

Alcohol, tobacco, marijuana and hallucinogen use in Samoan adolescents

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Abstract

Introduction and Aims. Adolescent substance use has increased with globalisation, and yet few data exist from lower- and middle-income countries and the Pacific Islands. This study examines the prevalence of three aspects of substance use over the past 30 days in Samoan adolescents: (i) use of alcohol, tobacco and other drugs; (ii) polysubstance use; and (iii) possible substance use problems. **Design and Methods.** A survey was administered to secondary school children ($n = 879$) between 12 and 19 years of age at a single school in Apia, the capital of Samoa, in August 2008. **Results.** There were important gender differences in substance use with boys reporting significantly higher rates of any use of each substance and polysubstance use. Boys were also three times more likely to report behaviours indicative of substance use problems. There were no significant differences in regular use of any substance with the exception of marijuana. Although the use of hallucinogens is prominent for boys and girls in the younger age group (12–15), consumption decreases with age. Boys showed substantial increases in any use of alcohol and marijuana and daily use of tobacco by age. There was also a significant increase in the number of boys reporting behaviours indicative of disordered use by age to 21% of 16- to 19-year-old boys. **Discussion and Conclusions.** One of few studies on substance use in Samoa, the data provide a basis for setting priorities to address health risks posed by adolescent use and understanding the influence of rapid change. [Odden HL. Alcohol, tobacco, marijuana and hallucinogen use in Samoan adolescents. *Drug Alcohol Rev* 2011]

Key words: adolescence, smoking, illicit drug, Samoa, Pacific Islands.

Introduction

One way in which globalisation has exerted an influence on adolescent health and well-being in the developing world has been through increases in substance use and abuse [1–5]. Understanding substance use is of critical importance because of the immediate negative health impacts it can exert as well as the substantial long-term contribution it makes to the global burden of disease [6–8]. Although we do have extensive data on adolescent substance use from Europe and North America, such as the ‘Health Behaviors in School-aged Children’ surveys (HBSC) [9], data from many low- and middle-income countries are lacking [10,11]. Research in these societies is also of particular importance, because many of them are undergoing rapid and widespread sociocultural, economic and political change. Determining patterns of substance use in these

societies is an important initial step in understanding the linkages between these ongoing societal transformations and adolescent health risks.

This article presents data concerning the prevalence of three aspects of adolescent substance use in the Western Polynesian society of Samoa: (i) any use and regular use of alcohol, tobacco and other drugs; (ii) polysubstance use; and (iii) possible substance use problems over the past 30 days. A survey instrument was administered to secondary school students between the ages of 12 and 19 in the capital city of Apia ($n = 879$) in August 2008, and statistical analyses compared prevalence rates by gender and age groups.

Samoa is of particular interest for research on adolescent substance use, not only because of the level and pace of sociocultural change and diversification, but also because it has experienced epidemic levels of suicide in both adolescent boys and girls, which is

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indicative of considerable psychosocial distress for this segment of Samoa's population. Booth's [12] study of adolescent suicide rates across the Pacific showed suicide rates in Samoa for the early and late 1980s and early 1990s to be among the very highest globally, and the interim director of the Mental Health Unit of Samoa's National Hospital suggested that contemporary incidence rates remain quite high (Parkin I, 28 July 2008, personal communication). Research by McDade [13,14] has also documented heightened levels of physiological stress (as evidenced by Epstein-Barr virus antibody levels) in Samoan adolescents associated with various aspects of culture change. To better understand adolescent health and well-being in Samoa and the challenges confronting it, it is important that we examine still other indicators of and behaviours associated with adolescent psychosocial distress, including substance use.

Samoa

The Samoan archipelago is divided into two geopolitical entities: American Samoa and larger and more populous Samoa, where the research described here was conducted. Over 180 000 people live on the four inhabited islands of Samoa [15]. The majority live in small rural, coastal villages of 500–2000 persons, and an additional 40 000 live in the capital city of Apia. The majority of economic activity is subsistence agriculture completed on family-owned land, with some limited participation in cash cropping. In the urban areas, there is wage labour employment in government, service and commercial sectors, but unemployment remains high.

In contrast to most other Polynesian societies, which were fundamentally transformed by colonisation, Samoa has maintained considerable cultural continuity [16–19] and there is great pride in Samoan traditions. The 'aiga (descent group) plays a fundamental role in everyday life and is the basic organising feature of the individual's social world and the root of their social identity. Samoan society is pervasively hierarchical and considerations of relative rank structure social interactions in a wide variety of social practices and institutions [17,18,20]. Titled chiefs wield extensive social, political and economic powers within their descent groups and villages.

There has been increasingly substantial change and cultural diversification in Samoa over the last several decades. The islands have been increasingly incorporated into global capitalist networks and a wide range of consumer and luxury goods are now readily available and desired [21,22]. New routes to status and power have emerged, including wage labour and higher

education [23,24]. Patterns of social organisation in urban areas have shown some change with increasing numbers of nuclear families, and population growth in areas with freehold land outside of the jurisdiction of chiefs [25]. Access to Western media has increased at a rapid pace with movies, television, music and the Internet widely available and enthusiastically consumed. Finally, Samoans have become an increasingly transnational population with regular movement of persons, remittances and goods between the islands and the very large migrant communities in Australia, New Zealand and the USA [26–29].

Drugs in Samoa

The range of psychoactive substances available to adolescents in Samoa is narrower than what is generally available in the industrialised West [11,30]. Locally brewed beer, inexpensive, distilled alcohol and locally manufactured cigarettes are readily available. Although illegal, marijuana and home-brewed alcohol (*pulu* and *fa'amafu*), which has an alcohol content of 10–25% [31], are widely available. There are also two hallucinogenic compounds locally available in Samoa. The first is *psilocybe* species mushrooms, which are brewed into a tea and drunk, and which causes shifts in consciousness for approximately 3–8 h depending upon dosage and individual metabolism. Samoans call these mushrooms *pulouaitu* ('spirit mushrooms') and *taepovi* ('cow shit', referring to where the fungi are thought to most frequently grow). The second hallucinogen is the berries of the *Atropa belladonna* plant, known as 'belladonna' or 'deadly nightshade' in the West, and locally called *logo* ('bell', referring to the shape of the plant's flowers). The ripened black berries contain tropane alkaloids, which cause vivid hallucinations and delirium. As a recreational drug, *A. belladonna* is quite dangerous because of the risk of unintentional overdose [32,33].

Interviews conducted with individuals with more intimate knowledge of drug sales and consumption in Samoa and police suggest that most other categories of psychoactive substances, including cocaine, opiates, prescription drugs and 'party drugs' (e.g. ecstasy), are currently not found in Samoa in any substantial amount. Inhalants, methylated alcohol and crystal methamphetamine are in use in Samoa as they are in other Pacific societies [11,30,34,35], but preliminary research suggested that they were used in more limited quantities by adolescents. Out of concern with informant burden due to the overall length of the survey, only a small portion of which is described here, the study chose to focus on the most commonly used categories of substances.

Method

Data collection

The data analysed in this study were obtained through administration of a survey instrument to students enrolled in grades 9–13 at a large, public secondary school in Apia in August 2008. A passive consent procedure was employed, and parents or caretakers were informed about the study through letters carried home by students. Children completed the survey at the conclusion of the school day in their regular classrooms. Teachers, who had been briefed by the researcher, distributed the survey in their regular classrooms, and read a statement that informed students about the purpose of the survey, confidentiality of their responses and their rights as research participants, including their right not to participate or to refrain from answering particular questions. The researcher was on hand to answer questions throughout the administration, and collected the completed surveys.

Eight hundred and seventy-nine school children completed the survey (76% of the students enrolled in the school) with absenteeism accounting for most of the non-response. Four per cent of the sample chose not to participate (and left the surveys blank) or their responses were excluded because of problems in scoring their answers, leaving a sample of 844 cases. Demographic characteristics of the study population can be found in Table 1. The study was approved by the Samoan Ministry of Education, Sports, and Culture, Purdue University's Institutional Review Board, and by the principal of the school at which the survey was administered.

Measures

Participants were asked about the frequency of their consumption within the past 30 days of five categories of commonly consumed substances: alcohol (beer and spirits), home-brewed alcohol, tobacco, marijuana and

the two locally available forms of hallucinogens. Responses for these questions include: 'none', 'once a week or less', 'more than once a week' and 'most days'.

To screen for alcohol and substance use problems, the survey included an adapted version of the CRAFFT, a brief alcohol and drug screening instrument that has been found to demonstrate good validity and reliability in identifying alcohol and drug problems in clinical and community populations of adolescents in the USA [36,37] and cross-culturally [38–41]. As no alcohol or drug screen has been explicitly validated for use in Samoa, preliminary research for the study, including interviews with members of the Samoan medical community (e.g. medical practitioners, community health clinic nurses) and focus groups with lay adults and older adolescents, was conducted to determine which adolescent screening instrument would be most appropriate for use in Samoa and to determine how best to adapt the selected instrument. On the basis of this research, the CRAFFT was selected for several reasons: brevity, developmentally appropriate for adolescents, worded to screen for both alcohol and other drugs, simple yes/no response format, and a focus on locally salient negative behaviours and consequences associated with disordered substance use (e.g. 'do you ever use alcohol and drugs while you are alone?', 'do you ever forget things you did while using alcohol or drugs?', 'have you ever gotten into trouble while using drugs or alcohol?'). The CRAFFT instrument was adapted for Samoa by removing two items determined to be potentially confusing or inappropriate by the preliminary research, including a question regarding drunk driving as most Samoan households—particularly in rural areas—lack cars. Three questions from the 'Substances and Choices Scale' (SACS) [42], which includes questions on negative behaviours associated with substance use very similar to those of the CRAFFT, were added to replace those removed.

The seven items exhibited good internal consistency (Cronbach's $\alpha = 0.74$) and all loaded onto a single component in exploratory factor analysis. For the sake of analytic simplicity, responses to the items were combined into a simple cumulative index, and the index was transformed into a binary value based on a cut-off of 2, which has been found to have acceptable sensitivity in identifying adolescents with substance use problems or disorders on the original CRAFFT in the USA [36,37] and across a range of other cultures [38–40]. Further study is necessary to properly validate the instrument for use in Samoa, and the cut-off value must be taken as tentative and results interpreted with caution. Nonetheless, an individual's endorsement of two or more different behaviours or consequences commonly associated with disordered substance use (e.g. amnesia, serious forms of misbehaviour or use-related legal

Table 1. Sample demographics (n = 844)

Age in years	
Range = 12–19 M = 15.3 SD = 1.4	
Gender	
Male	42.7% (360)
Female	57.3% (484)
Grade	
9	23.9% (202)
10	25.2% (213)
11	23.3% (197)
12	16.8% (142)
13	10.7% (90)

Number in parentheses is the number of cases.

problems, substantial time devoted to use, use while alone, failure to fulfil major role obligations) was judged by the local medical community as clinically indicative of hazardous levels of substance use and by the local lay community as meaningful and salient signs of disordered use meriting professional consultation and possibly intervention by family, community or medical professional.

The survey was translated and back-translated from English into Samoan with the assistance of bilingual professional translators associated with the National University of Samoa's Centre for Samoan Studies, and was then pretested on Samoan adolescents to ensure comprehensibility.

Data analysis

'Any use' for the five different substances was any reported use of a given substance over the past 30 days. 'Regular use' for alcohol, home-brewed alcohol, cannabis and hallucinogens was calculated as more than once per week over the previous 30 days. For tobacco, regular use was categorised as 'most days' over the past month. 'Polysubstance use' is defined here as the reported use of three or more of the five different categories of substances included in the survey (e.g. alcohol, tobacco and marijuana).

All statistical analyses were conducted with PASW Version 17.0 (SPSS Inc., Chicago, IL, USA). Children were separated into two age groups (12–15 and 16–19 years) of roughly equal size and number of years to facilitate comparison. For each type of substance, prevalence of both 'any use' and 'regular use' over the past 30 days is reported by gender and age group, and for the entire sample. Tests for significant differences by age group for each gender were calculated using Pearson's χ^2 -test of independence, and comparisons by gender were completed using Mantel-Haenszel statistics to produce age-adjusted odds ratios (ORs). An alpha level of 0.05 was used as a significance criterion for all statistical tests.

Results

Patterns of reported substance use over the past 30 days by gender and age group are reported in Table 2. One in four respondents (25%) reported having used at least one of the five categories of substances within the past month. Approximately 7.5% reported polysubstance use and about the same percentage (7.8%) reported behaviours suggestive of disordered substance use. In comparing frequencies of any reported use for the entire population, alcohol (14.6%) and tobacco (12.9%) were the substances most frequently reported. These two were followed by hallucinogens (9.4%), marijuana (8.4%) and home-brewed alcohol (7.4%).

Reported regular use followed exactly the same rank ordering, but the relative differences between the different categories were reduced, with alcohol being the substance most commonly used on a regular basis (5.4%) and home-brewed alcohol the least (3.4%). These prevalence rates appear to be equivalent to or lower than average rates for European and North American societies [9].

Consonant with other studies of substance use in the Pacific [11,30,35,43], the most obvious finding is pervasive gender differences in substance use. Boys were twice as likely as girls to report using any of the five psychoactive substance examined here within the past 30 days (age-adjusted OR = 1.92, 95% confidence interval (CI) = 1.39, 2.64, $P < 0.001$) and more than three times as likely to have engaged in polysubstance use (OR = 3.41, 95% CI = 1.95, 5.96, $P < 0.001$). Boys were also four times as likely as girls to describe a set of behaviours suggestive of substance use problems (OR = 3.96, 95% CI = 2.24, 6.99, $P < 0.001$).

Gender differences are also found in rates of any use for each of the five different categories of substances. The greatest disparity by gender was in marijuana use with boys using it more than four times as frequently (OR = 4.36, 95% CI = 2.50, 7.62, $P < 0.001$). The greatest parity was in the consumption of hallucinogens (OR = 1.68, 95% CI = 1.05, 2.68, $P = 0.029$). Gender differences are reduced when we look at regular use of substances, and there are no statistically significant differences with the important exception of marijuana, which boys reported using regularly substantially more than did girls (OR = 3.76, 95% CI = 1.79, 7.90, $P < 0.001$).

For the younger age group (12–15 years) of boys, tobacco (16.8%), alcohol (14.3%) and hallucinogens (14.2%) were the substances most frequently reported being used in order of prevalence. The most frequently reported substances being used on a regular basis were hallucinogens (7.9%), alcohol (5.8%) and marijuana (5.3%). There are a number of important shifts in consumption by age for boys, including increases in use of alcohol, tobacco and marijuana. Any use of alcohol increases by 83% between the two age groups to a rate of 26.1% in 16- to 19-year-olds, a statistically significant change, $\chi^2(1, n = 347) = 7.60, P = 0.006$. Rates of any use of marijuana increases by a comparable amount (87%) between the age groups to a rate of 19.6%, which is also statistically significant, $\chi^2(1, 349) = 5.70, P = 0.017$. Although any use of tobacco increases only nominally by age group, regular use (i.e. smoking 'most days') increases by 173% to a prevalence of 10.1% in the older age group, $\chi^2(1, 349) = 5.80, P = 0.016$.

Although there are nominal increases in the number of boys reporting any substance use (18.5%) and a

Table 2. Substance use in the past 30 days by gender and age group

	Boys			Girls			Boys vs. girls	
	12-15 years	16-19 years	All ages	12-15 years	16-19 years	All ages	Age-adjusted OR (95% CI)	Overall
Alcohol								
Any use	14.3%	26.1%**	19.6%	10.0%	12.4%	11.3%	1.92 (1.30, 2.83)***	14.6%
Regular use	5.8% (189)	8.9% (157)	7.2% (347)	2.7% (261)	5.5% (217)	4.2% (479)	1.78 (0.97, 3.26)	5.4% (826)
Homebrew								
Any use	10.1%	13.4%	11.5%	3.9%	5.0%	4.4%	2.84 (1.64, 4.90)***	7.4%
Regular use	4.2% (189)	4.5% (157)	4.3% (347)	2.7% (259)	2.8% (218)	2.7% (478)	1.62 (0.76, 3.44)	3.4% (825)
Tobacco								
Any use	16.8%	17.7%	17.2%	7.7%	11.9%	9.8%	1.91 (1.27, 2.88)***	12.9%
Regular use	3.7% (190)	10.1%* (158)	6.6% (349)	2.3% (261)	5.5% (218)	4.0% (480)	1.71 (0.92, 3.20)	5.1% (829)
Marijuana								
Any use	10.5%	19.6%*	14.6%	3.1%	4.6%	3.8%	4.36 (2.50, 7.62)***	8.4%
Regular use	5.3% (190)	10.1% (158)	7.4% (349)	2.3% (260)	1.9% (216)	2.1% (477)	3.76 (1.79, 7.90)***	4.4% (826)
Hallucinogens								
Any use	14.2%	9.5%	12.0%	9.7%	5.0%	7.5%	1.68 (1.05, 2.68)*	9.4%
Regular use	7.9% (190)	3.2% (158)	5.7% (349)	4.2% (259)	3.7% (218)	4.0% (478)	1.47 (0.77, 2.80)	4.7% (827)
Any substance use	29.8% (188)	35.3% (156)	32.3% (345)	19.0% (258)	20.5% (215)	19.7% (474)	1.92 (1.39, 2.64)***	25.0% (819)
Polysubstance use	10.6% (188)	14.7% (156)	12.5% (345)	3.9% (258)	4.2% (215)	4.0% (474)	3.41 (1.95, 5.96)***	7.5% (819)
Substance use problem	7.7% (181)	21.3%*** (141)	13.7% (322)	3.1% (257)	4.8% (210)	3.8% (467)	3.96 (2.24, 6.99)***	7.8% (790)

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. Number in parentheses is the number of cases; 'Regular use' for tobacco is 'most days' and for all other substances is two or more times per week; 'Polysubstance use' is any reported use of three or more of the five different categories of substances. CI, confidence interval; OR, odds ratio.

more substantial rise in polysubstance use (38.7%) by age group, neither of these increases are statistically significant. The most significant and troubling result of the study is the change between the two age groups in the percentages of boys whose responses on the adapted CRAFFT instrument suggest disordered substance use. With an 177% increase, 21.3% of all 16- to 19-year-old boys reported behaviours indicative of substance use problems, $\chi^2(1, 322) = 12.32, P < 0.001$.

In girls the three most commonly reported substance used by the younger age group are alcohol (10.0%), hallucinogens (9.7%) and tobacco (7.7%). As with boys of this age, the most regularly used substance were hallucinogens (4.2%). Rates of any substance use (19.0%), polysubstance use (3.9%) and substance use problems (3.1%) were substantially lower than what boys reported. In contrast to boys, there were more modest increases in reported use by age and none of these increases was statistically significant. Differences in regular use of tobacco by age groups is the only one to approach statistical significance, $\chi^2(1, 480) = 3.38, P = 0.066$. In the older age group of girls, alcohol (12.4%) and tobacco (11.9%) are the predominant substances consumed.

Patterns of hallucinogen use that emerge from this study are particularly interesting and merit further consideration. Use of hallucinogens is concentrated in the 12–15 year age group, where levels of any consumption in boys are equivalent to that of alcohol (14.3%) and are only surpassed by tobacco (16.8%). In girls, hallucinogens (9.7%) and alcohol (10.0%) are the two most commonly used substances. Hallucinogens also represent the category of substance most frequently regularly used by both 12- to 15-year-old boys (7.9%) and girls (4.2%). From a public health perspective, it is important to note that rates of hallucinogen use in 12- to 15-year-olds is equivalent to or surpass those of alcohol, tobacco and marijuana, which are the overwhelming focus of law enforcement efforts and public health interventions in Samoa. Consumption of *A. belladonna* berries likely carry far more short-term risk than any other substance considered here because of the high risk of accidental overdose. Unfortunately, the data do not allow us to parse what proportion of hallucinogenic substance use is *A. belladonna* and what proportion is the less dangerous *psilocybe* species mushrooms.

There is an interesting shift in patterns of hallucinogen consumption by age. More specifically, while rates of consumption of all other substances remain stable or increase, hallucinogens show a noticeable decrease for both boys and girls between the two age groups. Any use drops by 33% in boys and 48% in girls across the two age groups. In girls the finding approaches statistical significance, $\chi^2(1, 478) = 3.60, P = 0.058$. Regular

use drops by 60% in boys and 12% in girls with the reduction in boys also approaching statistical significance, $\chi^2(1, 349) = 3.56, P = 0.059$.

Hallucinogen use likely decreases by age for a number of reasons. In boys, substantial increases in rates of use of alcohol, tobacco and marijuana likely compensate for the decrease in hallucinogen use. Increased autonomy and access to money provides adolescents with the ability to purchase these higher status substances. Interviews with adolescents suggested that alcohol and cigarettes are associated with adulthood, maturity and ‘modernity’ in contrast to hallucinogens whose consumption can be perceived as ‘childish’ and ‘reckless’. Finally, some informants also suggested that the reduction in use might be due to the relative strength and length of effect of hallucinogens relative to other substances. Older adolescents, who are increasingly required to contribute more substantial amounts of labour to their extended households and descent group on a regular basis and/or who are students, may be less able to do so while consuming these particularly potent and long-lasting substances.

Although not definitive, there is evidence for change in prevalence of adolescent substance use in Samoa over time. Historical comparisons are difficult because of the lack of prior research, yet a rough comparison can be made against data collected by the Samoan government as part of the Apia Youth Survey [44], which was completed in 1994 and which included a comparable subpopulation of urban school children. The Apia Youth Survey reported *lifetime rates* of any use of marijuana in 15- to 19-year-old male students at 5.2% and alcohol at 20.9% ([44], p. 67–8, tables 28 and 29). Recalculating rates to include 15-year-olds in the older age group to allow for comparison, the study here found a rate of any use of marijuana *in the past 30 days* in 15- to 19-year-old male students at 16.2% and alcohol at 22.1%. Although not as pronounced, rates in girls were also elevated. These are striking differences, particularly given the different time scales (i.e. lifetime vs. past 30 days). Different methodologies preclude more detailed, direct comparison, but even this simple contrast strongly suggests a marked increase in substance use over the past 14 years, which is likely associated with processes of globalisation and cultural change over that period of time.

Discussion

The study described here provides data on patterns of substance use, polysubstance use and substance use problems in Samoan adolescents. This research is important because of the pace of sociocultural and economic change in Samoa and the association of such rapid and pervasive changes with increases in substance

use in the developing world [1,2,5,45], the suggestion of high levels of adolescent psychosocial distress in Samoa as evidenced by the high rate of adolescent suicide [12], and the need for a greater number of studies of substance use in the developing world [10,11].

Before a final discussion of the results, several of the study's limitations deserve attention. First, the study population is likely not representative of Samoan adolescents in general as the population was drawn from a single urban, secondary school. Data drawn from secondary school children in Samoa likely underestimate substance use rates that would be found in a community sample, because Samoan secondary schools are competitive and selective. Individuals engaged in substantial substance use would likely be removed from school by their family or school personnel, because mandatory schooling only extends through age 14. Second, additional research is needed to properly validate both the adapted CRAFFT alcohol and drug screen and the cut-off scores used to identify individual respondents with possible disordered substance use problems. The percentages of respondents whose responses suggest disordered substance use should be interpreted with caution until further research can be conducted.

Third, as the data were collected by self-report it is possible that the reported rates of drug use are deflated owing to stigma in reporting substance use or inflated by bravado. Fourth and finally, the full range of psychoactive substances available in Samoa were not examined in the study. Although my informants suggested that methylated alcohol, methamphetamines and inhalants was not a substantial feature of the local adolescent consumption, other researchers have reported use of these substances in Pacific societies [30,34,35].

Notwithstanding these limitations, there are several findings of note. As has been previously noted in the research literature on substance use in the Pacific [11,30,35], the study found substantial gender differences in substance use. There were statistically significant differences in prevalence of use across every category of substance, in any use over the past 30 days, polysubstance use and substance use problems. Most of these differences entailed several-fold difference between boys and girls. In Samoa, these differences in use are likely due to adolescent boys striving to demonstrate 'masculinity' and the recklessness and bravado thought to be characteristic of this life stage (on a comparable situation in Micronesia, see [46]). In contrast, lower rates in girls are probably due to the higher societal standards of dignity and behavioural restraint against which they are held [47–49], which are incompatible in many ways with substance use.

Although rates of female use show nominal increases over the two age groups, increases in boys are far more pronounced. In particular, we see significant increases in any use of alcohol and marijuana and regular use of tobacco between the two age groups. Although the prevalence rates appear to be equivalent to or lower than average rates for European and North American societies [9], these statistically significant increases are of concern. Of particular note is the fact that one-fifth of the older age group of boys (21%) provided answers suggestive of disordered substance use.

Although the study's limitations should be kept in mind, the findings do point to a few areas that could be considered priorities in addressing the health risks posed by adolescent substance use in Samoa. Alcohol, tobacco and marijuana represent the substances of greatest concern, although as noted above, consumption of hallucinogenic *A. belladonna* berries by younger adolescents, which can bear a greater risk of overdose [32,33], should also be a focus of future research and education. Given the far higher rate of male use and the important increases in use with age, Samoan boys should be the focus of substance use interventions and research. But as there is some evidence of reduced gender differences in substance use in more recent birth cohorts globally [8], Samoan girls should not be ignored if for no other reason than to better understand the social and cultural factors that keep these girls from initiating use. As there are statistically significant changes between age groups (12–15 vs. 16–19 years of age) in the percentage of boys reporting behaviours indicative of substance use problems, the study's results suggest that interventions and health promotion campaigns should at least begin to target this younger age group. Finally, as the comparison of this study's findings with the 1994 Apia Youth Survey [44] suggested substantial increases in alcohol, tobacco and marijuana use, further research explicitly considering the relationship of sociocultural and economic change and increases in substance use in Samoan youth would be extremely valuable.

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