evidence-based anti-bullying initiatives, and maintaining safe and supportive learning environments [17, 21]. Schools should also encourage student participation in Physical Education and structured physical activities, as engagement in school activities and physical activity was associated with lower suicide attempt risk. Teachers and guidance counselors should strengthen early identification mechanisms for students who exhibit behavioral risk indicators, particularly frequent truancy, repeated bullying victimization, limited peer relationships, and low parental understanding. Regular classroom observation, guidance consultations, and peer-support initiatives may help detect and assist students who may be at risk. At the family and policy levels, parents should strengthen open communication and emotional support within

the home environment, as parental understanding was strongly associated with lower suicide attempt risk. Education and health authorities should integrate behavioral risk monitoring into school-based mental health programs, particularly targeting substance use, bullying, unhealthy sleep patterns, and excessive sedentary behavior. Urgent investment in guidance counselor staffing is needed to approach the recommended 1:500 ratio in Philippine public schools [17]. Future researchers should further examine these predictors using longitudinal or cohort designs to clarify temporal relationships between the risk domains identified in this study, and should explore additional psychosocial variables—including gender, sexual orientation, and socioeconomic factors—that may interact with the risk factors identified here.

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