

High Prevalence of Non-Communicable Disease Risk Factors among Adolescents in Pohnpei, Micronesia

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Abstract

Non-communicable disease (NCD) related behaviors among adolescents are on the rise globally and in the Pacific region. To better understand and elucidate the prevalence of NCD risk factors among adolescents in Pohnpei state, Federated States of Micronesia, a cross-sectional study was conducted among secondary school students. Of 2965 students enrolled in the 2015-2016 academic year, 2555 (86.2%) completed the survey, and 2386 (80.5%) were included in the final analysis. Of the survey respondents, 21.7% of students self-reported smoking tobacco in the past 30 days, 30.3% self-reported drinking alcohol in the past 30 days, 40.9% self-reported chewing betel nut in the past 30 days, and 21.2% self-reported chewing tobacco with or without betel nut in the last 30 days. Male students, older students, and public school students had higher prevalence of substance use. Additionally, about 17.3% of students were overweight and 10.1% were obese according to physical measures of height and weight. Female students and private school students had higher prevalence of overweight and obesity than male students, and prevalence of overweight was higher in older age groups. These findings indicate a cohort of adolescents at substantial risk for the development of NCDs and signal an urgent need for public health interventions to address NCD risk factors.

Keywords

Secondary school survey, substance use, overweight, obesity, non-communicable disease, Federated States of Micronesia

Background

Non-communicable diseases (NCDs) such as cardiovascular diseases (CVD), cancers, chronic respiratory diseases, and diabetes are the leading causes of death globally.¹ Worldwide, 38 million of the 56 million deaths in 2013 were due to NCDs.¹ Of these deaths, 16 million were premature (occurring before the age of 70), and 82% of these premature deaths occurred in low-and middle-income countries. The majority of these premature deaths could have been prevented.¹

The Federated States of Micronesia (FSM) is a grouping of 607 small islands in the Western Pacific Ocean about 2,500 miles southwest of Hawai'i, lying just above the equator.² The FSM is comprised of four states: Yap, Chuuk, Pohnpei, and Kosrae. The state of Pohnpei is the capital state of FSM, consisting of one main and five outer islands with a total estimated population of 35,981 in 2010.³

The World Health Organization's (WHO) STEPwise approach to surveillance (STEPS) survey conducted in 2008 identified high prevalence of NCD risk factors among adults in Pohnpei. Almost one-quarter (24.7%) of 25-64 year-old adults reported having elevated blood glucose levels and/or were diagnosed with diabetes. Additionally, 29.2% currently smoked cigarettes, and 59.9% were overweight or obese.⁴

Areca nut, commonly known as betel nut is chewed in many parts of the world due to its stimulant effect. The International Agency for Research on Cancer has classified regular use of betel nut as being carcinogenic to humans as it is associated with oral cancer and cancer of the pharynx and esophagus.⁵ Betel nut chewing is also associated with hypertension,⁶ metabolic syndrome,⁷ cardiovascular disease,⁸ and diabetes.⁹ Although betel nut was not traditionally chewed in Pohnpei, it is a relatively new habit that has quickly grown throughout the state. The 2008 STEPS survey conducted in Pohnpei reported that 38.3% of adults chewed betel nut daily, with men (52.4%) reporting a significantly higher proportion of daily betel nut chewing than women (24.0%).⁴ In a survey conducted in 2012, 71.4% of seventh and eighth grade students in Pohnpei had ever used betel nut compared to 61.5% in Yap.¹⁰

In the Commonwealth of the Northern Mariana Islands, a study conducted in 2004 found that 63.4% of the 309 school children surveyed reported regular use of betel nut.¹¹

Given the high prevalence of NCDs and associated risk factors amongst adults in FSM, the prevalence of risk factors amongst adolescents are of interest for public health planning, and may have legal and policy implications. As part of a new, statewide NCD Monitoring and Surveillance Plan, biennial surveys of core NCD risk factors of secondary school students have been instituted, of which the first survey was conducted in 2015. The purpose of this study was to examine NCD risk factors among secondary school students in Pohnpei State using this baseline survey, and assess the relationships between demographic data and NCD risk factors.

Methods

Study Design

A cross-sectional survey of major modifiable risk factors for NCDs was conducted among all secondary school students enrolled in the 2015-2016 academic year in Pohnpei State. The survey questions were adapted from the Centers for Disease Control and Prevention (CDC) Youth Risk Behavior Surveillance System (YRBSS) standardized survey tool.¹² The questions were pilot tested on local high school students and simplified based on their qualitative feedback. Questions on chewing betel nut and chewing any tobacco (with or without betel nut) in the past 30 days (that are not included on YRBSS) were developed by adapting tobacco use questions from the YRBSS. All survey questions used were in alignment with the United

States Affiliated Pacific Islands (USAPI) NCD Monitoring and Surveillance Framework.¹³ The survey (Annex 1) was piloted in one of the secondary schools before being administered at all secondary schools.

Study Sample

All students enrolled in all of the secondary schools in Pohnpei state during the 2015-2016 academic year were included in this study. Students who attended school on the day of the survey in their school participated in the survey. Parents and students had the right to opt out of the survey, however no parents or students refused participation, therefore the only students who did not participate were those who were not present in school on the day of the survey. There were 2965 secondary school students enrolled in the 2015-2016 academic year. Of these, 2555 students completed the survey for a response rate of 86.2%. Students over the age of 18 ($n=167$) were excluded from this analysis in order to focus on adolescents. Also, one student with missing age data and one student with missing height and weight measurements was excluded. Therefore, the final study sample used in this analysis was 2368.

Data Collection

Data was collected from seven high schools between October to November 2015. The biggest public school was surveyed over the course of four days. Two additional public schools were surveyed over two days and the remaining four private schools were surveyed over the course of one day. Section one of the data form was completed by trained staff based on face-to-face interviews with students to collect data on the name of the school, current grade, gender, age, and municipality. Height and weight measurements were conducted by trained staff using simple wall measuring tapes and digital weight scales in a private room. Once section one was completed, the form was given to the student to complete section two of the data form. These questions were on substance use (tobacco, alcohol and betel nut use). The student was given a private space to complete their form. Upon completion of section two, students submitted the data form into a protected box with all other forms without any review to maintain confidentiality. Forms did not contain any student names to protect confidentiality of the students. After all forms were submitted, these were all entered into an electronic database by trained public health staff. This electronic database was password protected and retained within the Department of Health Services. All findings were presented on an aggregated level to protect confidentiality.

The age of students was categorized into three groups: 12-14 years, 15-16 years, and 17-18 years. BMI-for-age growth charts were used to calculate BMI percentiles, and <5th percentile was classified as underweight, from 5th to less than 85th percentile was classified as healthy weight, from 85th to less than 95th percentile was classified as overweight, and greater than or equal to 95th percentile was classified as obese.^{14,15}

Statistical Analysis

Descriptive statistics were performed on demographic and NCD risk factors. Categorical data (gender, age groups, type of school, grade, and BMI category) were summarized using count and percentage. The prevalence of substance use by age and gender was calculated in this population. Pearson Chi-square tests were used to determine statistical differences when examining risk factors by demographic characteristics and all P -values <.05 were considered statistically significant. All analyses were performed using Epi Info, version 7.2 (Centers for Disease Control and Prevention, Atlanta, USA).

Ethical Considerations

Permission for this study was provided by the Pohnpei State Department of Health Services, Pohnpei State Department of Education, and the principals of the private secondary schools in Pohnpei state. The principal of each school informed parents of this survey through a letter home to parents, and passive consent was used. Parents were instructed to call the school if they did not want their child to participate. Parents and students had the right to refuse participation at any point. Given that there is no formal IRB in Pohnpei, or even throughout the whole FSM, formal approvals from relevant government agencies were used as a substitute. Additionally, this survey is considered to be local surveillance rather than research, and due to the limited resources in FSM, outside IRBs were not consulted. Ethics committee approval was given by the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease (Paris, France), and study conduct was in accordance with the principles of Good Clinical Practice and the Declaration of Helsinki.

Results

Characteristics of the survey respondents are described in Table 1. A total of 2386 students were included in the sample, of which about half were male (48.9%) and half were female (51.1%). Students ranged from 12 to 18 years old, and almost half (44.3%) were between the ages of 15 and 16. A majority (86.4%) of the students in Pohnpei state were enrolled in public secondary schools, and over one-third (35.0%) were in the ninth grade. According to BMI percentiles, 17.3% of students measured overweight, and 10.1% measured obese. Overall, half (50.0%) of students reported using at least one substance (alcohol, betel nut, or tobacco) over the past 30 days, and 9.7% reported using all substances in the past 30 days. The most common substance behavior reported by students was chewing betel nut (40.9%), followed by drinking alcohol (30.3%), smoking tobacco (21.7%), and chewing tobacco (21.2%).

Table 2 presents BMI percentile classifications by demographic characteristics. Female students were more likely to be overweight compared to male students (23.8% vs 10.8%). Weight status also significantly differed by age group ($P=.02$). Prevalence of overweight was higher in the older age groups

Table 1. Characteristics of Adolescents Survey Respondents in Pohnpei, 2015	
Charateristics	N (%)
Gender	
Male	1167 (48.9)
Female	1219 (51.1)
Age Groups	
12-14	554 (23.2)
15-16	1056 (44.3)
17-18	776 (32.5)
Type of School	
Public	2061 (86.4)
Private	325 (13.6)
Grade	
9	836 (35.0)
10	622 (26.1)
11	503 (21.1)
12	425 (17.8)
BMI Category	
Underweight	46 (1.9)
Healthy weight	1687 (70.7)
Overweight	413 (17.3)
Obese	240 (10.1)
Substance Use (30 day)	
Alcohol	723 (30.3)
Chew betel nut	977 (40.9)
Chew tobacco	505 (21.2)
Smoke cigarettes	518 (21.7)
At least one substance used	1194 (50.0)
All four substances used	232 (9.7)
Total	2386

of 15-16 (19.1%) and 17-18 (17.5%) compared to 12-14 year olds (13.5%). Finally, BMI significantly differed by school type ($P<.01$). Obesity prevalence was higher in private school students (17.5%) compared to public school students (8.9%).

Table 3 presents 30-day substance use by demographic characteristics. Male students were significantly more likely to report drinking alcohol (37.6%), chewing tobacco (24.0%), and smoking tobacco (27.8%) compared to female students (23.3%, 18.5%, and 15.8%, respectively). Significant differences in drinking alcohol ($P<.01$), chewing betel nut ($P<.01$), chewing tobacco ($P<.01$), and smoking tobacco ($P<.01$) were also observed by age group. All substance use prevalence was highest amongst 17-18 year olds where 43.4% reported alcohol use, 54.1% reported betel nut chewing, 30.7% reported chewing tobacco, and 28.6% reported smoking tobacco. Consistently, a similar significant trend was observed when substance use prevalence was examined by grade. Finally, use of all substances examined was significantly different by school type. Public schools had a higher prevalence of drinking alcohol (32.5%), chewing betel nut (44.6%), chewing tobacco (23.0%), and smoking cigarettes (23.2%) compared to private schools (16.3%, 17.6%, 9.8%, and 12.0%, respectively).

Discussion

Among secondary school students surveyed in Pohnpei state, we found a high prevalence of NCD risk factors.¹⁶⁻²⁰ According to the YRBSS, among high school students in the United States (U.S.), 30-day smoking prevalence is 10.8% and 30-day smokeless tobacco chewing is 7.3%. Therefore, adolescent tobacco use prevalence in Pohnpei is about twice as high as in the U.S.¹² However, the adolescent 30-day alcohol prevalence observed in Pohnpei (30.3%) and the overweight/obesity prevalence (27.4%) is similar to U.S. high school students (32.8% and 29.9%, respectively).¹² It should be noted that the most common substance use reported was betel nut chewing, which is unique to the Asia-Pacific region.

The high proportion of adolescents chewing betel nut is concerning given the fact that several negative health outcomes are associated with betel nut chewing such as cancer of the pharynx and esophagus³, hypertension,⁶ metabolic syndrome,⁷ cardiovascular disease,⁸ and diabetes.⁹ In a recent study among Micronesian adolescents, betel nut use was also associated with oral decay and oral abscesses.¹⁰ In our study, 22.2% of 12 to 14-year-old students reported betel nut chewing in the past 30 days, indicating early initiation. To combat early initiation and use of betel nut among adolescents, legislation prohibiting businesses to sell betel nut to minors was recently unanimously passed by the Pohnpei State Legislature in 2016.²¹ However, this legislation will require ongoing enforcement and resources to make sure that business are in compliance.

The increasing prevalence of all risk factors by age in this study suggests that secondary school is a key period for uptake of new NCD risk factors. Since early habits after initiation are easier to change than those that have been established for years,²² a focus on programs and policies aimed at decreasing

Table 2. Body Mass Index (BMI) Percentile Classifications of Adolescent Survey Respondents in Pohnpei in 2015, by Demographic Characteristics					
Demographic Characteristics	Underweight n (%)	Healthy Weight n (%)	Overweight n (%)	Obese n (%)	P-value*
Gender					
Male	37 (3.2)	899 (77.0)	123 (10.5)	108 (9.3)	<.01
Female	9 (0.7)	788 (64.6)	290 (23.8)	132 (10.8)	
Age Groups					
12-14	9 (1.6)	406 (73.3)	75 (13.5)	64 (11.6)	.02
15-16	14 (1.3)	739 (70.0)	202 (19.1)	101 (9.6)	
17-18	23 (3.0)	542 (69.8)	136 (17.5)	75 (9.7)	
Type of School					
Public	36 (1.7)	1488 (72.2)	354 (17.2)	183 (8.9)	<.01
Private	10 (3.1)	199 (61.2)	59 (18.2)	57 (17.5)	
Grade					
9	20 (2.4)	613 (73.3)	123 (14.7)	80 (9.6)	.11
10	7 (1.1)	437 (70.3)	117 (18.8)	61 (9.8)	
11	8 (1.6)	337 (67.0)	104 (20.7)	54 (10.7)	
12	11 (2.6)	300 (70.6)	69 (16.2)	45 (10.6)	
Total	46 (1.9)	1687 (70.7)	413 (17.3)	240 (10.1)	

Table 3. Substance Use in Past 30 Days among Adolescent Survey Respondents in Pohnpei in 2015, by Demographic Characteristics								
Demographics	Drink Alcohol n (%)	P-value	Chew Betel Nut n (%)	P-value	Chew Tobacco n (%)	P-value	Smoke Tobacco n (%)	P-value
Gender								
Male	439 (37.6)	<.01	491 (42.1)	.27	280 (24.0)	<.01	325 (27.8)	<.01
Female	284 (23.3)		486 (39.9)		225 (18.5)		193 (15.8)	
Age Groups								
12-14	78 (14.1)	<.01	123 (22.2)	<.01	47 (8.5)	<.01	51 (9.2)	<.01
15-16	308 (29.2)		434 (41.1)		220 (20.8)		245 (23.2)	
17-18	337 (43.4)		420 (54.1)		238 (30.7)		222 (28.6)	
Type of School								
Public	670 (32.5)	<.01	920 (44.6)	<.01	473 (23.0)	<.01	479 (23.2)	<.01
Private	53 (16.3)		57 (17.5)		32 (9.8)		39 (12.0)	
Grade								
9	184 (22.0)	<.01	282 (33.7)	<.01	119 (14.2)	<.01	139 (16.6)	<.01
10	186 (29.9)		257 (41.3)		138 (22.2)		148 (23.8)	
11	179 (35.6)		221 (43.9)		113 (22.5)		111 (22.1)	
12	174 (40.9)		217 (51.5)		135 (31.8)		120 (28.3)	

access of children and adolescents to tobacco, alcohol, betel nut, and unhealthy foods may be one of the keys to addressing the epidemic of NCDs in Pohnpei. Of particular concern is the high prevalence of tobacco use amongst adolescents in Pohnpei. Anti-tobacco policies and programs targeted at youth and adolescents need to be strongly considered.

This report presents the first systematic collection of NCD risk factor prevalence in Pohnpeian adolescents. Its strengths include a survey design that allowed for confidential self-reporting of substance use, it included physical measures of height and weight by trained staff for accurate calculation of BMI percentiles, and had a large sample size and high response rate. Limitations of the study include potential sampling bias since the survey only included students attending school, and by possible response bias of students to accurately report on use of illicit substances although the answers were confidential. Future surveys should include more details on frequency of substance use and age of initiation in order to provide insight into behaviors influencing dependence.²³ There is also potential for this survey to be expanded to include other relevant adolescent health issues such as reproductive health. Finally, qualitative assessments should also be considered to better understand why adolescents engage in these risky behaviors, and how substances are accessed in order to provide adequate and appropriate public health programs and policies.

Conclusion

Secondary school students in Pohnpei have a high prevalence of substance use, particularly tobacco and betel nut chewing, and have a high proportion of overweight and obesity. These findings indicate a cohort at substantial risk for the development of NCDs, and an urgent need for public health interventions.

Conflict of Interest

None of the authors identify a conflict of interest.

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ANNEX 1: Pohnpei State Non-communicable Disease Secondary School Survey Questionnaire

Pohnpei State High School NCD Core Risks Questionnaire

Students will first be interviewed and measured by trained NCD Survey Staff to complete questions 1-10 in the shaded box. Then, students will complete questions independently, and then submit forms into a designated box. No names are to be collected.

SECTION 1: To be completed by NCD Survey Staff:

1. Date (M/D/Y): _____ / _____ / _____
2. Name of School: _____
3. Grade: 9 10 11 12 (circle one)
4. Name of Class or Section: _____
5. Gender: Male Female (circle one)
6. Age (years) _____ years
7. Residence (Municipality): _____
8. Staff Member Initials: _____
9. Height: _____ inches
10. Weight: _____ pounds
11. Staff Member Initials: _____

SECTION 2: To be completed by Student after SECTION 1

This section is for the student to complete (Do not put your name on this sheet. All information is confidential.)

- | | | | |
|--|-----|----|--------------|
| 12. During the past 30 days, did you smoke any tobacco? | Yes | No | (circle one) |
| 13. During the past 30 days, did you have at least one drink of alcohol? | Yes | No | (circle one) |
| 14. During the past 30 days, did you chew at least one betel nut? | Yes | No | (circle one) |
| 15. During the past 30 days did you chew any tobacco (with or without betelnut)? | Yes | No | (circle one) |