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Prevalence and Risk Factors Associated with Serious Injuries among in-school Adolescents in Samoa: A population based cross-sectional study

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Research Article

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Abstract Introduction

Injuries form one of the leading causes of death and disability among human populations. Notwithstanding the growing evidence of injuries worldwide, little is known about the case of adolescents in Samoa. The study aimed to explore the prevalence and risk factors associated with serious injuries among adolescents in Samoa.

Methods

The 2017 Global School-Based Student Health Survey data from Samoa was analysed using the Chisquare test and binomial logistic regression analysis with an adjusted odds ratio (AOR) at a 95% confidence interval (CI).

Results

The prevalence of serious injury among in-school adolescents in Samoa is 46.8%. Sex (male) (AOR = 1.60, CI = 1.29-1.98) was a significant predictor of serious injuries among adolescents in Samoa. Other predictors of serious injuries included physical attack (AOR = 2.21, CI = 1.66-2.94), Physical fights (AOR = 2.27, CI = 1.84-2.80) and being bullied (AOR = 1.59, CI = 1.28-1.99).

Conclusion

Samoa's serious injury rate among in-school adolescents requires multidisciplinary programmes like antibullying campaigns, violence-free relationship education and policies.

Introduction

Adolescent injuries are a serious global public health challenge that needs urgent attention [1]. Thus, injuries are the leading cause of morbidity and mortality among adolescents, especially those residing in low-and middle-income countries (LMIC) [1,2]. For example, Globally, about 2,300 children and adolescents die each day from unintentional injuries [3]. Moreover, when injuries do not result in death, they can inflict serious disability and lifelong misery on survivors and impose high costs on health care systems, families, and individuals [4,5]. However, developing countries have the largest burden of adolescent injuries, affecting health and productivity as well as increasing pressure on health systems [4-6].

Any injury that makes an adolescent miss usual activities or requires medical attention can be considered serious [7]. The prevalence and risk factors associated with serious injuries during adolescents have been

explored across various cultures over the past two decades. Some recent studies that examined serious injuries among adolescents in Africa have reported 66% [8] and 57% [9] in Ghana, 39% in Mauritius [10], 55.7% in Mozambique [1] and 63% in Ethiopia [11]. Moreover, a study conducted in sub-Saharan Africa among adolescents from 6 countries reported an overall prevalence of 68.2% of serious injuries [12]. Peltzer further reported that Swaziland, Namibia, Zimbabwe, Uganda, Kenya and Zambia had a prevalence of 38.6%, 60.2%, 62.8%, 63.4%, 71%, and 71.5% of serious injuries, respectively. Furthermore, Han et al. [7] explored the prevalence of serious injuries among adolescents between 12 and 15 years from 68 LMICs. They reported that 42.9% of adolescents sustained serious injuries a year before the study. Compared to Sub-Saharan Africa, the prevalence of serious injuries among adolescent in South America have been lower (Argentina (27.1%), Uruguay (29.5%), Chile (30.9%) and Bolivia (36.8%) [13].

Evidence shows that adolescents who are males [10,14,15] and from a low socio-economic background [1,16–18] are more likely to sustain serious injuries. Also, adolescents who are neglected by their parents or experience hunger regardless of their sex may be exposed to serious injuries [10]. In addition, adolescents who use substances such as alcohol and marijuana [10,15,17] and have ever had sex [1,18] have a higher risk of sustaining serious injuries. Moreover, adolescents who engage in physical education at school have a higher chance of being seriously injured [1,18]. Furthermore, truant adolescents [10,19], bullied adolescents [15,16], and those who engage in physical fights [19,20] are likely to sustain serious injuries. Additionally, adolescents who are experiencing mental health issues such as psychological distress [1,18,21], depression [12], loneliness [12,19] and suicidal ideation [10] may be at higher risk of experiencing serious injuries.

Few studies of injury prevalence and correlates have been explored in Polynesia, including Samoa [22]. For example. Denny et al. further reported that about 73% of non-fatal injuries among adolescents in Samoa and this is estimated to increase as more vehicles are seen on the roads of this small island country. Furthermore, drowning and near-drowning are considered the leading causes of injuries and deaths in most island nations [23]. However, there is limited evidence on the prevalence and risk factors of serious injuries among adolescents in Polynesia, especially in Samoa.

Evidence shows limited access to advanced medical and surgical care in most small island nations. Hence, Samoa may face a heightened injury burden, especially among residents in rural areas [24]. Perhaps, the severe lack of healthcare professionals such as midwives, nurses, and doctors in small island states due to brain drain may make adolescents who suffer from injuries that might require medical attention extremely vulnerable [25]. In resource-limited settings such as Samoa, it is pertinent to explore and understand the risk factors that are health threats and adopt a cost-effective primary intervention. Though most of the injuries that affect adolescents are unintentional, they are preventable if the contextual risk factors and population specific-threat to injuries are well understood with practical strategies and policies. Therefore, this study aimed to determine the prevalence and correlates of serious injuries among in-school adolescents in Samoa `using a national representative sample.

Methods

Research Design

We analysed data on serious injuries and their correlates among adolescents in Samoa using the 2017 Global School-Based Student Health Survey (GSHS) data [26]. A self-administered questionnaire was used in the GSHS to collect information on young people's health behaviours and protective factors concerning the world's top causes of morbidity and mortality in children and adults. The WHO, Samoa's Ministry of Health (MoH), and the US Centers for Disease Control and Prevention (CDC) collaborated to carry out the GSHS. Data from WHO member nations interested in avoiding injuries among teenagers were gathered through the survey using a cross-sectional study design. The study collected data from school-going adolescents aged 13-17 years in Samoa.

Ethical Consideration

The instruments used for data collection were pilot tested for validity and reliability before the actual data collection. Before data collection began, the project got the necessary Institutional Review Board authorisation from the Samoa MoH and the MoE. The researchers strictly adhered to the ethical policies of the MoH and MoE. To obtain approval from the MoH and the heads of the individual schools included in the study, entry permission protocols were followed. Informed consent, parental consent, and child assent were obtained from teenagers aged 18 and above, as well as children aged under 18, utilising both verbal and written agreement.

Sampling

The study employed a two-stage cluster sample design to generate data representative of all students aged 13-17 years in Samoa. In the first stage, schools were selected with a probability proportional to enrollment size. In the second stage, classes were randomly selected, and all students in selected classes were eligible to participate. The school response rate was 94%, the student response rate was 63%, and the overall response rate was 59%.

Variables

In this study, the key outcome variable was "severe injuries identified or reported" among the pupils. The outcome variable was described as "whether or not the student was significantly hurt one or more times in the preceding twelve months." The response options ranged from 0 to 12 or more times. We then divided the responses into two categories. Those who had no injuries (zero injuries) were labelled "no injury" and given the code "0". We further classified responders with at least one or more injuries as "severe injuries" and coded them as "1". The independent variables were classified as sociodemographic (sex, age, and grade), personal (missed school without permission, mostly or always went hungry), drugs and substance use (amphetamine use, current marijuana smoking, current alcohol use and ever got drunk after consuming alcohol), and psychosocial (physical attacks, suicide ideation, planning, and attempt, and bullying) (see Table 1).

Data Analysis

To avoid bias on various trends of non-responses, we used the sample weighting approach at the school, student, and sex within grade levels to make it representative of adolescents in Samoa. In this investigation, we recorded several variables on a binary scale. Additionally, we used the multiple imputations (MI) technique to address the issue of missing data. Where the missing values surpassed 1%, we used the MI method. Missing data ranged from 1% to 10% and occurred at random. To maintain data quality in the case of missing values, we performed five MIs using the automatic imputation approach. Using the whole case analysis, imputed values were appropriately compared to observed values and results. The goodness of fit of the final model was tested, and the results revealed no evidence of a lack of fit with our model's ability to forecast serious injuries significantly. To estimate the connection between serious injuries and the explanatory variables, we used bivariate analysis with Pearson Chi-square. The factors that indicated a significant correlation (p 0.05) were then put into a binomial logistic regression model. The analysis findings were reported with the matching adjusted odds ratio (AOR) at a 95% confidence interval (CI) (p 0.05).

Table 1: Definition of explanatory and measurement coding of variables

Variable	Survey Question			
Age	How old are you?	1=12- 14		
		2=15- 17		
Sex	What is your sex?	1= Male		
		2= Female		
Grade	In what grade are you?	1= 1-3		
		2= 4-6		
Hunger	Most of the time or always went hungry	1= yes		
		2= no		
Physical attack	Have you been attacked physically before?	1= yes		
		2= no		
Suicidal ideation	During the past 12 months, did you ever seriously	1= yes		
	consider attempting suicide?	2= no		
Suicidal attempt	During the past 12 months, did you attempt suicide?	1= yes		
		2= no		
Suicidal plan	During the past 12 months, did you make a plan about	1= yes		
	now you would attempt suicide:	2= no		
School truancy	During the past 30 days, did you miss classes or school	1= yes		
	without permission?	2= no		
Amphetamine use	During your life, did you use amphetamine or methamphetamine (also called ice or vellow)?	1= yes		
	methamphetamme (also called ice of yellow)?	2= no		
Current use of alcohol	During the past 30 days, did you have at least one drink	1= yes		
		2= no		
Ever got drunk after	Have you ever drunk so much alcohol that you were	1= yes		
consuming alcohol		2= no		
Current marijuana smoking	During the past 30 days, did you use marijuana?	1= yes		
		2= no		
Physical fight	Have you engaged in physical fights before? Page 6/16	1= yes		

		2= no
Bullied	Have you been bullied at school before?	1= yes
		2= no
Attended physical education	Did you attend physical education classes on five or	1= yes
		2= no
Currently smoke cigarettes	Do you currently smoke cigarette?	1= yes
		2= no

Results

Background Characteristics of the Adolescents in Samoa.

We found the prevalence of serious injuries among in-school adolescents in Samoa to be 46.8% (see Figure 1). More (21.6%) male in-school adolescents in Samoa significantly experienced serious injuries. Moreso, an additional percentage of in-school adolescents who missed classes or school without permission (19.7%), mostly or always went hungry (6.7%), ever used amphetamine (5.0%), smoke marijuana (5.4%), currently consume alcohol (8.0%), ever got drunk after consuming alcohol (7.1%) and smokes cigarettes (7.6%) experienced serious injuries. Similarly, more in school adolescents who were physically attacked (13.3%), engaged in a physical fight (27.3%), bullied (21,.1%), mostly felt lonely (6.0%), worried about things they could not study (6.5%), had suicidal ideation (13.8%), planned to commit suicide (12.5%), attempted suicide (12.9%) and those who attend PE classes on five or more days significantly experienced serious injuries (see Table 2).

Distribution and Chi-Square analysis of Serious Injuries across Demographic, Psychological, Personal Attribute Factors, Drugs and Substance Use Factors, and Psychosocial Factors.

The Chi Square test demonstrates that, sex (χ^2 =53.65, p<0.000), missing class/school without permission (χ^2 =26.28, p < 0.000), mostly or always experiencing hunger (χ^2 =8.36, p<0.004), amphetamine use (χ^2 =24.30, p<0.000), marijuana use (χ^2 =27.80, p<0.000), current consumption of alcohol (χ^2 =24.34, p < 0.000), ever got drunk after consuming alcohol (χ^2 =26.12, p<0.000), Smoked cigarettes (χ^2 =33.52, p < 0.000), physically attacked (χ^2 =98.90, p<0.000), physical fight (χ^2 =142.44, p<0.000), bullied (χ^2 =70.48, p<0.000), loneliness (χ^2 =15.39, p<0.000), worry (χ^2 =19.41, p<0.000), suicidal ideation (χ^2 =22.40, p<0.000), suicide plan (χ^2 =7.74, p<0.006), suicide attempt (χ^2 =29.62, p<0.000) and attending PE classes on five or more days (χ^2 =5.83, p<0.016) (See table 2).

 Table 2: Bivariate analysis of injuries among adolescents of school-going age in Samoa (n=1779)

ariables Serious injuries		es	Chi-square (χ ²)	$arphi_c$	
		Injuries (%)	No injuries (%)		
Demographic					
Age (years)	13-15	44(25%)	515(28.9%)	0.19	-0.010
	≥16	388(21.8%)	431(24.2%)		
Sex	Male	384(21.6%)	277(15.6%)	53.65***	
	Female	449(25.2%)	669((37.6%)		
Grade	Grade 8- 10	459(25.8%)	504(28.3%)	0.594	0.441
	Grade 11- 13	374(21.0%)	442(24.8%)		
Personal					
Truancy	Yes	350(19.7%)	287(16.1%)	26.28***	0.122
	No	483(27.2%)	659(37.0%)		
Hunger	Yes	120(6.7%)	94(5.3%)	8.36**	0.069
	No	713(40.1%)	852(47.9%)		
Drugs and substance use					
Amphetamine use	Yes	89(5.0%)	43(2.4%)	24.30***	
	No	744(41.8%)	903(50.8%)		
Marijuana use	Yes	96(5.4%)	45(2.5%)	27.80***	0.125
	No	737(41.4%)	901(50.6%)		
Current consumption of Alcohol	Yes	142(8.0%)	87(4.9%)	24.34***	
	No	691(38.8%)	859(48.3%)		
Ever got drunk after consuming	Yes	126(7.1%)	71(4.0%)	26.12***	0.121
aicului	No	707(39.7%)	875(49.2%)		
Smoke cigarettes	Yes	136(7.6%)	71(4.0%)	33.52***	0.137
	No	697(39.2%)	875(49.2%)		
Psychosocial					
Physically attacked	Yes	237(13.3%)	95(5.3%)	98.90***	0.236

	No	596(33.5%)	851(47.8%)		
Physical fight	Yes	485(27.3%)	285(16.0%)	142.44***	0.283
	No	348(19.6%)	661(37.2%)		
Bullied	Yes	376(21,.1%)	247(13.9%)	70.48***	0.199
	No	457(25.7%)	699(39.3%)		
Loneliness	Yes	106(6.0%)	68(3.8%)	15.39***	0.093
	No	727(40.9%)	878(49.4%)		
Worry	Yes	116(6.5%)	71(4.0%)	19.41***	0.104
	No	717(40.3%)	875(49.2%)		
Suicidal ideation	Yes	246(13.8%)	188(10.6%)	22.40***	0.112
	No	587(33.0%)	758(42.6%)		
Suicide plan	Yes	223(12.5%)	200(11.2%)	7.74**	0.066
	No	610(34.3%)	746(41.9%)		
Suicide attempt	Yes	230(12.9%)	160(9.0%)	29.62***	0.129
	No	603(33.9%)	786(44.2%)		
Attending PE classes on ≥5 days	Yes	160 (9.0%)	141(7.9%)	5.83*	0.057
	No	673(37.8%)	805(45.3%)		

Note. *p < 0.05, **p < 0.01, ***p < 0.001.

The binomial logistic regression analysis results on the factors associated with serious injuries among adolescents in Samoa show that being a male (AOR=1.601, 95%CI=1.292-1.985), experiencing physical attack (AOR=2.210, 95% CI=1.662-2.940), engaging in a physical fight (AOR=2.270, 95%CI=1.839-2.803) and bullied (AOR=1.594, 95% CI=1.277-1.990) (Table 3).

Table 3. Relationship between the significant variables and serious injuries among adolescents in Samoa.

	В	Wald test (z-ratio)	Adjusted Odds Ratio	95% confidence interval for odds ratio	
				Lower	Upper
Demographic					
Sex (male)	0.471***	18.446	1.601	1.292	1.985
Personal					
Truancy	.194	3.036	1.214	.976	1.509
Hunger	0.292	3.259	1.339	.975	1.837
Substance use and abuse					
Marijuana smoking	.081	.111	1.084	.674	1.745
Current smoking of cigarettes	.241	1.649	1.273	.881	1.840
Amphetamine use	.120	.242	1.127	.700	1.816
Alcohol	.071	.133	1.073	.734	1.568
Ever got drunk after consuming alcohol	.208	1.039	1.232	.825	1.839
Psychosocial					
Physically attacked	.793***	29.687	2.210	1.662	2.940
Physical fight	.820***	58.140	2.270	1.839	2.803
Bullied	.466***	16.934	1.594	1.277	1.990
Loneliness	.236	1.622	1.267	.880	1.822
Worry	.296	2.664	1.344	.942	1.917
Suicidal ideation	.230	1.883	1.259	.906	1.748
Suicidal plan	258	2.339	.773	.556	1.075
Suicidal attempt	.222	1.842	1.249	.906	1.723
Attending physical education classes on ≥5 days	.186	1.785	1.205	.917	1.584
Close friends	218	1.379	.804	.558	1.157
(Constant)	-7.411	81.306	.001		

Note. *p < 0.05, **p < 0.01, ***p < 0.001; Hosmer and Lemeshow test (goodness of fit), χ^2 (8) =12822.576, p= 0.000

Discussion

Key findings

The study aimed to explore the prevalence and correlates of serious injuries among in-school adolescents in Samoa. The prevalence of serious injury was 46.8% among adolescents. Furthermore, being a male, experiencing physical fights and attacks and being bullied contributed significantly to severe injuries among adolescents in Samoa.

Prevalence of Serious Injuries

The findings from this study show that almost 5 out of 10 adolescents in Samoa have experienced serious injuries for the past 12 months before the data collection. The relatively higher prevalence estimates in Samoa makes serious injuries among adolescents a significant public health issue requiring extensive research, intervention, and prevention efforts. A recent study that used a nationally representative sample of in-school adolescents reported relatively similar prevalence (Ghana = 46.1% and Liberia = 49.2%) [2]. However, Samoa's prevalence of serious injuries among adolescents (46.8%) is relatively higher than the prevalence of serious injuries reported in Benin (27.3%) using a national representative sample [2].

Reports on serious injuries among adolescents from other countries in Polynesia in 2016 have shown relatively similar prevalence (43.1% in Cooks Island, 40.8% in Niue and 49.1% in Tonga) [22]. Perhaps, drowning and near-drowning cases that are common in small island countries might be one of the reasons for the high prevalence of serious injuries among adolescents in Polynesia [22]. In addition, falls that are among the top causes of injuries reported in GSHS from small island countries might also be a reason for the high prevalence of serious injuries among adolescents in Polynesia [12]. For instance, evidence shows that some sources of serious injuries among young people include falls from rooftops, trees, and falls into well in Polynesia [22].

Some other fall injuries may occur while adolescents are engaged in agriculture and fishing, which are popular in Polynesia. Also, falls among adolescents can occur during sports activities and games because Rugby is popular in small island countries. Meanwhile, the high rates of rugby-associated injuries may explain the high prevalence of serious injuries among adolescents in Samoa [27]. The current prevalence of serious injury in Samoa (46.8%) is relatively lower than the previously reported prevalence (73.8%) of serious injury among adolescents in Samoa in 2016 [22]. Perhaps, significant efforts might have been made towards reducing injuries among adolescents in Samoa since 2016.

Correlates of Serious Injuries

This current study showed that sex is significantly associated with serious injuries among adolescents. Consistent with other studies conducted among adolescents (Mireku et al., 2021; Gao et al., 2019), the current study reported that adolescent boys are more likely to sustain serious injuries compared to girls. Perhaps, adolescent boys' interest in fishing [22] and contact and aggressive sports [28] might explain why boys are more likely to sustain serious injuries than girls. However, studies from Ghana [8] and Liberia [18] that reported that sex is not associated with serious injuries shows a sharp contrast from the finding of this current study. Perhaps, location, culture, and socio-economic variations might account for the differences in the results.

This study also found that adolescents who are involved in physical fights and attacks, as well as adolescents being bullied, are more likely to sustain serious injuries. A similar study conducted in Ghana has shown that adolescents, regardless of their sex, who engage in physical fights or attacks or who have been bullied, are more likely to experience serious injuries [10]. Furthermore, previous studies have reported that adolescents who are victims of bullies are likely to report various physical and psychological symptoms compared to their non-bullied counterparts [29,30]. Similar evidence from the Americas shows that bullied students are more likely to report serious injuries [31]. Perhaps, adolescents exhibiting one or any form of violent or aggressive behaviour could be a response or reaction to other aggressive behaviours towards them. For instance, evidence from Greenland [16], South Asia [1,32] and the Caribbean [33] that victims or perpetrators of bullying are more likely to engage in physical fights or attacks which might result in serious injuries.

Limitations and Strengths

The study provides a national view of the prevalence and risk factors associated with adolescent injury in the Island Country of Samoa. Also, such a nationally representative in-school adolescent population provides baseline results on serious injuries in Samoa. Notwithstanding a large-scale dataset from the 2017 GHSH, care must be taken when drawing causal inferences due to its cross-sectional survey design. Furthermore, single items to measure constructs like worrying, suicidal behaviours, and substance use may not be comprehensive. Moreover, in-school adolescents in this survey between the ages of 13 and 17 may limit the generalisation of findings to the entire adolescent population in Samoa.

Conclusion

This present study found a relatively higher prevalence of serious injuries among in-school adolescents in Samoa. In addition, factors associated with an increased likelihood of serious injuries among adolescents are sex (males) engaging in physical fights or attacks and being bullied. The high prevalence of serious injuries in Samoa negatively affects the provision of inclusive and equitable quality education and inhibits efforts being made to ensure adolescents in the country live healthily. Hence, school-based anti-bullying campaigns as well as interventions that promote self-esteem and violence-free relationships may be significant in reducing injuries among in-school adolescents in Samoa.

Declarations

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Author contributions

JOS conceived the idea of the study. JOS and PO downloaded and analysed data and prepared tables. JOS, PO, MA, PYK, AKA, TBG, A-GO, and IA wrote the manuscript. All authors read and approved the final version of the manuscript.

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Availability of data and materials

The dataset used for this analysis for this study was obtained from the GSHS-Samoa, 2017. Access to the data can be obtained at the WHO website: https://extranet.who.int/ncdsmicrodata/index.php/catalog/773

Ethics approval and consent to participate

All procedures contributing to this project were in accordance with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval was obtained from the Institutional Review Boards of the Ministry of Health of Samoa, WHO, and CDC. Written and signed consent was obtained from all individual participants included in the study.

Trail Registration: Global School-Based Student Health Survey 2017 (WSM_2017_GSHS_v01) Registered August 2020, https://extranet.who.int/ncdsmicrodata/index.php/catalog/773.

Consent for publication

Not applicable

Competing interest

The authors have no competing interest to declare.

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Figures



Figure 1

Serious injuries among in-school adolescents in Samoa