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Youth Knowledge and Practices towards Noncommunicable Disease Risk Factors in
Pohnpei, Federated States of Micronesia

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2006

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Youth Knowledge and Practices towards Noncommunicable Disease Risk Factors in Pohnpei, Federated States of Micronesia

By Anupama Mathur

Background: The Federated States of Micronesia (FSM) is a lower middle income country in the Western Pacific Region that suffers from a high burden of noncommunicable diseases (NCD). Pohnpei state has a high prevalence of diabetes among its adult population. NCDs such as Type 2 diabetes occur in children and appear to have their origins in early life. Limited data is available on youth knowledge, attitudes and practices regarding modifiable risk factors for NCDs in the FSM.

Objective: To identify gender differences among Pohnpeian youth ages 10-24 years in knowledge and practices relating to two modifiable NCD risk factors, namely physical inactivity and poor nutritional intake.

Methods: A seven-page survey consisting of 19 NCD risk factor questions was pilot tested and conducted among a convenience sample over the course of five weeks. Data were analyzed using SAS statistical software version 9.2.

Results: High proportions of both males and females practiced traditional physical activity, physical activity in their leisure time, and participated in at least one school sponsored physical activity in the previous school year. However, the percentages of daily vigorous physical activity, a component of total daily physical activity, were low for both males and females. Low proportions of males and females reported daily intakes of fruits and vegetables with significantly less females reporting daily vegetable intake than males. A majority of youth attained their knowledge of physical activity and health practices from school.

Discussion: Two studies in the last decade reported on youth health behaviors in Pohnpei. This study contributes to the literature by providing knowledge on youth practices, including various types of physical activity, towards two NCD risk factors with a focus on gender. No significant gender differences were found in leisure time and school-sponsored physical activity practices. Significantly more males than females practiced traditional physical activity. Female health practices put females at increased risk for NCDs more so than males since significantly fewer females consumed vegetables daily than males and, although not significant, fewer females met vigorous physical activity recommendations than males. Results suggest that a majority of youth are physically inactive and have poor nutritional intakes.

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Chapter 1: Introduction

Overview

Chronic non-communicable diseases (NCDs) are the largest cause of death in the world, contributing to 36 million deaths annually, and accounting for 47% of the global burden of disease.¹⁻⁵ NCDs are defined as diseases which are not transmissible or caused by injury.⁶ They include diseases such as cardiovascular disease (CVD), some cancers, chronic respiratory disease and diabetes mellitus.^{1-5,7} Some risk factors for NCDs include unhealthy diets, physical inactivity, tobacco and alcohol use, heredity and age.⁷ The burden of NCDs and their risk factors have occurred in part because of the processes of globalization and urbanization and may have been perpetuated by social determinants of health such as low income levels, poor knowledge and literacy, poor health resources and infrastructure, and unsanitary environments.⁶⁻⁸

In Asia's Western Pacific Region (WPR), a regional classification of the World Health Organization (WHO), 26,599 people die every day from NCDs.⁷ Most deaths caused by NCDs in this region are occurring at younger ages than in developed countries.⁹⁻¹⁰ The Federated States of Micronesia (FSM) is a lower middle income country in the WPR that suffers from a high burden of diabetes mellitus in its adult population.¹⁰ In 2002, 32.1% of the population, 25-64 years of age, was categorized as diabetic, with a higher percentage of diabetic women (37.1%) than diabetic men (26.4%). In this same year, 73.1% of the same population was found to be overweight with more women (82.7%) than men (63.9%) who were overweight and 42.6% of this population

was obese.¹¹ These data dispel a common misconception that NCDs, such as diabetes, are diseases of affluence; a misconception that prevents NCD action in low and middle income countries like the FSM.⁶

The FSM population and one of its four states, Pohnpei, has a young age-structure, with approximately 56% of 102,624 Micronesians being 24 years of age or younger.¹²⁻¹³ As of 2008, 52.6% of 25-44 year old Micronesians were already determined to be at a high risk for developing NCDs.¹¹ With its young age structure, and with NCDs increasingly affecting children and adolescents, the FSM may be susceptible to an increase in the incidence and prevalence of NCDs if preventive action in regards to NCD risk factors is not taken.¹³ The health consequences of these diseases are severe. For instance, undiagnosed or untreated diabetes can lead to end-stage renal disease, lower-limb amputations, blindness, cardiovascular diseases and even death.¹⁴

Some risk factors for NCDs are modifiable through lifestyle change. Two of these are unhealthy diet and physical inactivity. These risk factors are also among the leading causes of CVD, Type 2 Diabetes Mellitus (T2DM) and certain types of cancer.⁴ They can influence health both together and individually. Physical inactivity specifically is the main cause for 27% of diabetes, 30% of ischemic heart disease burden and 21-25% of breast and colon cancers globally. About 31% of ischemic heart disease and 11% of stroke worldwide is caused by low fruit and vegetable intake.¹⁵ When unhealthy diets and inadequate physical activity interact, they can lead to another modifiable NCD risk factor, obesity.^{4, 10, 16-17} Obesity and overweight is the cause of 44% of diabetes, 23% of ischemic heart diseases and 7-41% of certain cancers globally.¹⁸ Additional health

benefits can be obtained from physical activity independent of nutrition and diet, and nutritional risks unrelated to obesity exist.¹⁹

The WHO stresses that timely, appropriate and valid surveillance of NCDs and their risk factors are needed by countries to support the planning, implementation and evaluation of public health prevention initiatives, which are imperative to address the growing burden of NCDs in low and middle income countries, such as the FSM.⁶ The WHO and the United Nations Children's Fund (UNICEF) also agree that the most important investment that any country can make is in the future health of adolescents. A failure to do so would result in large economic and social costs.^{11, 20}

In the FSM, there is currently no regular surveillance of the incidence and prevalence of NCDs and their risk factors in youth 24 years of age or younger. Some studies exist on youth knowledge, attitudes and practices regarding physical inactivity and unhealthy diet.^{13, 20} Only two studies were found to assess youth food and beverage consumption and physical activity practices and these were conducted in the state of Pohnpei. The first was the Health Behavior and Lifestyle of Pacific Youth (HBLPY) surveys conducted in 2001 by UNICEF and WHO. The second was an Emory University student's 2008 thesis; 'Youth Health Behaviors in Pohnpei, Federated States of Micronesia.'^{13, 20}

There has been growing acceptance that young people between the ages 10 and 24 years are a distinct population with needs different from others.²⁰ Therefore additional studies are required to confirm past behavioral findings on youth as it relates to NCDs and their risk factors in order to inform the development of appropriate services,

programs and policy interventions for NCD prevention, especially diabetes prevention, for youth ages 10-24 years in the FSM.

Thus, the primary purpose of this study is to contribute to the research on youth knowledge and practices toward the modifiable NCD risk factors, namely physical inactivity and poor nutritional intake, among those aged 10-24 years in Pohnpei, Micronesia. Since gender differences in the prevalence of diabetes and NCD risk factors have been reported in previous Micronesian studies, particular attention is also given to identifying gender differences in this study.^{11, 13, 20}

Research Question

Are there gender differences among Pohnpeian youth of ages 10-24 years in terms of their knowledge and practices toward two modifiable NCD risk factors, namely physical inactivity and poor nutritional intake?

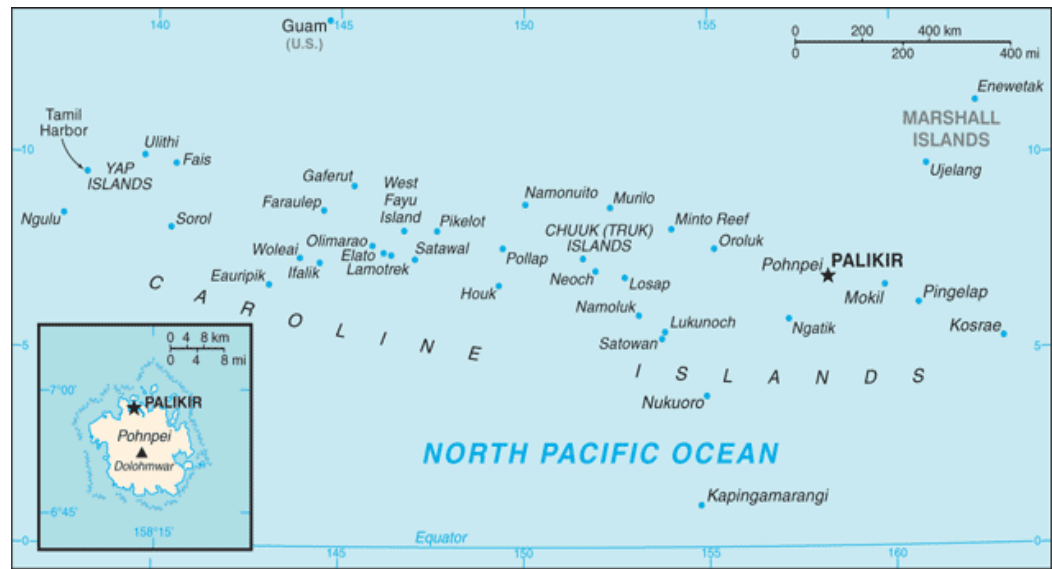
Specific Aims

- Provide data on leisure time, traditional, and school physical activity practices among Pohnpeian males and females ages 10-24 years
- Provide data on physical activity and health educational resources of youth ages 10-24 years with regards to gender
- Provide data on fruit and vegetable intake among Pohnpeian males and females ages 10-24 years

Concerns about NCDs, such as diabetes, affecting youth and its increasing prevalence have been voiced by members of a local non-governmental organization, the Island Food Community of Pohnpei (IFCP). The IFCP identified the need for this research study to help address NCDs and their risk factors among Pohnpeian youth. Also, due to the sparse research in this population and research topic, previous reports and studies have suggested that additional research is required to provide frequent and updated information to form evidence-based NCD prevention initiatives.¹³ It is hoped that results from this study will be used by the IFCP, state and national governments of the FSM and other key stakeholders to inform gender and age appropriate NCD prevention initiatives for Pohnpeian youth aged 10-24 years.

Chapter 2: Literature Review

The Federated States of Micronesia



Map 1: The Federated States of Micronesia

Source: Central Intelligence Agency. (2011). *The World Factbook - Micronesia, Federated States of*. From <https://www.cia.gov/library/publications/the-world-factbook/geos/fm.html>

Location and Demographics

The Federated States of Micronesia (FSM) is located north of the equator and consists of 607 islands (volcanic and atolls) spread across 2.6 million km² of North Pacific Ocean.^{11, 21-23} Sixty-five of these islands are inhabited with a total population of 102,624.^{11, 21-23} The islands are grouped into four states; Pohnpei, which is the most Westernized state and on which the capitol, Palikir, is located (shown by the star on Map 1); Chuuk; Yap; and Kosrae.^{11, 21, 24} According to the 2010 census, approximately 47.7% of the population lives in Chuuk, 35.1% in Pohnpei, 11.1% in Yap and 6.4% in

Kosrae.²² The 2010 census also reported that 35.7% of the total population was 0-14 years of age, 20.6% was 15-24 years of age, 38.1% was 25-59 years of age and 5.6% were over 60 years of age.^{12, 22}

Micronesians are diverse in terms of culture traits, languages, and ethnicities²³⁻²⁴ This in part resulted from colonization by Spain, Germany and Japan which occurred between 1885 through 1945.²³ Ethnically, the population of the FSM is 48.8% Chuukese, 24.2% Pohnpeian, 6.2% Kosraean, 5.2% Yapese, 4.5% Yap outer islands, 1.8% Asian, 1.5% Polynesian, 6.4% other and 1.4% unknown according to the 2000 census.²¹ Vernaculars such as Pohnpeian, Yapese, Chuukese, Ulithian, Nukuoro, Kosraen, Woleaian and Kapingamarangi are commonly spoken and English is spoken when needed.²¹

The main religions are Roman Catholic and Protestant and these were introduced to the country through Christian missionary contact in the 17th and 18th centuries.²⁵ Other religions practiced are Latter-Day Saints, Seventh-Day Adventist, Assemblies of God, Jehovah's Witnesses, and the Baha'i Faith.¹¹ In terms of social structure, communities are still made up of large matrilineal clan groups and the household structures consist of the extended families of these clans. The clans and the traditional systems such as the, *Nahmwarki* ('King') Political System in Pohnpei, continue to play an important role in governing society.¹¹

Political Structure

The four states, Pohnpei, Chuuk, Kosrae and Yap and their outer islands began their governance under the same constitution in 1986 when independence was granted. This constitution is similar to that of the United States' (US) Bill of Rights in that it

guarantees basic standards of human rights but is unique in that it protects traditional rights and leadership in FSM society and culture.^{11, 21, 24, 26} Thus while the political structure consists of a President and a Vice President and a fourteen-seated Congress that is unicameral, traditional leaders, such as chiefs, and religious leaders are still important political forces in the FSM.²⁷ Since no formal political parties exist, congress members are elected by popular vote.¹¹ The four senators representing each of the four states serve a 4-year term and elect the president and vice president; the other ten senators serve a two-year term in Congress.²¹

Foreign Aid Agreements

In addition to this political structure, the FSM also has a Compact of Free Association with the US. This is an aid agreement that allows for limited funding grants and social services.¹¹ Being a remote island nation, the FSM is vulnerable to geographic dispersion, population pressure, natural disaster, emigration to US mainland, and a limited resource base.²⁴ The Compact agreement allows aid in imports of food and other items to these islands as assistance. The top five imported commodities by value are canned or frozen meats (including high-fat items such as turkey tail), beer, motor vehicles, cigarettes and polished white rice.²⁸ As of 2008, the FSM's gross domestic product (GDP) per capita was US\$2,200 and the primary sources of income were mainly subsistence farming of breadfruit, banana, taro, yam, citrus and coconut; subsistence fishing; selling of fishing licenses and the internet domain name.^{11, 21, 23} Despite these sources of income, the FSM has and continues to be reliant on US aid, having received US\$1.3 billion in grant aid from 1986 to 2002 and with millions of dollars in annual assistance guaranteed through to 2023 under the 20-year Compact of Free Association

agreement.^{11, 21} The Compact also guarantees a Trust Fund into which both the FSM and the US make contributions to annually after 2023.¹¹ With this Compact agreement, the US has not only a financial investment and responsibility to the FSM but additionally a responsibility for military defense.^{21, 24}

Health and the Health Care System

Access to medical care is a challenge in the FSM as there is a shortage of health professionals in the Pacific and nutritional professionals in all four states of the FSM.^{24, 27} As a result a large portion of the FSM's health budget is spent on off-island medical referrals, leaving little money for preventative health care.²⁷ The rural outer islands have great barriers to accessing health care including lack of money, medications, transportation, a lack of trust and language difficulties.²⁹ The concept of health in the FSM is also viewed differently from Western concepts; it is seen more in terms of a family concept than an individual one. An example of this is mothers being fed large amounts of food and given emotional support to care for their children and for their whole family's well being.²⁷

Additionally, there are strong beliefs in the relationship of the supernatural and spirits with health, making discussions of nutritional benefits or biological concepts of health ineffective approaches in explaining the importance of preventative health measures in areas of the FSM.²⁷ While an attitude exists in the FSM that Western health systems are superior to traditional health systems, the Western health concepts, as mentioned earlier, are difficult to explain culturally and do vary from what some Pacific Islanders' actually practice in terms of their diet.²⁷ For instance, fruits are generally not eaten as part of meals as they are in the West, but rather as snacks or as a staple in the

main dish as is done with green bananas²⁷. Thus, a reorientation of the health system in the Pacific to reintroduce Western health concepts in a culturally appropriate model is needed.²⁷

Noncommunicable Diseases

Definition and Epidemiology

Noncommunicable diseases (NCDs) are diseases which are not transmissible or caused by injury and include mainly cardiovascular diseases (CVD), cancers, chronic respiratory disease and diabetes.^{2-3, 6} They are also sometimes referred to in the literature as 'chronic diseases'.^{1, 6} NCDs have become a major global public health issue and affect individuals of all ages, races, ethnicities, genders, nationalities, socio-economic, cultural and educational backgrounds.^{6, 10} They are the largest cause of death in the world with stroke and ischemic heart disease contributing to the most deaths at 17 million, followed by cancer with 7 million, chronic lung disease with 4 million and diabetes with almost 1 million deaths as of 2002.³

The poor have the worst outcomes from NCDs with 77% of the total global mortality from NCDs occurring in low and middle income countries in 1998.⁶ In 2005, it was estimated that 60% of all deaths (35 million) resulted from chronic diseases and more than 80% of these deaths were in low-income and middle-income countries.¹⁻² These statistics dispel a common misconception that NCDs are diseases of affluence; a misconception that hinders NCD action in low and middle income countries.⁶ The number of deaths worldwide that result from chronic NCDs is now twice the number of

deaths that occur from a combination of infectious diseases (including HIV/AIDS, malaria and tuberculosis), maternal and perinatal conditions and nutritional deficiencies.¹

Cardiovascular Diseases

The majority of deaths in the world, 17.1 million lives a year, are caused by cardiovascular diseases (CVD).³⁰ CVD is a term used for a range of conditions related to the heart and blood vessels. The majority of CVDs are coronary heart disease, also called ischemic heart disease, and include heart attacks.³¹ Atherosclerosis is a condition that leads to many CVDs. It is the slow accumulation of fatty plaque that accumulates, and eventually narrows and blocks the heart's coronary arteries. This same process is responsible for cerebrovascular diseases (strokes) as well when the critical blood vessels to the brain are blocked.

The leading risk factor for CVD is hypertension, or high blood pressure, but also includes risk factors such as impaired metabolism of glucose and raised blood lipids.³¹ Other risk factors for CVDs that are modifiable include overweight and obesity, tobacco use, physical inactivity, unhealthy diets, excessive alcohol consumption. Some non-modifiable risk factors are sex, ethnic group and age with increasing age bringing a higher incidence of heart disease and stroke and accounts partly for the rise in CVD in ageing populations.³¹

By the year 2020, it is projected that CVD will be the leading cause of death in all countries with nearly 17 million deaths a year.³¹ In the Asia Pacific Region nearly six million deaths were due to CVD divided between stroke and ischemic heart disease. The burden of CVDs affects both women and men. As seen in Figure 3, the prevalence of

ischemic heart disease mortality was higher for men than women but the prevalence of cerebrovascular disease mortality was higher for women than men in 2004.

Cancer

Cancer is defined as a group of more than 100 diseases that occurs through a pathological breakdown of the process which controls cell proliferation, differentiation and death.³¹ Tobacco smoking is associated with cancer of the lung, larynx, pancreas, stomach, bladder and cervix. Chewing tobacco is a leading cause of oral cancer.³¹ Other common cancers are stomach and liver cancer and breast cancer. Breast cancer is the most common cancer among women in the Asia Pacific Region, which includes the FSM, and is related to the two modifiable NCD risk factors- a high-calorie diet and a lack of exercise, as well as reproductive factors.³¹ Other diet-related cancers are colon cancer and cancer of the prostate. Improvement in diet and physical activity levels makes the primary prevention of colorectal, prostate and breast cancer possible, which in turn can reduce the health burden of NCDs.³¹

Chronic Respiratory Diseases

These are diseases of the airways and other lung structures. Asthma, chronic obstructive pulmonary disease (COPD), pulmonary hypertension and respiratory allergies are some of the most common types of these diseases. These diseases cause more than 4 million deaths globally each year.³¹ In Pohnpei, in 2004, 7.7% of men and 6.2% of women died from respiratory diseases.³² Preventable risk factors for these diseases include tobacco smoking, indoor and outdoor air pollution, allergens and vulnerability from occupational risks.

Diabetes Mellitus

Diabetes Mellitus, commonly referred to as 'diabetes', is characterized by hyperglycemia. Since insulin is the only hypoglycemic hormone, hyperglycemia is the result of impaired secretion of insulin (Type 1 Diabetes Mellitus, T1DM), the resistance to the effect of insulin in liver or muscle (Type 2 Diabetes Mellitus, T2DM) or, a combination of the two³³. T1DM is a major form of diabetes in children under 10 years of age but can occur in adolescence. T2DM occurs in adults and children and appears to have their origins in early life.^{34 33} Other specific types of diabetes do exist as well such as gestational diabetes.

If diabetes is left undiagnosed, untreated or poorly managed, it can lead to serious and long-term complications including cardiovascular disease and stroke, blindness and visual impairment, kidney disease including end stage renal failure, foot ulcerations and lower limb amputations, sensory neuropathy and erectile dysfunction.¹⁰ The delayed diagnosis of T2DM usually results in short term complications which may be life threatening.¹⁰ They include ketoacidosis, hypoglycemia, hyperosmolar coma, and infections such as tuberculosis and pneumonia¹⁰.

The non-modifiable risk factors for T2DM are genetic susceptibility, or having a first degree relative with diabetes or being from a certain ethnic background; having a history of gestational diabetes; and increasing age.¹⁰ Impaired fasting glucose and impaired glucose intolerance carry some significant predisposition to diabetes but have been demonstrated to be preventable.¹⁰ The main modifiable risk factors that have been widely acknowledge are obesity, which doubles the risk of T2DM, physical inactivity and poor diets. Poor diets imply a greater consumption of processed foods or foods high in

saturated fats, low in fiber, and/or having a high glycemic load.^{8, 10} Modifying these lifestyle risk factors can delay and prevent the development of diabetes.¹⁰ There are also other modifiable risk factors that are increasingly being recognized as important risk factors for T2DM such as psycho-social stress.^{17, 34}

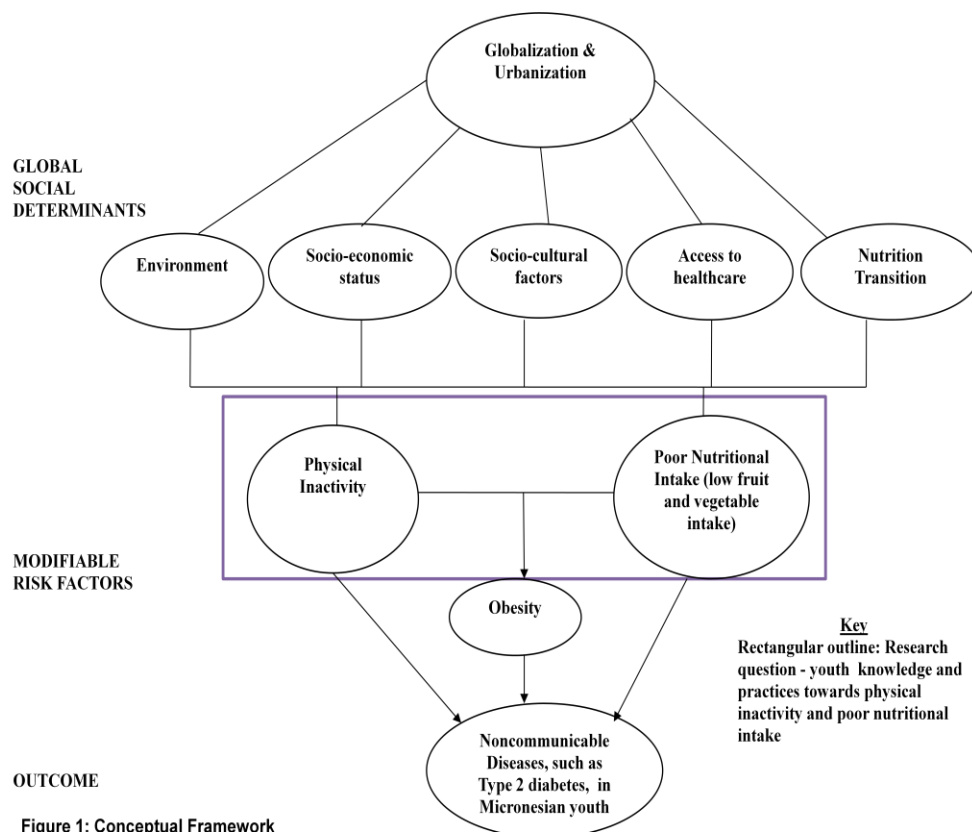
Type 2 diabetes mellitus is not only rising rapidly but recent data indicates that it is escalating in young people worldwide too, including adolescents and young children.^{8, 10, 35} T2DM was rare in children and youth until recently. It used to be a condition that occurred in individuals over 40 years of age, however, now the age of onset can occur in pre-teen children with overweight and obesity acting as the main driver to this development.⁸ In Japan for instance, T2DM is now seven times more common than T1DM in Japanese children, a 30 fold increase in incidence over the past 20 years. This epidemiological change is believed to be due in part to the changing diet and increasing obesity rates since the increasing trend in T2DM in youth parallels the increase in childhood obesity.^{8, 33} Obesity and overweight now affect an estimated 10-20% of children worldwide.⁸

Other risk factors for T2DM are family history, physical inactivity hypertension, lipid disorders and ethnic background.^{8, 35} Of all newly diagnosed adolescent T2DM diabetics, between 8% and 50% are in part due to ethnicity. Pacific Islanders are known to be at high risk for diabetes.⁸ Since most children with T2DM are obese or overweight at the time of diagnosis, a child of Pacific Islander ethnicity, because of their ethnic predisposition to developing T2DM may develop T2DM at a lower Body Mass Index (BMI) than would a child of Caucasian ethnicity. There are still few data on long-term follow up studies on the onset of T2DM from adolescence.

Noncommunicable Disease Risk Factors

The conceptual framework shown in Figure 1 provides a general understanding of how several inter-related factors may contribute to the development of NCDs. The four NCDs that contribute to most of the global NCD mortality (cardiovascular diseases, cancers, chronic lung diseases and diabetes), share four modifiable risk factors related to lifestyle: poor diet or poor nutritional intake, low levels of physical activity, tobacco and alcohol use.^{3, 6, 28} The framework highlights some modifiable risk factors, physical inactivity, obesity and poor nutritional intake; those of interest to the study are demarcated by a square outline (Figure 1). There are other important NCD risk factors, such as genetics and age but they are not shown in the conceptual framework since they will not be examined in this study.¹⁶⁻¹⁷ Also, as shown in Figure 1, there are global social determinants and environmental factors that may influence the onset of NCDs but again these are not the primary focus of the study. This is not to say, however, that these other risk factors and social determinants are not potential target areas in the prevention of NCDs.

Past exposures to modifiable NCD risk factors reflect the current burden of NCDs, and likewise the future burden will largely be determined by current exposures to these risk factors.^{1, 3, 6, 11} Exposure to risk factors are further perpetuated by globalization, industrialization and urbanization and by other global social determinants such as socio-cultural factors, traditions in a society, socioeconomic status such as low income levels, education, low levels of education and literacy, poor access to health resources, poor infrastructure and unsanitary environments.^{6, 10, 31}



Consequences of NCDs

From an individual's perspective, having an NCD reduces the quality of life.¹⁰ For a diabetic individual for instance this includes the frequent self-measurement of blood glucose, planning and timing meals, payment for and administration of medications, difficulty in accessing appropriate health care services, feeling the loss of control, embarrassment, social stigma and potential or real disadvantage in the workplace or personal situations.¹⁰

NCDs also impact areas other than health, such as national economies. For instance, in the next ten years China, India and the United Kingdom are projected to lose \$558 billion, \$237 billion and \$33 billion in national income respectively as a result of

heart disease, stroke and diabetes.¹ This is partly due to the result of reduced economic productivity from citizens burdened by these diseases.¹ It has also been suggested that the greatest rise in the number of people with diabetes will occur in an individual's productive years, between the ages 20-64 years.¹ This in turn has other indirect impacts and costs, especially to developing nations, including an increased demand on health service systems, social costs and economically productive year costs.^{10, 36}

The Western Pacific Region's Noncommunicable Disease Burden

The Western Pacific Region (WPR) consists of 39 countries and areas, according to the World Health Organization (WHO), and includes the FSM. The FSM has a very high burden of NCDs.^{6, 11, 24, 26} The rates of NCDs in the Pacific Islands are also among the highest in the world and are the leading causes of morbidity and mortality accounting for 75% of all deaths annually.^{11, 26, 28, 36-37}

Over 30 million people have diabetes in the Western Pacific Region and by 2025 it is predicted to increase to 56 million¹⁰ as seen in the Figure 2. Also, demonstrated by Figures 2 and 3 is that chronic NCDs have not replaced the burden of communicable disease but have rather attributed a double burden of disease to these regions which puts further strains on already limited health services in developing countries.³ Since Asia remains the most populous region, sixty percent of the world's population with diabetes will come from this region.

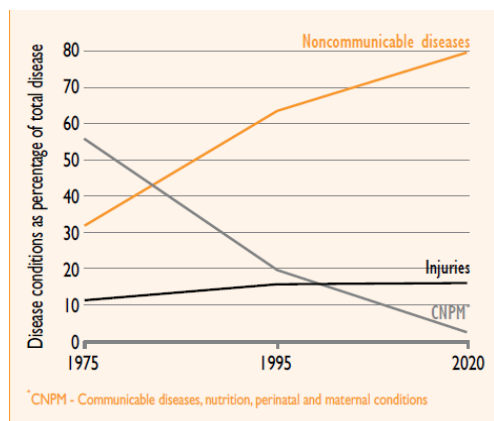


Figure 2: Projected increase in NCDs 1975-2020

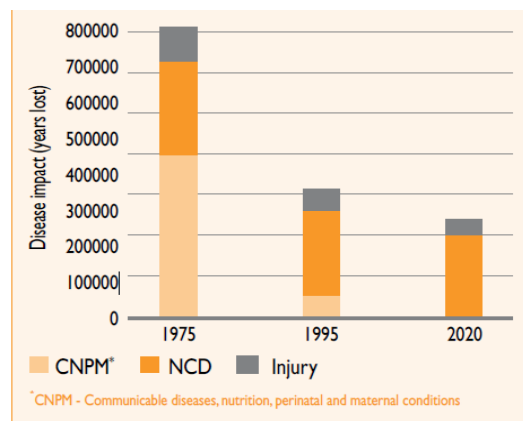


Figure 3: Disease impact projections in the Western Pacific Region 1975-2020

Source: Figures 1 and 2 from *Noncommunicable Disease and Poverty: The Need for Pro-poor Strategies in the Western Pacific Region A Review*. Geneva, World Health Organization, 2006.

The Federated States of Micronesia's Noncommunicable Disease and Noncommunicable Risk Factor Burdens

As Figure 4 shows, NCDs contributed to at least 70% of deaths in both males and females in 2004. In 2002 in the FSM, over 32.1% of the adult population ages 25-64 years was diabetic.¹¹ A higher percentage of women, 37.1%, than men, 26.4% were reported as diabetic in this population. In terms of NCD risk factors, there was a very high percentage of overweight women, 82.7%, and men, 63.9%, in this population.^{11, 36} Also, 42.6% of the 25-64 year old Pohnpeians were categorized as obese, 65.3% had low levels of physical activity and 81.8% consumed less than five combined servings of fruits and vegetables a day.^{11, 23-24} As of 2007, obesity prevalence on Kosrae, Pohnpei and Chuuk was 2.5 to 3 times the prevalence in the US. These are striking statistics because prior to 1960, obesity, overweight and diabetes were virtually unknown in Yap.²³

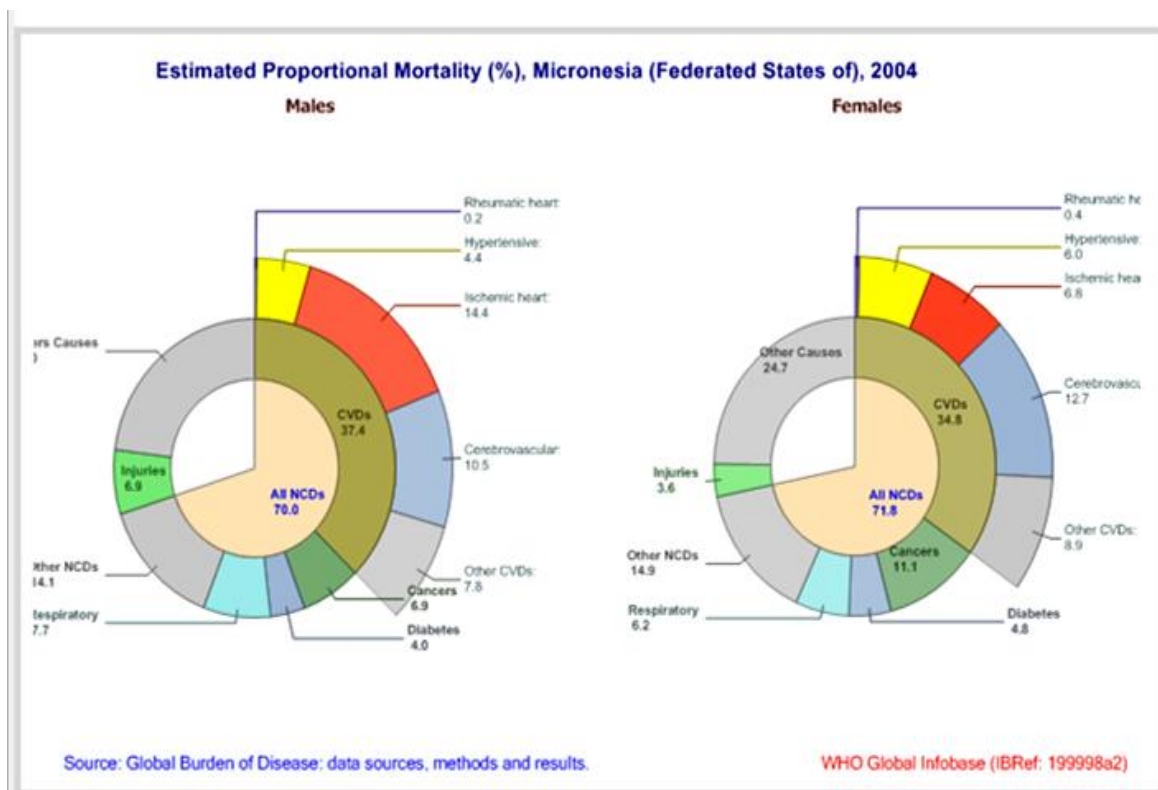


Figure 4: Estimated Mortality by Gender in The Federated States of Micronesia in 2004

Source: World Health Organization Global Infobase. World Health Organization. <https://apps.who.int/infobase/CountryProfiles.aspx>

Tobacco use contributes to the leading causes of diseases in the FSM, in particular cancer, chronic respiratory diseases, CVD and stroke.²⁸ Cigarettes and other tobacco products come either from U.S. owned subsidiaries in the Philippines or from the US. Distributors of tobacco products are located on Guam and two brands dominate the market: Philip Morris Benson and Hedges and RJR Nabisco's Winston.²⁸ Studies show that there are predominantly more male smokers in the FSM than female smokers. Social acceptance for smoking by adolescent males exist, however, religious belief in Micronesian females acts as a deterrent.²⁸

Prevention of Noncommunicable Diseases

NCDs can be reduced by common prevention strategies, as tools and knowledge to reduce the burden of NCDs exist.^{1,6} For instance, research has shown the benefits of avoiding tobacco use, regular physical activity, and having a healthy diet, and because of this evidence, population based public health interventions were established.⁴ Reviews of current scientific literature and research has also contributed to establishing recommendations and instructional guidelines regarding diets and physical activity on an individual level.⁴ Greater attention and priority is needed in NCD prevention, in the Western Pacific Region especially in the FSM, with specific attention to risk-taking behavior since the region has the second highest mortality rate from NCDs globally.⁶

The World Health Organization (WHO) states that timely, appropriate and valid surveillance of NCDs and their risk factors are needed by countries to support the planning, implementation and evaluation of public health prevention initiatives to address the growing burden of NCDs in low and middle-income countries. Since there is still only a small body of literature and disaggregated data on the prevalence of NCD risk factors and the incidence of NCDs among the poor in the Western Pacific Region, prevention strategies for this region, including the FSM, should begin by gathering risk factor data and using the data on risk factors in an integrated manner at the level of the community and family because these lifestyle risk factors are deeply rooted in the social and cultural framework of a society.^{1,6} The WHO STEPS report mentioned that diabetes control could be the entry point for NCD prevention and control in the FSM.¹¹

Physical Activity

Physical activity is defined as any bodily movement that is produced by the skeletal muscles that requires energy expenditure.³⁸ It includes exercise, as well as other activities such as playing, working, recreational activities and household chores. The health benefits of physical activity are widely acknowledged, and different types and amounts of physical activity are needed for different health outcomes.⁴ Reduction in the risk of CVD, diabetes, colon cancer and breast cancer is achieved with at least 30 minutes of regular, moderate-intensity physical activity on most days.⁴ Physical activity is also irrefutably known to have a role in reduction in overweight and obesity and increasing insulin sensitivity, making this a powerful factor in the prevention of T2DM.^{33, 35, 39-40}

Physical inactivity, or low physical activity levels, is a risk factor for NCDs and has been identified as the fourth leading risk factor for global mortality or 6% of all global deaths.⁴¹ Physical inactivity has been estimated to be the main cause for approximately 27% of diabetes, 21-25% of breast and colon cancer, and 30% of ischemic heart disease. On the population level, physical inactivity is apparent in developed and developing countries alike. For instance, currently less than 20% of Americans are engaging in regular exercise.⁶ International comparisons from the global public health perspective show variations in physical activity levels, which could be due to factors such as differing cultures, stages of economic development, geopolitical determinants, behavioral factors, among other things.³⁹

The reduction of physical activity in developing nations occurs greatly in areas where urbanization has been rapid, and modernization and industrialization is linked to the reduction of physical activity in the work place and at home for both men and

women.⁶ This trend is due to the shift from agriculture and manual labor which requires high amounts of physical activity to “office based” sedentary work.⁶ In China, overall levels of physical fitness have been reported but information on this topic in other developing Pacific Asian countries is sparse. Additionally assessing physical activity in an individual’s leisure time is a challenging task.^{6, 39}

Youth Studies

Studies with youth have demonstrated that with increasing physical activity, reductions in adiposity and moderate changes in body weight occur.³⁵ However, there is still a discrepancy in community-based interventions that include large numbers of healthy-weight children as they rarely show this change and randomized controlled studies are needed to confirm that 60-90 minutes of physical activity daily are required to maintain a healthy body weight in youth.³⁵ In addition to the duration of physical activity needed, the intensity and frequency of the physical activity are also considered for the prevention of overweight and in turn NCDs such as T2DM in youth.³⁵ Duration, intensity (low, moderate, vigorous) and frequency are considered the prescribed ‘dose’ of physical activity. Observational studies have shown a dose-response relationship between moderate to vigorous physical activity and adiposity in adolescents and children.³⁵ For instance, in some studies, time spent engaging in moderate to vigorous activity was more closely associated with adiposity than total daily physical activity.³⁵ These studies suggest the inclusion of moderate to vigorous intensity physical activity as the preferred prevention of weight gain.³⁵ Systematic reviews also consistently indicate 40-60 minutes of moderate to vigorous physical activity 3-5 times per week as an appropriate

recommendation which supports expert guidelines of 60 minutes of physical activity daily with some being of moderate to vigorous activity for optimal youth health.³⁵

Cross-sectional studies, such as the European Youth Heart Study, randomized control trials involving primarily aerobic activity and resistance training in high-risk youth, and longitudinal studies involving increased habitual physical activity have shown that physical activity improves insulin sensitivity in children and adolescents and reduces the risk for T2DM in young adulthood.³⁵ In adult clinical trials such as the Diabetes Prevention Project, the LOOK Ahead trials and the Finnish Diabetes Prevention Study demonstrate that significant improvements in diabetes risk, glycemic control, blood pressure and lipoprotein profile can be achieved with greater than 150 minutes of activity weekly combined with a 5-7% reduction in body mass and randomized control trials. Prospective cohort studies are needed to confirm that the effects of these interventions are the same in youth with T2DM. Exercise in conjunction with diet or exercise alone has been shown to enhance insulin sensitivity, lower total cholesterol, reduce systolic blood pressure, raise HDL-C and improve endothelial function in overweight adolescents.³⁵

Physical Activity in the Federated States of Micronesia

The first study found to report on physical activity in the FSM was the Unicef's Health Behavior and Lifestyle of Pacific Survey in 2001.^{13, 20, 42} This study included a representative sample of youth aged 14-17 years in Pohnpei. The study reported that approximately one quarter of participants participated in four or more sessions of exercise a week and a little over one quarter reported undertaking 2 hours or more of physical activity a week in total.⁴² Gender differences in these results were apparent with a higher

proportion of boys engaging in these activities than girls engaging in physical activity less so than boys.^{13,42}

The WHO's Noncommunicable disease (NCD) Risk Factors STEPS Report was the most comprehensive study to report on physical activity in the FSM. It had a representative population of adults aged 25-64 years in Pohnpei and reported that the total physical activity per day across all settings averaged 47.8 minutes a day for women and 105 minutes a day for men with most of the daily physical activity coming from transportation activity such as walking¹¹. Leisure time physical activity was very low with only 4.6% of total physical activity for women and 8.6% of total physical activity for men¹¹. Part of these gender differences come from the gender-based differences in lifestyle of men and women where women are typically more restricted and sedentary, resulting in higher risk of obesity.⁶

In 2008 a study of 360 Pohnpeian youth aged 10-22 years was conducted.¹³ This was not a representative sample nor was it a comprehensive study on physical activity levels as was the WHO STEP Report. However, 50% of youth reported playing sports and walking several miles to commute to school less than or equal to two days in one week.¹³ There were also significant gender differences reported where nearly 50% of all males reported exercising five or more times a week and only 27% of girls reported doing this.¹³

Physical Activity Recommendations

Studies have shown that late adolescence and early adult life is a period of transition from high levels of physical activity to substantially lower levels of physical activity and thus an appropriate time for lifestyle interventions.³⁹ Physical activity levels

are a recommendation and strategy in many targeted developing countries. The American Diabetes Association and the American Heart Association recommend more than one hour of daily moderate to vigorous physical activity.³⁵

Nutrition

There is a growing body of evidence that optimal nutrition plays a vital role throughout a persons' lifespan.⁴³ Several elements define a healthful diet for children and adults. One notable element is increasing vegetable and fruit intake and eating a variety of vegetables, especially orange, red and dark-green vegetables. Increasing the intake of fruits and vegetables is associated with reduced risk of many NCDs. For instance, there is evidence that indicates that an intake of at least two and a half cups of fruits and vegetables a day is associated with a reduced risk of CVD, cerebrovascular disease (stroke) and heart attacks.⁴³ These affects are attributed to fruits and vegetables as being major contributors of several nutrients, a few of which are potassium and dietary fiber⁴³ Dietary fiber from natural food sources promotes healthy glucose tolerance and lipid profiles and normal gastrointestinal function in adults and children. Fruits and vegetables can also help individuals achieve and maintain a healthy weight, if they are prepared without added sugar and fats, as they are relatively low in calories.

Whole fruits, which can be fresh, canned, frozen, or dried , should be consumed, rather than fruit juices because certain nutrients are not retained in fruit juices.⁴³ It is also important that if juices are consumed, 100% juice should be encouraged to limit intake of added sugars. Consuming too much added sugars, sodium, solid fats, and cholesterol,

saturated and *trans* fatty acids and alcohol increases the risk of NCDs.⁴³ Thus limiting these food and food components, controlling calorie intake to appropriate amounts, and consuming nutrient-dense foods such as fruits and vegetables help individuals meet nutritional needs and enjoy a healthy diet.

Local Food and Diet in Pohnpei

Local foods in Pohnpei consist mostly of indigenous starchy staples. These foods include breadfruit, green banana, different types of taro and yam, cassava, arrowroot, and sweet potato and have high nutrient and fiber content that lead to increased satiety. One hundred and thirty-three breadfruit, 55 banana and 24 giant swamp taro varieties mark the abundance and diversity of Pohnpei's indigenous local foods which have been the basis of the Pacific Island diet for years.²⁶⁻²⁷ Other local foods and drinks include fresh seafood, and island fruits such as mangoes and drinking coconut^{23, 36}. The traditional Pohnpeian meal consists of a starchy local food and cooked or raw seafood²⁶. The local diet has been viewed as very healthy and consumption of local foods rich in provitamin A carotenoids, found in a variety of bananas, breadfruit, giant swamp taro and pandanus, may protect against diabetes and other NCDs⁴⁴⁻⁴⁶.

Nutrition Transition in the Federated States of Micronesia.

Colonization, missionary influences, trading, and more recently, globalization and industrialization, have been cited as reasons for the introduction of new foods to the traditional Pohnpeian diet – foods such as rice, refined sugar and canned foods – as well as for introducing new methods of cooking.²³ A significant change to the traditional diet occurred around World War II, when the Japanese introduced rice as a staple food and

long-time FSM residents claimed the dietary shift to rice. Tinned food consumption took effect in the 1970s following the initiation of programs by the United States' administration suggesting a link between the programs and the dietary shift.²³ The United States Department of Agriculture (USDA)'s supplementary feeding programs further included surplus commodities such as tinned food and rice for school lunch programs which reached 30% of the entire population in 1985.^{23, 26} The US has been criticized for these programs as local food items were not initially accepted into these programs thus creating new dependencies on foreign foods, and shaping new food habits and tastes in the FSM.^{6, 23} Also during the time of the nutrition transition, the epidemiologic shift from infectious diseases to predominantly chronic diseases began to appear in the FSM population. Prior to this time, NCDs had never been reported.²⁵ Pohnpei is now between its third and fourth stages of the nutrition transition and its epidemiologic shift from infectious diseases to NCDs have been claimed to be associated with the changing dietary habits and lifestyle.^{13, 26-27} Internal and external government policies, and the change from subsistence to a market economy has and continues to also impact these nutrition and epidemiological transitions²⁷.

Youth Food Intake in Pohnpei

While studies on Pohnpeian youth's diet patterns are lacking, some cross-sectional studies show have shown the prevalence of intake of imported, processed food that are high in fat and sugar and the prevalence of local food intake¹³. In a 2008 convenience sample of 360 Pohnpeian youth aged 10-22 years, 82% of participants consumed rice daily compared to 14% local staples daily.¹³ Of 1,516 representatively sample Pohnpeian youth ages 14 and 17 years, in the HBLPY survey in 2001, more than

50% of youth consumed white bread, turkey, chicken and soft drinks at least once a day, less than 20% consumed taro daily and only 40% ate fresh fish, fruits and vegetables on a daily basis¹³.

Gender differences were apparent in the 2001 HBLPY study and the youth health behavior study in 2008. Twice as many girls in the 2001 HBLPY study reported consuming sweets at least daily than boys, and 57.2% of girls compared to boys reported consuming soft drinks at least daily.^{13, 42} The 2008 study, reported a significantly higher consumption of local fruits and vegetables amongst males rather than females.¹³ Females also reported a higher average consumption of soft drinks than males.¹³

Chapter 3: Research Methodology

Study Background

The researcher, Ms. Anu Mathur, partnered with the Island Food Community of Pohnpei (IFCP), a local non-governmental organization located in Kolonia, Pohnpei to conduct this research. The small NGO aspires to improve health, preserve culture, provide economic benefits and sustained development, protect natural resources and empower the community through its mission.⁴⁷ Its mission is to promote the consumption, production and local marketing of locally grown island foods in order to live on an environmentally sound island.⁴⁷ Initial contact was established with Dr. Lois Englberger, Lead Researcher of the IFCP, in mid-January 2010.

After an initial literature review and several e-mail discussions, a consensus was reached by the researcher and the IFCP that limited data were available on youth attitudes and practices toward the common Noncommunicable diseases (NCDs) risk factors, namely, physical inactivity, obesity and poor diets. Thus a decision was made to conduct a needs assessment that would help fill this information gap and to expand on previous research conducted with the IFCP in 2008. The 2008 study focused primarily on youth food intake practices.¹³ Therefore, the primary focus of Ms Mathur's study was to address youth (ages 10-24 years) practices and knowledge towards the two NCD risk factors, namely physical inactivity and poor nutritional intake.

The Secretary of the Federated States of Micronesia's (FSM) National Department of Health, Dr. Vita Skilling, and Dr. Rally Jim, the Chief of the Primary Health Care Division within Pohnpei State's Department of Health Services were

informed of this research prior to Ms. Mathur's arrival in the FSM and supported this needs assessment in Pohnpei.

Population

Pohnpei, one of the four states of the Federated States of Micronesia, was the location of interest for this research study and all survey sites are located in this state. Youth between the ages of 10 and 24 years were the target population. The most recent national census was conducted in 2010, the same year of this research study, cited the total population of Pohnpei proper as 34,574. This includes all five of Pohnpei's municipalities: Madolenihmw, U, Nett, Sokehs, Kitti and Kolonia. Approximately 34% of the population in Pohnpei was between the ages of 10 and 24 years in 2010. The population in the 10-14 year age group was 4,467 (2,299 males and 2,168 females); 4,067 in the 15-19 year age group (2,114 males and 1,953 females); and 3,315 in the 20-24 year age group (1,684 males and 1,631 females).¹²

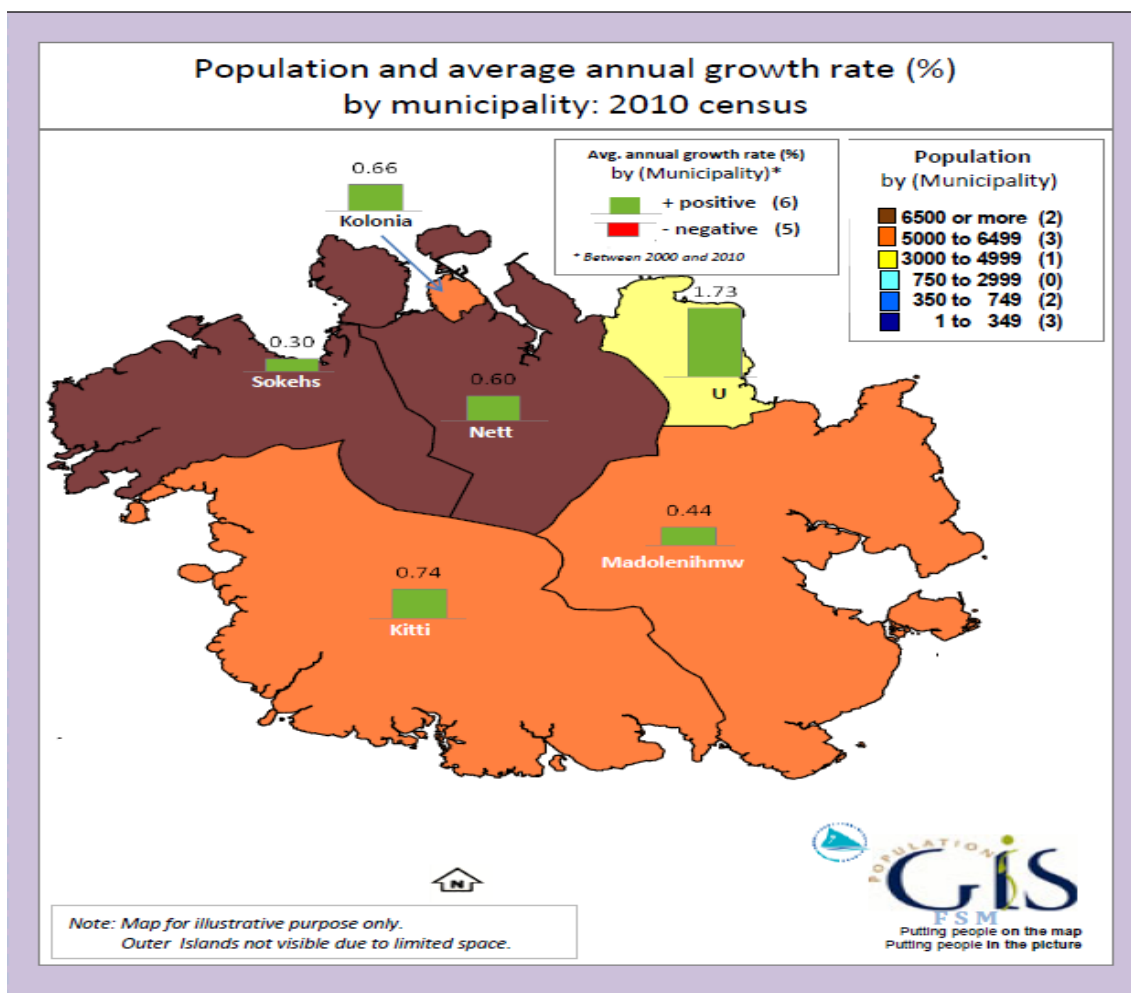
Boys and girls aged 10-24 years were surveyed in all five municipalities in an attempt to be inclusive and representative of the whole state. The population of Madolehnhmw in 2010 was 5,662; 3,192 in U; 6,542 in Nett; 6,640 in Sokehs; 6,470 in Kitti; and 6,068 in Kolonia. Map 2 shows the population by municipality as well as the growth rate by municipality from 2000 to 2010.¹² Since 2010 data for targeted group could not be attained, the census data from 2000 provides an indication of the population in each targeted age group in all five states in Chart 1.¹² The outer islands of Pohnpei were not surveyed due to limitations in researchers and staff, funding, time and access to

the islands. As of 2010, Pohnpei's outer islands consisted of 3.9% of the entire Pohnpei population.¹²

Municipality	10-14 years	15-19 years	20-24 years
Madolenihmw	644	578	438
U	347	316	224
Nett	762	657	421
Sokehs	665	652	437
Kitti	870	745	525
Kolonia	656	658	512

Chart 1: Number of people in age groups by municipalities

Source: 2000 FSM Census Analytical Report. Division of Statistics Office of Statistics & ICT, Budget and Economic Management, Overseas Development Assistance and Compact Management. 2000.



Map 2: Population and average annual growth rate by municipality in 2010.

Source: 2010 FSM-Wide Census of Population & Housing Pohnpei State. Division of Statistics Office of Statistics & ICT, Budget and Economic Management, Overseas Development Assistance and Compact Management. 2010

Research Design

The survey was designed as a tool to obtain data and to provide a framework for discussion regarding knowledge and practices of Micronesian youth towards the NCD risk factors, physical inactivity and poor nutritional intake. A cross-sectional survey was created with both quantitative and qualitative questions on physical activity, obesity and food and beverage consumption. However, a majority of the questions focused on

physical activity in order to address the research question. The questions were created with consideration to some of the main NCD risk factors, physical inactivity, obesity and poor diet, because these risk factors are common to diabetes mellitus, some cancers and CVDs all of which constitute the NCD health burden in Pohnpei. Traditions and cultural practices were also considered when formulating the questions.

Convenience sampling was performed. The sites included churches, elementary schools, youth summer camps, and colleges and universities throughout the five municipalities of Pohnpei, all of which targeted youth in the required age group for the study (ages 10-24 years). On-going partnerships with Peace Corps Micronesia, the Pohnpei State Department of Education and religious and community leaders had been long established by the IFCP prior to the researcher's arrival in Pohnpei. IFCP Lead Researcher, Dr. Englberger, made initial contact with leaders and organizers of potential research sites and requested that 30 minutes be reserved to conduct the survey at their site. The researcher, Ms. Mathur, made final scheduling arrangements with all leaders and organizers previously mentioned, who then recruited the participants at their summer camp sites, church groups and elementary and college school classes. The surveys were administered over the period of approximately five weeks, from June 8 to July 12, 2010 by the researcher and one trained IFCP staff member.

Survey Development

The knowledge and practices survey, consisted of 7 pages and 19 questions. It included a 7-day food frequency questionnaire (FFQ) and KAP questions on physical activity, alcohol, tobacco and substance use, obesity and overweight. The survey was

designed and written in American English by the researcher and was modeled after Knowledge Attitudes and Practices surveys regarding physical activity.^{13, 48} A majority of the questions focused on physical activity: the type of physical activity practiced in the school environment and in leisure time; and the amount of time spent and days allocated to traditional physical activity work with family; socio-cultural factors that influenced physical activity; places of learning about physical activity. The FFQ included the number of days in a week fruits and vegetables were consumed which were indicators for the NCD risk factor, and a portion of the research question on poor nutritional intake practices. Since these questions were of primary interest to the research question, they were created with advice from a physical activity specialist of the Pohnpei Department of Education who provided suggestions on school physical activity questions and the traditional physical activities and a local nutritionist and Lead Researcher of the IFCP, Dr. Lois Englberger.

There were some questions that did not relate directly to the primary research question on the survey tool. These questions were created mainly to provide additional information for the partnering organization, the IFCP, and leaders in the Pohnpei community. One concerned weight and height to assess obesity prevalence in the study population. A question on diabetes risk factor knowledge and a career related question were formulated in part to understand youth health knowledge and the sustainability of local food production. A question on the desire for a professional career was also created in order to assist teachers in the FSM who were vital in survey-site recruitment, understand the youth's attitudes toward careers. The FFQ question was structured to collect information on the daily and weekly food consumption pattern based on 13 food

and beverage items (2 of these items – fruits and vegetables – were used to answer the research question). These food and beverage items were selected by the IFCP as part of an on-going research study to understand the sustainability of consumption of popular local foods and beverages and the consumption of common imported foods and beverages consumed by local Pohnpeians. The FFQ did not include portion sizes or total quantities of all food and beverages consumed.

The survey questions were reviewed by local IFCP staff for cultural appropriateness and by Dr. Lois Englberger for question content based on her expertise and many years of research experience in Pohnpei. The survey questions were designed to be completed in thirty minutes or less to prevent respondent burn-out and also to provide a broad understanding of youth physical activity practices and knowledge. The survey was reviewed and revised based on advice from local staff to ensure understanding and appropriate responses from participants.

The survey was pilot tested with the male and female youth in the youngest age group 10 to 14 years, the middle age group 15 to 17 years, and the oldest age group 18 to 24 years. The youngest age group needed assistance in interpreting questions and dictated direction was necessary for this age group to answer appropriately. This age group took approximately 30 minutes to answer the survey. The middle and oldest age groups did not have trouble reading and following instructions and completed the survey within 15 minutes. With the assistance of the IFCP staff and Dr. Englberger, the pilot test results were analyzed to ensure proper understanding of the questions. Those questions that were misunderstood were re-worded in the final survey tool.

Also in response to the pilot test analysis, a standardized procedure for conducting the survey was created to ensure that differences in the results would be due to the characteristics of the population and independent of the sampling method used. Thus all intentions of the study, instructions and questions were read aloud to all participants at all survey locations, first in English and then in Pohnpeian for additional comprehension of the survey tool. Ample time and encouragement to ask questions were also given to participants who needed clarification. Dr. Englberger, Mr. Adelino Lorens, the IFCP Chairman, Dr. Vita Skilling and Dr. Rally Jim, all reviewed the survey and expressed full support of its use with the age groups in the research study.

While survey administration was on-going, the researcher and Dr. Englberger decided it was important to capture information on municipality location of the participants and this question was added to the survey after the second survey site and for the 125th participant onward to answer (See Appendix I). Thus, participants 1 to 124 were not asked to provide information on which municipality they currently lived in and this information was coded as missing.

Research Procedure

One staff member from the IFCP, Ms. Areline Joakim, and the researcher, Ms. Mathur, administered 581 surveys at the survey sites aforementioned. There was 100% participation at all survey sites. Ms. Joakim was trained by the researcher on survey administration and also had previous survey experience. She is also bi-lingual and fluent in English and Pohnpeian. With some assistance from two other local staff members who were also fluent in English and Pohnpeian and trained in survey administration, Ms.

Joakim translated and back-translated the survey from English to Pohnpeian. During the survey administration, the researcher read a pre-written explanation (See Appendix II) of the purpose of the study, information on the primary researcher's role, the approximate completion time of the survey, the general content in the survey, and the anonymous and voluntary nature of the survey. Verbal consent was obtained as written consent is unusual in the culture and not a part of research protocol in Pohnpei. Then the instructions from the first page of the survey document were read aloud along with all questions and followed by Pohnpeian translation (See Appendix I).

Reading of the survey was done at a pace that participants could follow as pre-determined in the pilot test. Participants were also encouraged to ask for clarification when unclear or unsure at any point during the survey. Ample time was given for each question and researcher checked if more time was needed. Participants were responsive to the prompts and questions of both survey administrators. Administrators ensured compliance with the age-group criteria by reminding participants prior to survey distribution that their current age must fall in the 10 to 24 year age bracket in order to participate. All surveys that were completed but were ineligible to participate by age or did not report any age or birth date were disregarded from the survey analysis.

To comply with Emory University's Institutional Review Board confidentiality requirements, all surveys were de-identified; only survey numbers were used instead of participant names. All surveys were also locked in a cabinet when not in use for additional privacy and security. Upon completion of the thesis all hard copies of surveys will be destroyed. Finally, all participants and survey site contacts were given the IFCP email address and phone number if they had any questions post-survey. However, no

participants or survey site contacts expressed any concerns with the research study. All participants of the survey received either an IFCP promotional pen or pencil as a token of appreciation for completing the study and an IFCP lesson on the benefits and importance of a healthy local diet and adequate physical activity for the prevention of noncommunicable diseases.

Data Management

The researcher performed all data entry and analysis. Variable names were created for all survey questions, survey identification numbers, survey location sites, and all possible answers to survey questions (See Appendix III). These variables were then entered into the EpiInfo software program. To reduce number of unintentional errors and reduce information bias, the checking features built into EpiInfo were used. All survey data was entered into the EpiInfo program after data collection was completed. Then the data were reformatted and exported from EpiInfo into an Excel spreadsheet.

Data in the Excel spreadsheet were checked for missing values which were noted and examined and new variables created to address them. Blank surveys, that is, individuals who were above or below the age limit or who did not provide any indication of age or residential Pohnpeian status, were removed before the final data analysis(N=15).

Data Analysis

The data in the Excel Spreadsheet was imported into SAS statistical software version 9.2. Five hundred and eighty-one surveys were administered to youth aged 10-24 years. However, of the surveys, 15 were removed from the final analysis for not meeting the required age criteria or Pohnpei residency status, leaving a total of 566 surveys for analysis.

All data were cleaned and variables were re-coded into categories for a thorough descriptive analysis; and continuous variables were re-coded into categorical variables. Variables of interest for analysis were those that related to the primary research question and included questions regarding youth demographic characteristics, physical activity and nutritional intake practices and physical activity knowledge. The demographic questions used in the analysis were the participants' birthdates, which was re-coded into calculated ages, Pohnpeian residency status, municipality residency, ethnicity, gender, and school level. The question regarding nutritional intake inquired into the number of days respondents ate fruits and vegetables in the past seven days. The knowledge question related to where they learned to be healthy and active with options to include all nine places or people (school, Pohnpei Public Health department, books and newspapers, foreign magazines, television and DVDs, posters, radio, church and friends and family).

The physical activity questions included whether they participated in any of the six school sponsored physical activities (basketball, running, baseball, volleyball, dancing, aerobic exercise) in the previous school year, whether they participated in physical activity in their free (leisure) time, whether they helped their parents plant, maintain, harvest and prepare local foods, and if so which days they helped throughout

the week and how much time they spent doing so in one day. Finally, participants were asked to circle the number of days in the last seven days in which they were physically activity (with vigorous intensity) that caused them to sweat and breath hard for at least 30 minutes. These questions can be found in Appendix I.

Frequency tables for all categorical variables were created to check coding and to identify implausible values. Chi-square tests, frequencies and prevalence odds ratios were calculated to determine whether gender differences were present. Significant gender differences were found using the chi-square test at a 0.05 level of significance. Data was also stratified by age groups, 10-14, 15-17 and 18-24 years to account for significant variations in responses from a large age range among young people.

The findings from the statistical analysis are divided into the following four subheadings: I) Demographic Characteristics, II) Youth Physical Activity Practices, III) Youth Physical Activity Knowledge, IV) Youth Nutritional Intake, V) Other Findings. Youth ages 10-24 years were analyzed under each sub-heading and gender differences or failure to detect gender differences were reported within each subheading. Where relevant in each subheading, results of youth re-classified into their age groups as 10-14 year olds, 15-17 year olds and 18-24 year olds were discussed with regards to gender differences. These findings are fully reported and discussed next in Chapter 4.

Chapter 4: Results

Demographic Characteristics

The mean age of participants was 16.3 years ($SD=3.1$) with a female majority (59.2%). Almost half of all respondents (45.2%) were currently enrolled in, or progressing into a college-level education. The other half of the respondents were currently still in, or progressing into an elementary (27.1%) or a high school (27.7%) level of education. A majority (85.5%) of respondents considered themselves to be of mainland Pohnpeian ethnicity; 10.3% of ethnicities of the outer islands of Pohnpei; and 4.2% of another ethnicity. Age groups were created for further analysis with 185 respondents in the 10-14 year age group; 200 respondents in the 15-17 year age group and 181 in the 18-24 year age groups. Table 1 summarizes all demographic information of the sample population including municipalities in which respondents reside.

Table 1. Demographic Characteristics of Youth aged 10-24 years in Pohnpei, Federated States of Micronesia (N=566)

Characteristic	Ages 10-24 (%)	Ages 10-14 (%)	Ages 15-17 (%)	Ages 18-24 (%)
N	566 (100)	185 (32.7)	200 (35.3)	181 (32.0)
Gender				
Male	231 (40.8)	64 (34.6)	79 (39.5)	88 (48.6)
Female	335 (59.2)	121 (65.4)	121 (60.5)	93 (51.4)
Mean Age, SD*	16.3, SD 3.1	13.1, SD 1.1	15.9, SD 0.8	20.0, SD 1.7
Ethnicity				
Pohnpeian	484 (85.5)	173 (93.5)	172 (86.0)	139 (76.8)
Outer Islands of Pohnpei**	58 (10.3)	9 (4.86)	24 (12.0)	25 (13.81)
Not of Pohnpeian Ethnicity	24 (4.2)	3 (1.62)	4 (2.0)	17 (9.39)
Residential municipality				
Kitti	162 (28.7)	29 (15.7)	66 (33.0)	67 (37.4)
Kolonia	57 (10.1)	20 (10.8)	16 (8.0)	21 (11.7)
Madolenihmw	95 (16.8)	45 (24.3)	33 (16.5)	17 (9.5)
Nett	20 (3.6)	2 (1.1)	6 (3.0)	12 (6.7)
Sokehs	72 (12.8)	23 (12.4)	22 (11.0)	27 (15.1)
U	39 (6.9)	24 (13.0)	13 (6.5)	2 (1.1)
Unknown	119 (21.1)	42 (22.7)	44 (22.0)	33 (18.44)
Missing Responses	2	0	0	2
Current or Next School Level				
Elementary	150 (27.1)	119 (65.8)	29 (14.7)	5 (2.9)
High School	153 (27.7)	62 (34.3)	158 (80.2)	30 (17.1)
College	250 (45.2)	0 (0.0)	10 (5.1)	140 (80.0)
Missing Responses	13	4	3	6

*Standard

Deviation

**Outer islands of Pohnpei: Mokil, Pinglap, Sapwuaifik, Nukuoro and Kapingamarangi

Youth Physical Activity Practices

Leisure time and Vigorous Physical Activity

A high proportion of females (88.8%) and males (87.7%) ages 10-24 years participated in physical activity in their leisure time. The high prevalence of leisure time physical activity is apparent throughout all age groups and no gender differences were found at the 0.05 level of significance (Table 2). However, only 27% of females and 37% of males aged 10-24 years participated in daily vigorous physical activity for 30 minutes or more (Table 2). Less than half of all males and females in all age groups engaged in vigorous physical activity daily for at least 30 minutes in the week prior to the survey (Table 2). Although no significant gender differences were found in terms of daily vigorous physical activity participation, males reported higher percentages of daily vigorous physical activity than females in all age groups (Table 2). Although not significant at the 0.05 level, females were 1.57 times likely to report 0-2 days of vigorous physical activity than males (Appendix IV: Table A).

School Physical Activities

In the previous school year, high percentages of youth reported participating in at least one or more of the school physical activities listed in Table 2. Of all 10-24 year olds, 90.1% of females and 84.0% of males participated in at least one school physical activity in the previous school year and this high prevalence of participation is reported throughout all age groups and genders (Table 2). A significantly higher percentage of females aged 15-17 years reported participating in at least one school physical activity in

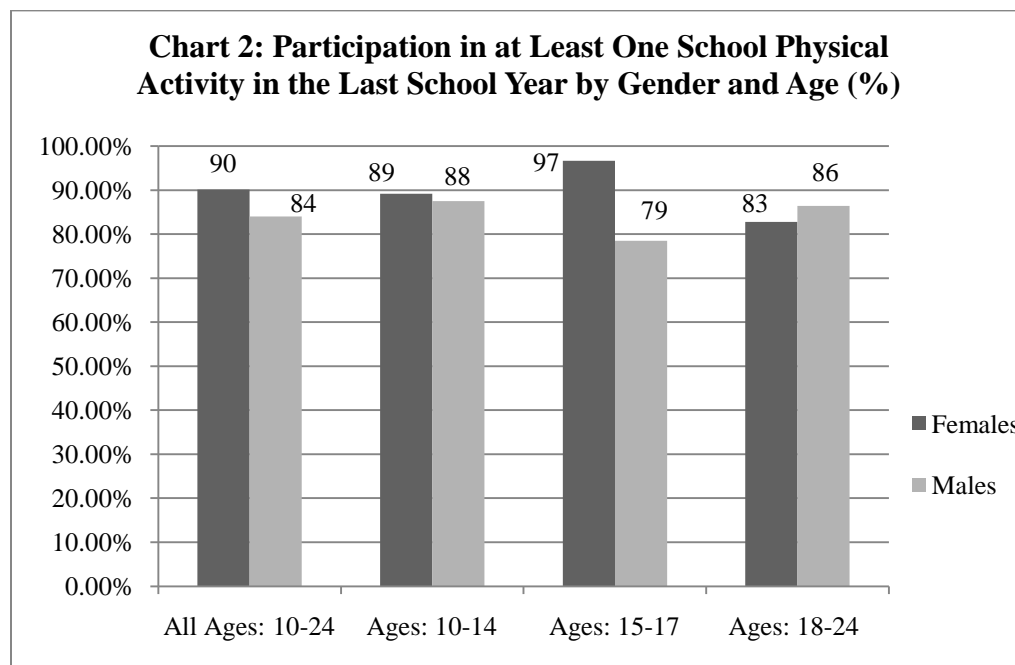
the previous school year compared to males ($p=0.0061$) aged 15-17.

This is depicted in Chart 2.

Table 2: Proportion of participants who participated in various types of physical activities, % (N=566)

Ages	Participated in leisure-time physical activity			Daily Vigorous Physical Activity for 30 minutes			Participated in at least 1 School Physical Activity in the Previous School Year		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
10-24 (n=566)	88.8	87.7	0.6854	27.2	37.0	0.2241	90.10	84.0	0.2390
10-14 (n=185)	91.6	92.2	0.8898	23.1	29.7	0.2662*	89.2	87.5	0.1573*
15-17 (n=200)	92.4	87.0	0.2112	33.9	44.3	0.7283*	96.7	78.5	0.0061*
18-24 (n=181)	80.4	84.9	0.4354	23.7	35.6	0.3405*	82.8	86.4	0.3282*

χ²Chi-square test excludes missing data
*p-value for Fisher's Exact Test



Traditional Physical Activity

Five hundred of all 566 youth (88.3%) aged 10-24 years reported helping their parents plant, maintain, harvest and prepare local foods. This is a high proportion from both males (over 89%) and females (over 80%) throughout all age groups (Table 3). Of all youth aged 10-24 years, there were significantly more males (93.0%) than females (87.3%) that performed these physical activities at a 0.05 level of significance ($p=0.0300$). Although still a high percentage at 80.4%, females aged 18-24 years was the demographic category that had the lowest proportion of responses to helping their parents with this physical activity (Table 3).

Of the 500 youth aged 10-24 years old who help their parents plant, maintain, harvest and prepare local foods, significantly more males (73.1%) than females (55.6%) reported helping their parents with these traditional agricultural physical activities for

more than one hour a day on the days that they helped ($p=0.0002$). A similar significant gender difference is also reflected in the 10-14 year age group where less than half of all girls aged 10-14 years (45.3%) reported helping their parents for more than one hour and this was the lowest proportion across genders and age groups (Table 3). Although not significant, more males than females spent more than 1 hour helping with traditional physical activity in the 15-17 year and 18-24 year age group as well (Table 3).

Table 3: Participation and length of time spent on traditional agricultural physical activity, % (N=566)

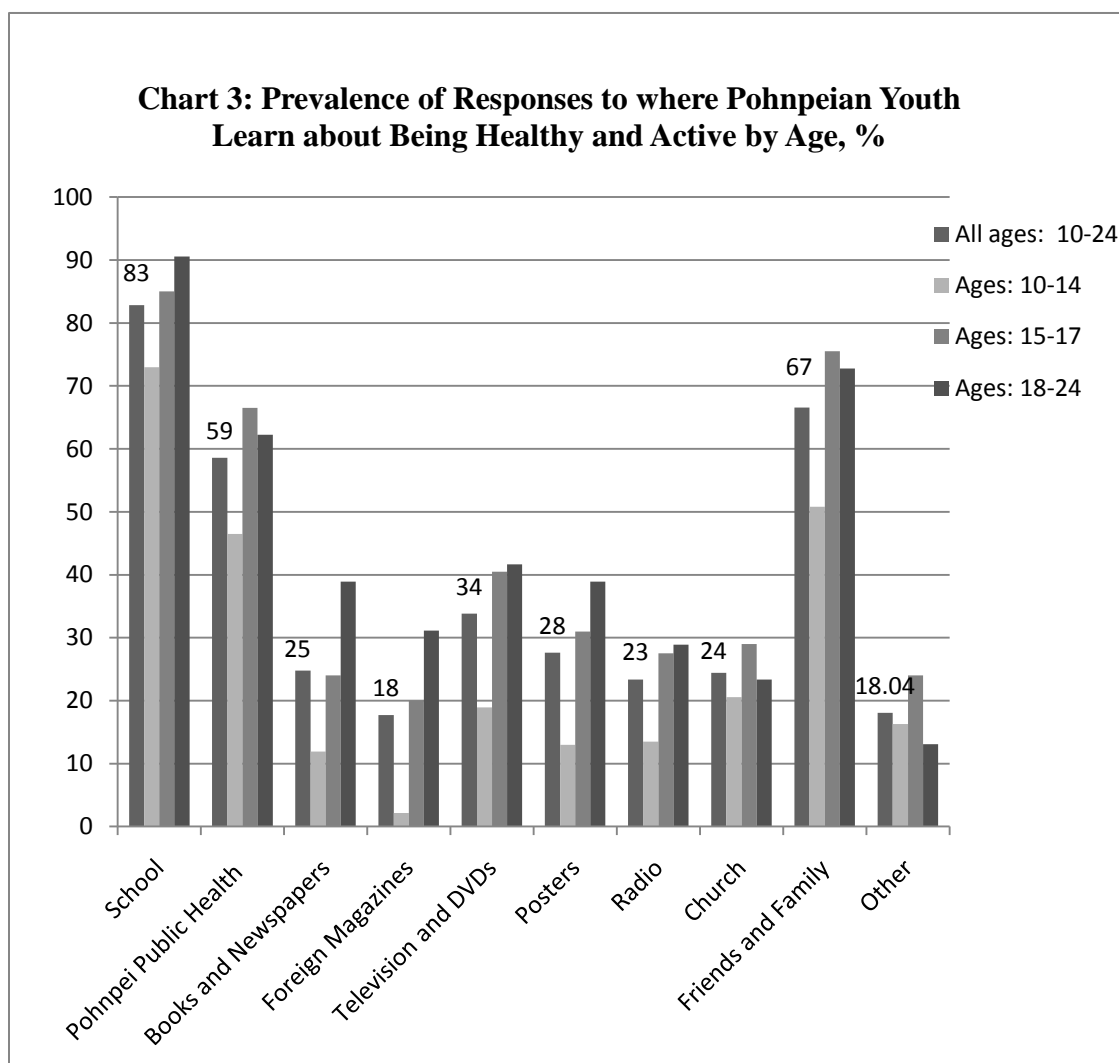
Ages	Help parents to plant, maintain, harvest and prepare local foods (N=566)			Spend more than 1 hour planting, maintaining harvesting and preparing local foods (N=500)		
	Females	Males	p-value	Females	Males	p-value
10-24 (n=566)	87.3	93.0	0.0300	55.6	73.1	0.0002
10-14 (n=185)	89.8	96.8	0.1429*	45.3	75.4	0.0005
15-17 (n=200)	90.0	93.5	0.3924	59.3	69.4	0.3601
18-24 (n=181)	80.4	89.8	0.0795	64.9	74.7	0.2901

[†]Chi-square test excludes missing data
 *p-value for Fisher's Exact Test

Youth Physical Activity Knowledge

A majority of youth, both males and females, ages 10-24 years reported attaining their knowledge of physical activity from school (Chart 3). This suggests the importance

of schools for the dissemination of health information and healthful practices. The second most frequent place of learning about physical activity and health for both male and female youth aged 10-24 years was from friends and family as seen in Chart 3. The only significant gender difference found was in the 15-17 age group where 28.9% of females compared to 16.5% of males reported learning from books and newspapers ($p=0.0435$) as seen in Appendix IV Table B.



Youth Nutritional Intake

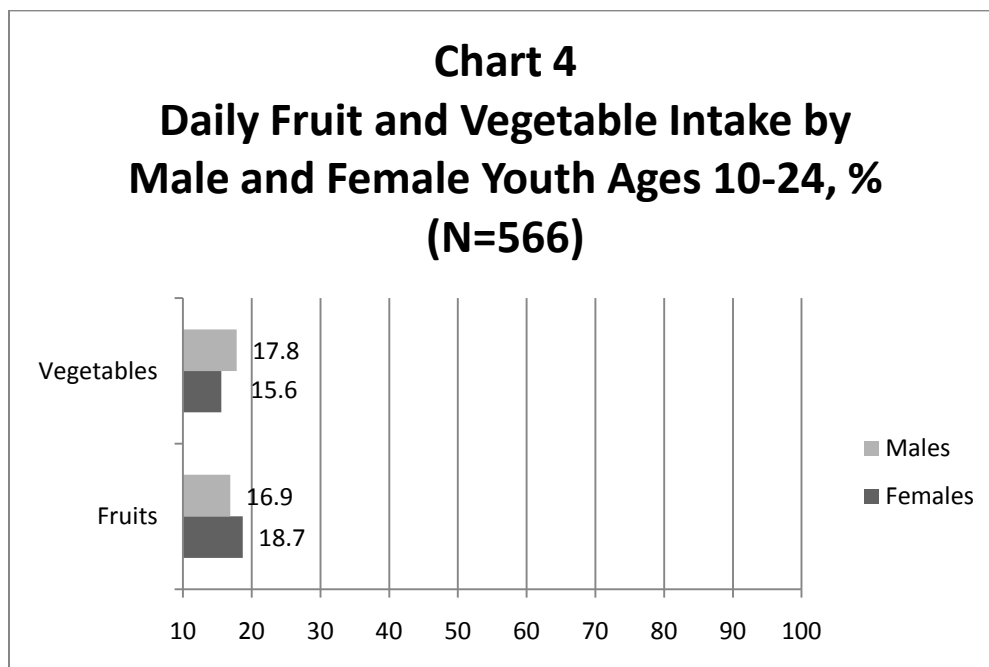
Fruits and Vegetables

Fruits and vegetables were consumed on average 3 days a week by all youth ages 10-24 years (Appendix V: Table 4). The proportion of males and females who consumed fruits and vegetables daily in the previous week was low throughout all age groups (Appendix 5: Tables 1-3). Only 18.7% of all females and 16.9% of all males aged 10-24 years reported a daily consumption of fruits in the previous week (Chart 4). As seen in Table 4, males reported a significantly higher daily consumption of vegetables (17.8%) compared to females (15.6%) amongst youth aged 10-24 years ($p=0.0030$). A significant gender difference in both vegetable consumption was found in the 10-14 year age group across all the frequency categories of days of consumption: never, sometimes, frequently, and daily (Appendix 5: Table 1). Also, in the 10-14 year old age group, a higher proportion of females (54.6%) compared to males (32.8%) reported never eating vegetables in the past week ($p= 0.0142$) and a higher proportion of females (35%) compared to males (20.3%) reported never consuming fruits in the past week ($p=0.0522$) (Appendix 5: Table 1).

Table 4:

Proportion of participants by age who reported consuming
fruits and vegetables daily in the last week, %

Age groups	Fruits			Vegetables		
	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	18.7	16.9	0.5676	15.6	17.8	0.0030
10-14 (n=185)	16.7	10.9	0.0522	8.3%	9.4	0.0142
15-17 (n=200)	25.0	21.5	0.7317	18.2	25.3	0.2275
18-24 (n=181)	13.0	17.1	0.5346	21.7	17.1	0.5577
Chi-square test excludes missing data						
p-value for Fisher's Exact Test						



Other Findings

School Physical Activities Practiced by Youth

Of all the school physical activities, females aged 10-24 years reported the highest participation in volleyball while males aged 10-24 years reported the highest participation in basketball in the previous school year. There was a significant difference in basketball participation with males participating more than females in all age groups at the 0.05 significance level (Table 5).

There was also a significant gender preference in volleyball and dancing for all youth aged 10-24 years; with female respondents reporting a higher percentage of participation in these activities than males (Chart 5). In the 10-14 year age group, a significantly higher percentage of females reported dancing than males. In the 15-17 year age group, females

reported a higher percentage of participation in volleyball and dancing than males (Chart 5). In the 18-24 year age group females reported a significantly higher percentage of participation in volleyball than males (Chart 5).

No significant gender differences were found in running, aerobic exercise or baseball (Table 6). Less than half of all females and males aged 10-24 years participated in aerobic exercise, running and baseball (Table 6).

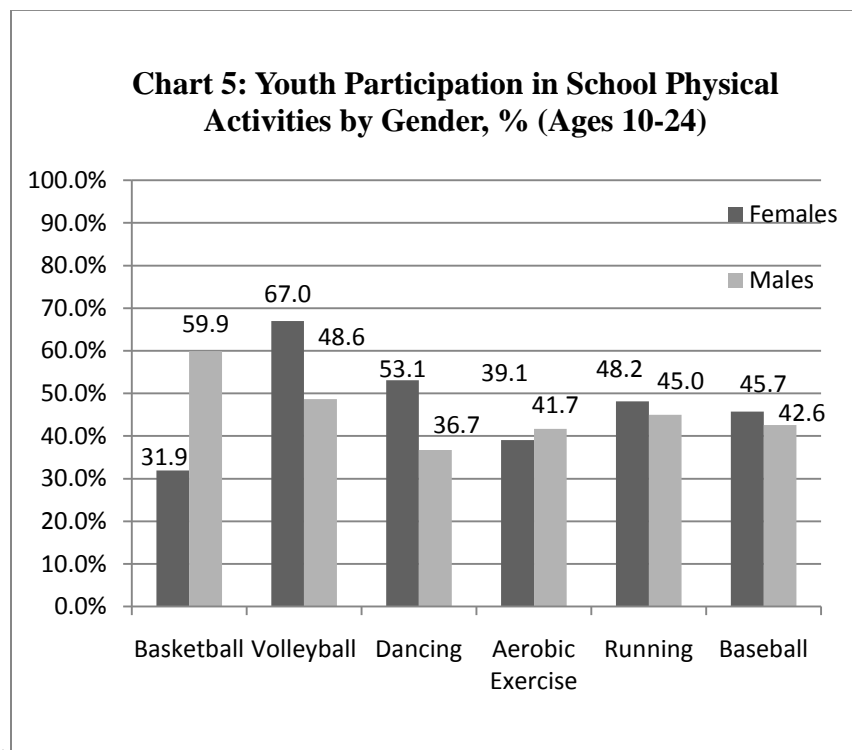


Table 5: Significant Gender Differences in Youth (Ages 10-24) Participation of School Physical Activities in the Previous School Year, % (N=566)

Ages	Basketball			Volleyball			Dancing		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	31.9	59.	<0.0001	67.0	48.6	<0.0001	53.1	36.7	0.0002
10-14 (n=185)	30.8	60.3	0.0002	57.5	45.0	0.1140	60.3	42.6	0.0249
15-17 (n=200)	37.8	58.1	0.0061	77.5	52.0	0.0002	55.0	34.3	0.0052
18-24 (n=181)	25.6	61.2	<0.0001	65.6	48.2	0.0210	41.1	34.5	0.3722

‡ Chi-square test excludes missing data

Table 6: Non-significant Gender Difference among Proportion of Youth who Participated in School Physical Activities in the Previous School Year, % (N=566)

Age groups	Aerobic Exercise			Running			Baseball		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	39.1	41.7	0.5466	48.2	45.0	0.4611*	45.7	42.6	0.4714
10-14 (n=185)	38.7	41.7	0.7097	53.8	61.0	0.3611*	46.6	55.0	0.2913
15-17 (n=200)	47.1	50.7	0.6264	50.0	47.3	0.7152*	49.2	38.9	0.1672
18-24 (n=181)	28.9	33.7	0.4932	38.2	31.8	0.3751*	40.0	36.9	0.6759

‡ Chi-square test excludes missing data

Days Practicing Traditional Physical Activity

Of the 500 respondents who helped their parents to plant, maintain, harvest and prepare local foods, a majority of 10-24 year old males and females responded to helping their parents on Saturdays out of all the days in the week (Appendix IV: Table D and Chart 1). The least popular day to help with traditional physical activity by both genders was on Sundays as seen in Chart 1 (Appendix IV).

Chapter 5: Discussion, Conclusions and Recommendations

Discussion

This research study attempted to provide information on Pohnpeian youth aged 10-24 years and their knowledge and practices of two NCD risk factors, namely physical inactivity and poor nutritional intake with regards to gender differences.^{4,7} In a survey conducted by convenience sampling during the summer of 2010, a total of 566 female and male youth between the ages of 10 and 24 years reported their knowledge and practices towards four types of physical activity: leisure time, vigorous, traditional, school-related. The youth respondents also self-reported the number of days they consumed fruit and vegetables in the previous week. Frequencies, prevalence odds ratios and chi-square tests were conducted to detect gender differences from a cross-sectional dataset on these NCD risk factor questions to answer the primary research question.

Additionally, youth reported on food and beverage intake of selected items, and other non-research related questions to assist partners in understanding youth behaviors. Smaller age groups were created from the 10-24 year age range in the analysis primarily to assist stakeholders in future efforts to create age-stratified youth NCD prevention programs and interventions. Results are thus reported first in regards to all 10-24 year old youth, and then in regards to the age groups, 10-14, 15-17 and 18-24 years if relevant, and with regards to gender.

In addressing the first aim of the research question, physical activity practices of youth aged 10-24 years, results revealed that a high prevalence of both males and females

participated in physical activity in their leisure time and engaged in traditional types of physical activity with their parents. A high proportion of both males and females also participated in at least one school physical activity in the previous school year. There was a significant gender difference with males having a higher prevalence of helping their parents with traditional physical activity, compared to females. Of the 88.3% of youth who participated in traditional physical activity, that is in helping their parents plant, maintain, harvest and prepare local foods, significantly more males than females reported helping their parents for more than one hour each day they helped.

A striking result was that a low percentage of both boys (37.0%) and girls (27.2%) participated in daily vigorous physical activity for at least 30 minutes; with girls showing a lower prevalence throughout all age groups, though not statistically significant. Also, although not statistically significant, females were 1.57 times more likely than males to have practiced vigorous physical activity 0 to 2 days a week. The World Health Organization global recommendations for physical activity state that youth aged 5-17 years should acquire at least 60 minutes of moderate to vigorous intensity physical activity daily and vigorous intensity activities should be incorporated at least 3 times per week. The vigorous activity recommendations for individuals aged 18-64 years is at least 75 minutes throughout the week; and at thirty minutes per day as was asked in the survey, this is equivalent to at least 2.5 days per week.⁴⁹ In relation to the second aim of the study, a majority of youth, both males and females, learned about being healthy and active from schools (83%) and friends and family (67%). In regards to the third aim, less than 20% of males and females reported a daily intake of fruits and vegetables. Significantly more males reported a daily consumption of vegetables than

females. The recommendations of the United States Department of Agriculture (USDA) is a daily intake of vegetables at a range of 2-3 cups a day for boys and girls 9-18 years and 2.5-3 cups a day for men and women ages 19-30 years.⁵⁰ The USDA also recommends daily intake of fruits for girls and boys ages 9-13 years at 1.5-2 cups of fruit per day and men and women ages 19-30 at 2 cups per day.⁵¹

The results of this study are:

- 1 A high percentage of both males and females participated in physical activity in their leisure time, engaged in traditional physical activity with their parents and participated in at least one school physical activity in the previous school year. Gender differences were found in traditional physical activity practice and duration. Significantly more males practiced traditional physical activity than females. Also during the days of traditional physical activity practice, significantly more males than females reported performing for more than one hour.
- 2 The majority of male and female youth are not receiving the recommended amounts of daily vigorous physical activity which implies low levels of physical activity. Though not statistically significant, females performed less vigorous physical activity daily and were less likely to meet the recommendations of at least 3 days of vigorous physical activity at a minimum of 30 minutes per day.
- 3 A majority of males and females attained their physical activity and health knowledge from school, and friends and family.

- 4 Less than 20% of both males and females reported consuming fruits and vegetables daily which may imply poor nutrient consumption. Males reported a significantly higher percentage of daily vegetable intake than females. Although not significant, females reported a higher daily percentage of fruit intake than males.

Limitations

A limitation of this study is the inability to infer causality due to the cross-sectional nature of the survey. Since convenience sampling was part of the research design and while attempts were made to make the samples as representative of the youth population in Pohnpei by sampling various sites in all municipalities, results cannot be generalized to all Pohnpeian youth between the ages of 10 and 24 years. Thus external validity does not hold to this study since random sampling was not conducted. Also due to convenience sampling, this study is subject to selection bias as only the summer schools, camps and programs that desired to participate were included in the study. Other youth not enrolled in summer program activities or were in summer programs that did not wish to participate had to be excluded from the study.

An attempt was made to capture obesity prevalence by asking for self-reported weight and height measurements. These measurements, participant-reported age and sex, would have been used to calculate the Body Mass Index for each individual in order to assess obesity prevalence⁵². Unfortunately, the response rate for these height and weight questions was low with only a 28% response for the weight question and 24% for the

height question. Other responses to these questions indicated that youth did not know their height or weight or both.

Despite instructions and additional clarification, recall bias may exist in the results relating to the food frequency question (FFQ) on fruit and vegetable intake, and the questions regarding physical activity knowledge and practices. Youth may have had difficulty remembering their weekly dietary and physical activity patterns. The FFQ also only reported the days that youth reported consuming foods and drinks but it is unknown whether youth met recommended portion sizes and servings per day.

Conclusions

Despite these limitations, this study does provide additional and new results regarding youth knowledge and practices towards physical inactivity and nutritional intake regarding fruits and vegetables.

The first conclusion from this study is that youth aged 10-24 years need to improve their vigorous activity levels to meet recommendations by the World Health Organization of daily or at least 3 days of vigorous activity per week for youth ages 5-17 years and 75 minutes for adults, 18-64 years. The second conclusion is that a large majority of youth, over 80%, are not receiving recommended daily intakes of fruits and vegetables, with females consuming significantly less vegetables than males.⁵⁰⁻⁵¹ Finally, the study provided new information that a majority of youth, males and females attain their knowledge of physical activity and health from school and from friends and family.

The Youth Health Behavior study in 2008 reported that only fifty percent of youth engaged in vigorous physical activity less than 2 days a week, thus supporting the results from this study that youth are not practicing recommended amounts of vigorous physical activity. However, the criteria for vigorous physical activity in the 2008 study was narrowly defined as playing sports and walking several miles to commute to school which could have caused some bias and possible underreporting. Unlike the 2008 study, this research study expanded on other physical activity practices and clearly defined and described vigorous physical activity.

In the HBPLY study from 2001, the levels of physical activity reported by youth aged 13-15 year olds was not considered optimal.^{20, 42} It reported that of all 14-17 year olds only 14.3% exercised every day. Since the HBPLY study was a representative sample, these results may be a good indication of exercise levels but not of the overall levels of physical activity. Exercise is a subcategory of physical activity. The 2001 study also does not indicate exercise levels for those younger than 14 or older than 17 years of age. The 2010 study by the author expanded on this age range to capture additional youth knowledge and practices regarding physical activity and incorporated various type of physical activity including school and traditional physical activity for a culturally and age appropriate assessment of physical activity among Pohnpeian youth.

The 2008 study also reported that youth ages 10-22 years were consuming fruits and vegetables on average approximately 4 days a week. However, in this present study, fruit and vegetable consumption averaged 3 days a week. In the 2008 study, males reported a significantly higher average consumption of local fruits and vegetables than females ($p < 0.001$).¹³ Results from the HBPLY study in 2001 showed that only about

16% of 14-17 year olds reported eating fresh vegetables daily and 14% reported eating fruits daily.⁴² These results are similar to those reported in this study by the author. In the present study by the author, daily fruit and vegetable consumption, with regards to gender, were reported in addition to the average number of days of fruit and vegetable intake.

Unlike the two previous studies, this study broadened the criteria for youth physical activity in Pohnpei by including various types of physical activity (traditional school-sponsored and leisure) and created a more comprehensive, gender and age-group specific physical activity assessment. It found that a majority of females and males aged 10-24 years are not practicing the recommended frequency of vigorous physical activity. It showed that a high percentage of both males and females participated in physical activity in their leisure time, engaged in traditional physical activity with their parents and participated in at least one school physical activity in the previous school year and that gender differences were present in traditional physical activity practice and duration. Unfortunately, duration, intensity and frequency of all activity types and levels of obesity could not be assessed. The results also suggest that female health practices put females at increased risk for NCDs more so than males since significantly fewer females consumed vegetables daily than males and, although not significant, fewer females met vigorous physical activity recommendations than males. These findings are supported by the previous two studies from 2001 and 2008 in that a large majority of youth between the ages of 10 and 24 years do not acquire daily intakes of fruits and vegetables. Portion and serving sizes of daily fruit and vegetable intake, and diet patterns were not assessed in this study.

Recommendations

This study has indicated that a large proportion of both male and female youth in Pohnpei aged 10-24 years, performed physical activity in their leisure time, played at least one school-sport, and performed daily traditional physical activity, but did not acquire adequate amounts of vigorous physical activity. Regular physical activity at the recommended levels reduces the risk of CVD, diabetes, breast cancer, and colon cancer⁴. Also physical activity at levels higher than what is recommended assists in weight control⁴. Therefore, a randomized, study on physical activity intensity, duration and frequency is vital to validate these results, and to ascertain total amounts physical activity practiced by youth aged 10-24 years. A possible study design for this type of research could be modeled after the WHO STEPS survey for FSM adults. Partnerships with the FSM national and Pohnpei state governments and the WHO, or the United States' Centers for Disease Control and Prevention may be necessary for this comprehensive and representative study. Without a study of this kind it would be difficult to confirm whether youth are physically inactive. This would be an important study since physical inactivity is a risk factor for NCDs such as CVD, cancer, stroke and diabetes, and is the fourth leading risk factor for global mortality.^{4, 41, 49} The majority of youth do not intake fruits and vegetables daily; females have significantly less daily intake of vegetables than males. This result may suggest a poor diet and a randomized study should be conducted to analyze youth diets with regards to gender using 24-hour recall as well as food frequency methodology. Cultural and gender-appropriate qualitative studies are needed to determine the reasons for the low-level of nutritional intake and to determine factors that

lead to increased fruit and vegetable intake across this age group and also with regards to gender.

A majority of males responded to participating in basketball while a majority of females responded to participating in volleyball as their school sports. There were significant gender differences throughout age groups in relation to school sports. Thus future interventions should consider the types of physical activity to encourage, where to conduct them, and are the most appropriate day of the week based on age group and gender. Results of this research also show that a majority of youth aged 10-24 years learned about being physically active in schools and from family and friends.

Finally, a consultation with a physical education specialist from the national government revealed that there is no regular monitoring and surveillance of anthropometric measurements, including weight and height, at local elementary schools, high schools and colleges throughout Micronesia. This study showed that it was difficult to ascertain BMI and obesity prevalence by self-report. Therefore, information on obesity prevalence should be gathered through anthropometric measurements using a random sample of the target population to understand Pohnpeian youth risk and prevalence of obesity and overweight since obesity is a risk factor for NCDs, especially Type 2 Diabetes Mellitus.

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Appendix I—Survey Tool

**Chronic Disease Risk Factor Youth
Questionnaire**

**Prepared For:
The Island Food Community of Pohnpei
P.O. Box 1995
Kolonia, Pohnpei FM 96941
Federated States of Micronesia**

**Prepared By:
Ms. Anu Mathur
MPH Candidate
Emory University
Atlanta, GA**

Survey Location: _____

DIRECTIONS

Please read carefully and circle the answer(s) that apply, or write your responses on the lines provided.

This questionnaire is not a test. We hope you will answer every question. No one, other than the research team, will see the responses to this survey. This survey is purely confidential and anonymous. Do not provide any personal identification on this survey (name, address, etc.).

Please go to the next page to begin the questionnaire.

- 1) What is your date of birth? (EX: DD/MM/YYYY. Day, Month AND year)
- _____
- 2) Do you currently live in Pohnpei?
- a. Yes
 - b. No
- 3) What is your weight? (If you do not know please write “D/K”.)
- _____
- 4) What is your height? (If you do not know please write “D/K”.)
- _____
- 5) What is your gender?
- a. Female
 - b. Male
- 6a) Do you go to school or college? (If your answer is “yes”, please answer question 6b. If it is “no”, please skip to question 7.)
- a. Yes
 - b. No
- 6b) Which level of school are you in now? (If you are going to start a different level of school, circle the level you are going into. Circle one.)
- a. Elementary
 - b. High School
 - c. College

7) Circle or write which of the following you consider yourself. (Circle one.)

- a. Main Island – Pohnpeian
- b. Outer Islands of Pohnpeian (Mokil, Pinglap, Sapwuafik, Nukuoro, Kapingamarangi)
- c. None of the above. I am _____

8) What municipality do you live in? (Circle one.)

- a. Kitti
- b. Kolonia
- c. Madolenihmw
- d. Nett
- e. Sokehs
- f. U

9) How many days in the last seven days did you eat or drink?

(EX.: 0, 1, 2, 3, 4, 5, 6, or 7. If you did not eat or drink the item, write 0. Your answers should not be larger than 7.)

<i>Food or Drink Item</i>	<i>Number of days (0-7)</i>
Rice	
Local Food (breadfruit, banana, taro, etc.)	
Flour products (donuts, bread, Ramen, etc.)	
Koolaid with Ramen	
Fruits (ripe banana, papaya, pandanus, etc.)	
Vegetables (cucumber, Chinese cabbage, etc.)	
Kirahka (candy bar, chocolate, cookies, etc.)	
Water	
Soft drinks (Coke, Islanders, Fanta, Sprite, other colas etc.)	
Drinking coconut	
Imported fruit juices (apple juice, orange juice, mango juice, etc.)	
Betel nut with tobacco (cigarettes, Skoal)	
Alcohol (beer, wine, liquor)	

10) Where do you learn about being healthy and active? (Circle all that apply.)

- a. School
- b. Pohnpei Public Health
- c. Books and newspapers
- d. Foreign Magazines (fitness magazines, women's magazines)
- e. Television and DVDs
- f. Posters
- g. Radio
- h. Church
- i. Friends & Family
- j. Other
- k. None

11) Please list one or more of the causes of diabetes.
(If you do not know please write "D/K".)

12) Did you participate in the following school-sponsored or college-sponsored physical activities in the last school year?

Basketball (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

Running (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

Baseball (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

Volleyball (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

Dancing (Local, Hula, etc.) (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

Aerobic Exercise (Circle below one response that applies.)

Did not participate Participated Participated as an office leader or captain

If any other, please write physical activity here:

_____)

Did not participate Participated Participated as an office leader or captain

13a) Do you do any physical activity (dancing, household chores, sports, aerobic, etc.) in your free time? (If “yes” please answer 13b, if “no” skip to question 14.)

a. Yes

b. No

13b) If yes, list one physical activity you do most often?

14) Do your parents agree that girls should only stay around the house to do household chores in their free time?

a. Yes

b. No

15a) Do you help your parents to plant, maintain, harvest and prepare local foods? (If your answer “yes” please answer questions 15b and 15c. If your answer is “no”, please go to question 16.)

- a. Yes
- b. No

15b) Approximately how much time do you spend helping your parents planting, maintaining, harvesting and preparing local foods in one day? (Circle one.)

- a. 1 minute -30 minutes
- b. 31 minutes - 1 hour
- c. More than 1 hour

15c) Which days do you help your parents to plant, maintain, harvest and prepare local foods? (Circle all that apply.)

- a. Monday
- b. Tuesday
- c. Wednesday
- d. Thursday
- e. Friday
- f. Saturday
- g. Sunday

16. On how many of the past 7 days did you exercise or participate in physical activity for at least 30 minutes that made you sweat and breathe hard, such as basketball, soccer, farming, fishing, walking far distances, chores, running, swimming laps, fast bicycling, paddling, fast dancing, or similar aerobic exercise? (Circle one.)

- a. 0 days
- b. 1 day
- c. 2 days

- d. 3 days
- e. 4 days
- f. 5 days
- g. 6 days
- h. 7 days

17. Are you trying to do any of the following about your weight? (Circle one.)

- a. Lose weight
- b. Gain weight
- c. Stay the same weight
- d. I am not trying to do anything about my weight

18. Do you desire to have a professional career?

- a. Yes
- b. No

19. Do you desire to have a professional career in growing and promoting local foods?

- a. Yes
- b. No

*****Thank you for completing the survey. Please hand it to the research assistant.*****

Appendix II—Survey Information and Verbal Consent

My name is Anu Mathur and I am a student from Emory University. I am here to help the Island Food Community of Pohnpei conduct a research study. This study is in collaboration with Emory University and is being done to provide information to develop programs that will help to prevent Micronesian youth from developing chronic diseases such as diabetes and heart disease which have long term negative effects on health such as blindness, limb amputations and can even lead to death. We would like to learn about Pohnpeian youth's physical activity and what foods and drinks the Pohnpeian youth are consuming. Through this study, the IFCP and partners will be able to work with the community to prevent youth such as yourselves from developing chronic diseases and the harmful, life-long effects.

We are asking if you are willing to be in this study on Pohnpeian youth health. This means we will ask you to respond to some questions about your health, on physically activity, and diet. These survey questions will take less than 30 minutes of your time to respond to.

We will first explain the instructions and read through all the questions with you. We will be available to answer any questions you have while you are responding to the survey. You do not need to provide your name or any personal information for the purpose of this study. Your answers will remain confidential and anonymous. No one except the research team at the IFCP will see the survey answers but once again they are all anonymous. Once the study is completed, the results will be used by the IFCP and partners to assist in programs to prevent chronic diseases in the youth in Pohnpei.

Participation in this study is voluntary. That means that no one (not your teachers, your parents, or even the IFCP research team) can make you participate if you do not want to and there are no consequences for not participating. If you have any concern or questions, about this study, please feel free to ask them now. If you do not want to do this study please let us know now. If you agree to be in the study but change your mind, you can let me or Dr. Lois Englberger at the IFCP know and we will remove you from the study. Our phone number is 691-320-3259 and the email is nutrition@mail.fm.

You can also contact Anu and Dr. Englberger if you have concerns, complaints or questions later. If you would like to contact someone on the Review Board for the same concerns or more information about your rights as a participant, you can email Donna Dent at dzdent@emory.edu.

Thank you for volunteering!

Appendix III—Variables from Survey

PARTICIPANT: Identification number given to participant at time of survey - numbered on surveys

SURVEYLOC: Survey location. Camp Glow, Agriculture Summer, National Campus, Nanmand Church, Catholic Church, National Campus, Danpei, Upward Bound, Wone Catholic Church, Elementary Schools

DOB: Survey responses were given in Day/Month/Year format

CALCAGE: Age calculated from date of birth reported

AGEGRP14: CALCAGE 10-14

AGEGRP17: CALCAGE 15-17

AGEGRP24: CALCAGE 18-24

LOC: Do you currently live in Pohnpei. Yes coded as '1'. No coded as '0'. Blank is no response given.

WEIGHT: Weight in pounds. Blank is no response given. 'dk' is participant does not know.

HEIGHT: Height in feet and inches. Blank is no response given. 'dk' is participant does not know.

GEN: Gender. Female or male. Blank is no response given.

SCHL: Do you go to school or college? Yes coded as '1'. No coded as '0'. Blank is no response given.

SCHLVL: Which level of school are you in now. College, high school, elementary. Blank is no response given.

**If students were transitioning from levels after the summer, students were asked to give the level they were going into next year.*

ETH: Ethnicity: 'pohnpeian', 'outer islands of pohnpei' or 'none of the above'. Blank is no response given.

MUNIC: What municipality are you from? Kitti, Kolonia, Madolenim, Nett, Sokehs, U. Blank response means no response given except for **Participants #1-124**.

**Surveys were updated with municipality question after Agricultural Summer Program and Camp Glow administrations.*

[*FFQ_*: Food frequency questionnaire. How many days in the last seven days did you eat or drink the following. Reported are 1, 2, 3, 4, 5, 6, or 7 days.

**answers that were written as '5/6' were entered into the system as an average as participants did not follow instructions (N=3). Blanks mean no response given.)*]*

FFQ_R: Rice

FFQLF: Local food

FFQFP: Flour products

FFQKO: Koolaid with ramen

FFQF: Fruits

FFQV: Vegetables

FFQKR: Kirahka

FFQW: Water

FFQSD: Soft drinks

FFQC: Drinking coconut

FFQFJ: Imported fruit juices

FFQBT: Betel nut with tobacco

FFQAL: Alcohol

[*LRN_*: Where do you learn about being healthy and active? Circled recoded as '1' (Yes) No circle coded as '0' (No). Blank means no response.]

LRNSCH: School

LRNPNP: Pohnpei Public Health

LRNBKS: Books and newspapers

LRNFM: Foreign magazines (Fitness magazines, women's magazines)

LRNTV: Television and DVDs

LRNPO: Posters

LRNRA: Radio

LRNCH: Church

LRNFF: Friends and Family

LRNOT: Other

LRNNO: None

DIAB (Q11): Please list one or more of the causes of diabetes. Open ended answers. Blank means no response given.

[*P_*: Did you participate in the following school/college-sponsored physical activities this past school year? 'p' – Participated, 'dnp' – did not participate, 'p/o' – participated as an officer. Blank means no response given. Recoded in analysis as 'p and p/o' as '1' (Yes participated and 'dnp' as '1' (No did not participate)]

PABB: Basketball

PAR: Running

PAB: Baseball

PAV: Volleyball

PAD: Dancing

PAAE: Aerobic Exercise

PAOT: Other. Open ended question

PAFT: Do you do any physical activity (dancing, sports, aerobic, etc.) in your free time? Yes coded as 1. No coded as 0. Blank response means no response given.

PAFTMO: If yes to PAFT, list one physical activity you do most often. Open ended question. Blank means no answer given or does not apply.

PAGRE: Do your parents agree that girls should only stay around the house to do household chores in their free time? Yes coded as '1'. No coded as '0'. Blank means no response given

PPREP: Help parents to plant, maintain, harvest and prepare local foods. Yes coded as '1'. No coded as '0'. Blank means no responses given.

PPREPT: Time spent helping parents with traditional physical activity Follow up to *PPREP*.

1. 1-30 mins

2. 31-1 hr

3. More than 1 hr

Recoded '1-30 mins' as '0' (less than 1 hour) and '31 mins-1hr' and 'more than 1 hour' as '1' (more than 1 hour). Blank means no response given.

[*PPREP_*: Days spent helping parents to plant, maintain, harvest and prepare local foods Answer all that apply. 1 is yes. 2 is no. Blank means no response given. *PPREPM-SU* (Monday through Sunday)]

PPREPM: Monday

PPREPTU: Tuesday

PPREPW: Wednesday

PPREPTH: Thursday

PPREPF: Friday

PPREPSA: Saturday

PPREPSU: Sunday

EXER: Exercised vigorously in the last seven days. '1 day' through '7 days'. Blank means no answer given. Recoded 1-6 days as '0' (not daily) and 7 days as '1' (daily).

LOWGT: Trying to do any of the following about your weight.

Lose weight, gain weight, stay the same weight, not trying to do anything about my weight. Blank means no response given. Not analyzed.

PROFC: Desire for a professional career.

Yes coded as '1'. No coded as '0'.

PROFCLF: Desire for a professional career in growing and promoting local foods

Yes coded as '1'. No coded as '0'.

Appendix IV—Chapter 4 Results Tables

Table A. Prevalence Odds Ratios of Knowledge, Attitudes, and Practices of Females as compared to Males Among Youth Aged 10-24 in Pohnpei, Federated States of Micronesia (N=566)						
Characteristic	Crude		Age-Adjusted*			
	Odds Ratio	95% C.I.	Odds Ratio	95% C.I. [†]	heterog. p-value ^	
Leisure Time						
	No	0.90 (0.53-1.51)	0.98 (0.58-1.66)		0.3347	
	Yes	1.00	1.00			
Traditional Physical Activity						
	No	1.93 (1.06-3.53)	2.15 (1.16-3.96)		0.6607	
	Yes	1.00	1.00			
Traditional Physical Activity Time						
	More than 1 hour	0.46 (0.31-0.67)	0.48 (0.33-0.71)		0.1348	
	Less than 1 hour	1.00	1.00			
Days of Vigorous Physical Activity						
	0-2 days	1.57 (1.03-2.38)	1.51 (0.99-2.29)		0.2379	
	3-7 days	1.00	1.00			
Number of School Activities						
	No physical activities	0.57 (0.35-0.95)	0.60 (0.37-0.99)		0.0016	
	More than 1	1.00	1.00			
Played School Basketball						
	No	0.88 (0.62-1.24)	0.92 (0.65-1.30)		0.2233	
	Yes	1.00	1.00			
Played School Volleyball						
	No	0.47 (0.33-0.66)	0.45 (0.32-0.65)		0.3316	
	Yes	1.00	1.00			
Participated School Dancing						
	No	0.51 (0.36-0.73)	0.54 (0.38-0.77)		0.3988	
	Yes	1.00	1.00			
<i>†Chi-square test, d.f. = degrees of freedom</i>						
<i>Chi-square test excludes missing data</i>						

Table A1. Stratum Specific Prevalence Odds Ratios of Number of School Activities Practiced by Females as Compared to Males Aged 10-24 in Pohnpei, Federated States of Micronesia (N=566)

Characteristic		Stratum specific	
		Odds Ratio	95% C.I. [†]
Number of School Activities (age 10-14)	No Physical activities	0.84	(0.33-2.15)
	More than 1	1.00	
Number of School Activities (age 15-17)	No Physical activities	0.12	(0.04-0.39)
	More than 1	1.00	
Number of School Activities (age 18-24)	No Physical activities	1.32	(0.58-2.97)
	More than 1	1.00	

[†]Chi-square test, d.f. = degrees of freedom

Table B. Reported knowledge resources of health and physical activity by Pohnpeian youth aged 15-17 years by gender, % (N=200)

Characteristic		Female (N=121)	Male (N=79)	X ² (d.f) [‡]	p-value
School	Yes	84.3	86.1		
	No	15.7	13.9	0.12 (1)	0.7306
Pohnpei Public Health	Yes	67.8	64.6		
	No	32.2	35.4	0.22 (1)	0.6381
Books and Newspapers	Yes	28.9	16.5		
	No	71.1	83.5	4.07 (1)	0.0435
Foreign Magazines	Yes	20.7	19.0		
	No	79.3	81.0	0.08 (1)	0.7724
Television and DVDs	Yes	40.5	40.5		
	No	59.5	59.5	0.00 (1)	0.9988
Posters	Yes	33.1	27.9		
	No	66.9	72.2	0.61 (1)	0.4361
Radio	Yes	27.3	27.9		
	No	72.7	72.2	0.0079 (1)	0.929
Church	Yes	24.0	36.7		
	No	76.0	63.3	3.77 (1)	0.0522
Friends and Family	Yes	76.0	74.7		
	No	23.9	25.3	0.05 (1)	0.8283
Other	Yes	21.5	27.9		
	No	78.5	72.2	1.06 (1)	0.3032

[‡] Chi-square test, d.f. = degrees of freedom

[^] Chi-square test excludes missing data

Table C: Proportion of participants by age and gender who reported helping parents on weekdays to plant, maintain, harvest and prepare local foods, %

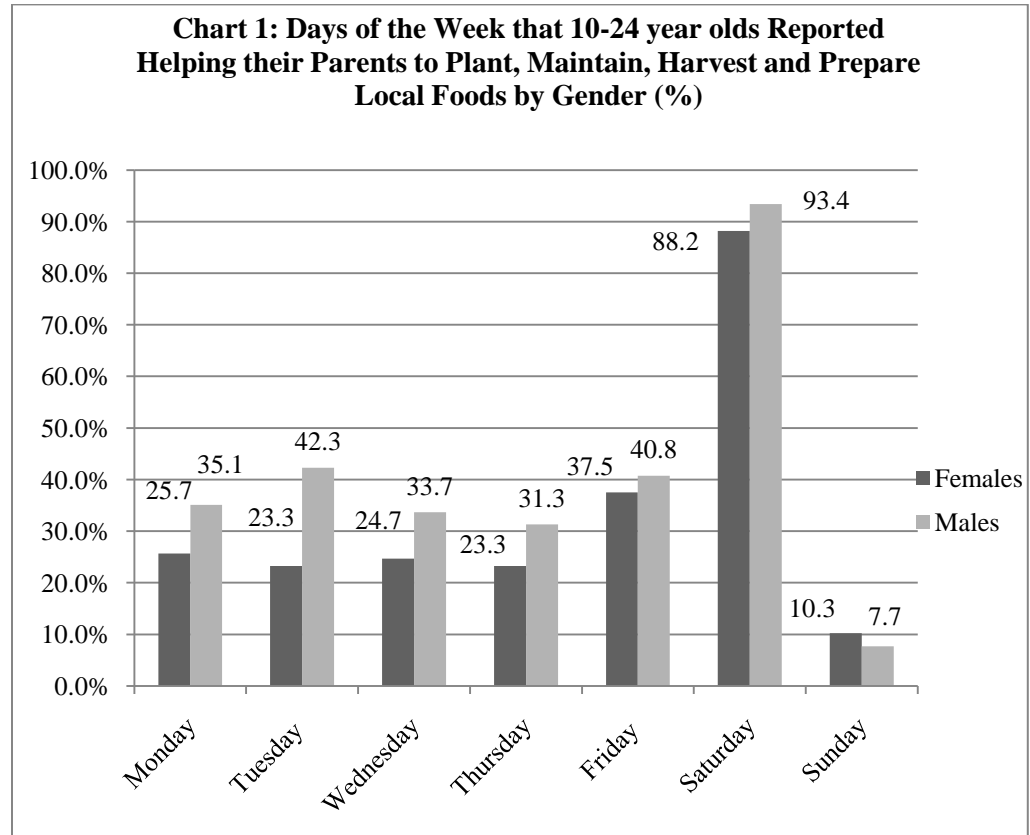
Ages	Monday			Tuesday			Wednesday			Thursday		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	25.7	35.1	0.0236*	23.3	42.3	0.0144	24.7	33.7	0.0279	23.3	31.3	0.0457
10-14 (n=185)	30.2	50.0	0.0115*	31.1	40.0	0.2491	28.3	38.3	0.1842	28.3	36.7	0.2657
15-17 (n=200)	19.4	36.1	0.0129*	14.8	41.7	<0.0001	21.3	37.5	0.0177	15.7	34.3	0.0033
18-24 (n=181)	28.4	22.8	0.4291*	24.3	20.3	0.5463	24.3	26.6	0.7496	27.0	24.1	0.6739

* Chi-square test excludes missing data

Table D: Proportion of participants by age and gender who reported helping parents on weekdays to plant, maintain, harvest and prepare local foods on weekends, %

Ages	Friday			Saturday			Sunday		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	37.5%	40.8%	0.4612	88.2%	93.4%	0.0513	10.3%	7.7%	0.3327
10-14 (n=185)	45.3%	46.7%	0.8639	90.6%	88.5%	0.6753	15.4%	6.8%	0.1382*
15-17 (n=200)	31.5%	48.6%	0.0209	84.3%	95.8%	0.0158*	1.9%	9.9%	0.0307*
18-24 (n=181)	35.1%	29.1%	0.4266	90.5%	94.9%	0.3571*	15.3%	6.4%	0.0798

[†] Chi-square test excludes missing data
 *p-value for Fisher's Exact Test



Appendix V—Additional Data Analysis: Food Frequency Question

Table 1. Reported Consumption of Food, Drinks and Substances by Pohnpeian youth aged 10-14 years by gender (N=185)						
Pohnpei, Federated States of Micronesia						
Characteristic		Female % (N=121)	Male % (N=64)	X² (d.f) †	p-value	Fisher's*
Rice	Never (0 days)	2.5	0.0			
	Sometimes (1-2 days)	3.3	3.1			
	Frequently (3-6 days)	13.2	15.6			
	Daily (Everyday)	81.0	80.3			0.7670
Local Food	Never (0 days)	22.5	18.8			
	Sometimes (1-2 days)	25.8	31.3			
	Frequently (3-6 days)	34.2	40.6			
	Daily (Everyday)	17.5	9.4	3.07 (3)	0.3803	
Flour Products	Never (0 days)	5.8	17.2			
	Sometimes (1-2 days)	36.4	40.6			
	Frequently (3-6 days)	39.7	28.1			
	Daily (Everyday)	18.2	14.1	7.78 (3)	0.0507	
Koolaid with Ramen	Never (0 days)	31.4	46.9			
	Sometimes (1-2 days)	38.8	37.5			
	Frequently (3-6 days)	23.1	14.1			
	Daily (Everyday)	6.6	1.6			0.0925
Fruits	Never (0 days)	35.0	20.3			
	Sometimes (1-2 days)	30.0	37.5			
	Frequently (3-6 days)	18.3	31.3			
	Daily (Everyday)	16.7	10.9	7.72 (3)	0.0522	
Vegetables	Never (0 days)	54.6	32.8			
	Sometimes (1-2 days)	19.0	20.3			
	Frequently (3-6 days)	18.2	37.5			
	Daily (Everyday)	8.3	9.4	10.58	0.0142	

				(3)		
Kirahka (candy bars)	Never (0 days)	8.3	20.6			
	Sometimes (1-2 days)	25.8	27.0			
	Frequently (3-6 days)	29.2	31.8			
	Daily (Everyday)	36.7	20.6	8.50 (3)	0.0368	
Water	Never (0 days)	0.0	1.6			
	Sometimes (1-2 days)	4.2	1.6			
	Frequently (3-6 days)	3.4	7.8			
	Daily (Everyday)	92.4	89.1			0.2088
Soft Drinks	Never (0 days)	23.1	35.9			
	Sometimes (1-2 days)	30.6	25.0			
	Frequently (3-6 days)	33.9	31.3			
	Daily (Everyday)	12.4	7.8	3.84 (3)	0.2789	
Drinking Coconut	Never (0 days)	54.6	42.2			
	Sometimes (1-2 days)	25.2	26.6			
	Frequently (3-6 days)	12.6	23.4			
	Daily (Everyday)	7.6	7.8	4.29 (3)	0.2316	
Imported Fruit Juice	Never (0 days)	40.8	43.8			
	Sometimes (1-2 days)	30.8	29.7			
	Frequently (3-6 days)	21.7	20.3			
	Daily (Everyday)	6.7	6.3	0.15 (3)	0.9852	
Betel Nut with Tobacco	Never (0 days)	75.8	53.1			
	Sometimes (1-2 days)	5.8	9.4			
	Frequently (3-6 days)	5.8	7.8			
	Daily (Everyday)	12.5	29.7	10.83 (3)	0.0127	
Alcohol	Never (0 days)	93.3	75.0			
	Sometimes (1-2 days)	5.0	12.5			
	Frequently (3-6 days)	0.8	9.4			
	Daily (Everyday)	0.8	3.1			0.0017
<p>χ² Chi-square test, d.f. = degrees of freedom ^Chi-square test excludes missing data</p>						

*Fisher's Exact Test P-value conducted for cells with numbers less than 5

Table 2. Reported Consumption of Food, Drinks and Substances by Pohnpeian youth aged 15-17 years by gender (N=200)						
Pohnpei, Federated States of Micronesia						
Characteristic		Female % (N=121)	Male % (N=79)	X² (d.f)_f	p-value	Fisher's*
Rice	Never (0 days)	0.0	0.0			
	Sometimes (1-2 days)	1.7	2.6			
	Frequently (3-6 days)	10.7	19.2			
	Daily (Everyday)	87.6	78.2			0.1598
Local Food	Never (0 days)	6.6	6.3			
	Sometimes (1-2 days)	22.3	19.0			
	Frequently (3-6 days)	54.6	58.2			
	Daily (Everyday)	16.5	16.5	0.37 (3)	0.9456	
Flour Products	Never (0 days)	5.0	13.9			
	Sometimes (1-2	27.7	26.6			

	days)					
	Frequently (3-6 days)	27.7	20.3			
	Daily (Everyday)	39.5	39.2	5.46 (3)	0.1411	
Koolaid with Ramen	Never (0 days)	29.2	62.0			
	Sometimes (1-2 days)	36.7	26.6			
	Frequently (3-6 days)	26.7	8.9			
	Daily (Everyday)	7.5	2.5			<0.0001
Fruits	Never (0 days)	14.2	16.5			
	Sometimes (1-2 days)	27.5	22.8			
	Frequently (3-6 days)	33.3	39.2			
	Daily (Everyday)	25.0	21.5	1.29 (3)	0.7317	
Vegetables	Never (0 days)	34.7	22.8			
	Sometimes (1-2 days)	22.3	20.3			
	Frequently (3-6 days)	24.8	31.7			
	Daily (Everyday)	18.2	25.3	4.33 (3)	0.2275	
Kirahka (candy bars)	Never (0 days)	6.6	34.6			
	Sometimes (1-2 days)	25.6	21.8			
	Frequently (3-6 days)	41.3	32.1			
	Daily (Everyday)	26.5	11.5	27.63 (3)	<0.0001	
Water	Never (0 days)	1.7	1.3			
	Sometimes (1-2 days)	1.7	1.3			
	Frequently (3-6 days)	4.2	8.9			
	Daily (Everyday)	92.4	88.6			0.613
Soft Drinks	Never (0 days)	18.2	17.7			

	Sometimes (1-2 days)	32.2	38.0			
	Frequently (3-6 days)	33.9	34.2			
	Daily (Everyday)	15.7	10.1	1.56 (3)	0.6675	
Drinking Coconut	Never (0 days)	45.5	21.5			
	Sometimes (1-2 days)	30.6	44.3			
	Frequently (3-6 days)	11.6	25.3			
	Daily (Everyday)	12.4	8.9	15.96 (3)	0.0012	
Imported Fruit Juice	Never (0 days)	31.4	39.2			
	Sometimes (1-2 days)	24.0	17.7			
	Frequently (3-6 days)	25.6	26.6			
	Daily (Everyday)	19.0	16.5	1.91 (3)	0.5918	
Betel Nut with Tobacco	Never (0 days)	71.1	51.9			
	Sometimes (1-2 days)	0.8	5.1			
	Frequently (3-6 days)	6.6	10.1			
	Daily (Everyday)	21.5	32.9			0.0225
		28.9	48.1			
Alcohol	Never (0 days)	89.3	79.8			
	Sometimes (1-2 days)	4.1	7.6			
	Frequently (3-6 days)	3.3	8.9			
	Daily (Everyday)	3.3	3.8			0.2292
χ^2 Chi-square test, d.f. = degrees of freedom ^Chi-square test excludes missing data *Fisher's Exact Test P-value conducted for cells with numbers less than 5						

Table 3. Reported Consumption of Food, Drinks and Substances by Pohnpeian youth aged 18-24 years by gender (N=181)						
Pohnpei, Federated States of Micronesia						
Characteristic		Female % (N=93)	Male % (N=88)	X² (d.f)_f	p- value	Fisher's*
Rice	Never (0 days)	2.2	3.4			
	Sometimes (1-2 days)	6.5	3.4			
	Frequently (3-6 days)	10.9	19.3			
	Daily (Everyday)	80.4	73.9			0.2988
Local Food	Never (0 days)	6.5	4.6			
	Sometimes (1-2 days)	33.7	27.3			
	Frequently (3-6 days)	41.3	50.0			
	Daily (Everyday)	18.5	18.2			0.6503
Flour Products	Never (0 days)	9.8	18.2			
	Sometimes (1-2 days)	30.4	27.3%			
	Frequently (3-6 days)	42.4	40.9			
	Daily (Everyday)	17.4	13.6	2.87 (3)	0.4118	
Koolaid with Ramen	Never (0 days)	22.8	47.7			
	Sometimes (1-2 days)	35.9	33.0			
	Frequently (3-6 days)	27.2	15.9			
	Daily (Everyday)	14.1	3.4			<0.0001
Fruits	Never (0 days)	16.3	22.7			
	Sometimes (1-2	27.2	22.7			

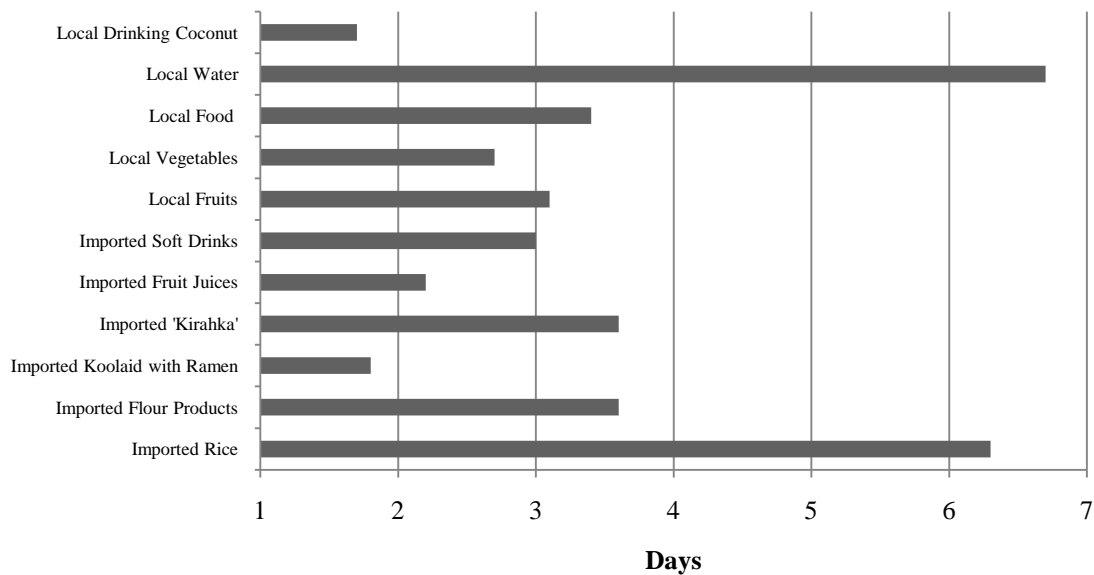
	days)					
	Frequently (3-6 days)	43.5	37.5			
	Daily (Everyday)	13.0	17.1	2.19 (3)	0.5346	
Vegetables	Never (0 days)	20.7	22.7			
	Sometimes (1-2 days)	26.1	20.5			
	Frequently (3-6 days)	31.5	39.8			
	Daily (Everyday)	21.7	17.1	2.07 (3)	0.5577	
Kirahka (candy bars)	Never (0 days)	13.0	30.7			
	Sometimes (1-2 days)	14.1	29.6			
	Frequently (3-6 days)	35.9	20.5			
	Daily (Everyday)	37.0	19.3	20.10 (3)	0.0002	
Water	Never (0 days)	0.0	2.3			
	Sometimes (1-2 days)	4.4	0.0			
	Frequently (3-6 days)	4.4	6.8			
	Daily (Everyday)	91.3	90.9			0.0894
Soft Drinks		5.4	14.8			
	Sometimes (1-2 days)	30.4	21.6			
	Frequently (3-6 days)	43.5	50.0			
	Daily (Everyday)	20.7	13.6	6.96 (3)	0.0730	
	Missing 1 female					
Drinking Coconut	Never (0 days)	48.9	45.5			
	Sometimes (1-2 days)	32.6	26.1			
	Frequently (3-6 days)	15.2	19.3			
	Daily (Everyday)	3.3	9.1			0.308
Imported Fruit Juice	Never (0 days)	32.5	51.1			
	Sometimes (1-2 days)	31.5	13.6			

	days)					
	Frequently (3-6 days)	23.9	27.3			
	Daily (Everyday)	13.0	8.0	11.83 (3)	0.0080	
Betel Nut with Tobacco	Never (0 days)	35.9	21.6			
	Sometimes (1-2 days)	5.4	5.7			
	Frequently (3-6 days)	13.0	9.1			
	Daily (Everyday)	45.7	63.6	6.48 (3)	0.0903	
Alcohol	Never (0 days)	69.2	35.2			
	Sometimes (1-2 days)	13.2	29.6			
	Frequently (3-6 days)	15.4	26.1			
	Daily (Everyday)	2.2	9.1			4.97E-05
<p>‡ Chi-square test, d.f. = degrees of freedom</p> <p>^Chi-square test excludes missing data</p> <p>*Fisher's Exact Test P-value conducted for cells with numbers less than 5</p>						

**Table 4. Reported Consumption of food and beverages by Pohnpei youth aged 10-24
(N=566)**

Food	Mean	Never		Sometimes		Frequently		Daily	
	No. of Days	(0 Days)	%	(1-2 days)	%	(3-6 days)	%	(7 days)	%
Rice	6.3±1.6	8	1.4	19	3.4	81	14.4	456	80.9
Local Food	3.4±2.2	62	11.0	148	26.2	261	46.3	93	16.5
Flour Products	3.6±6.0	60	10.7	176	31.3	190	33.8	137	24.3
Koolaid with									
Ramen	1.8±2.1	215	38.1	198	35.1	115	20.4	36	6.4
Fruits	3.1±2.5	120	21.3	156	27.7	186	33.0	101	17.9
Vegetables	2.7±2.6	186	32.9	121	21.4	165	29.2	93	16.5
Kirahka	3.6±2.6	97	17.3	135	24.0	181	32.2	149	26.5
Water	6.7±1.2	6	1.1	13	2.3	31	5.5	510	91.1
Soft Drinks	3.0±2.4	105	18.6	169	29.9	213	37.7	78	13.8
Drinking Coconut	1.7±2.2	249	44.2	172	30.6	95	16.9	47	8.4
Imported Fruit									
Juice	2.2±2.5	220	39.0	140	24.8	137	24.3	67	11.9

Chart 1: Average Number of Days of Local and Imported Food and Beverage Consumption by Youth Ages 10-24 (N=566)



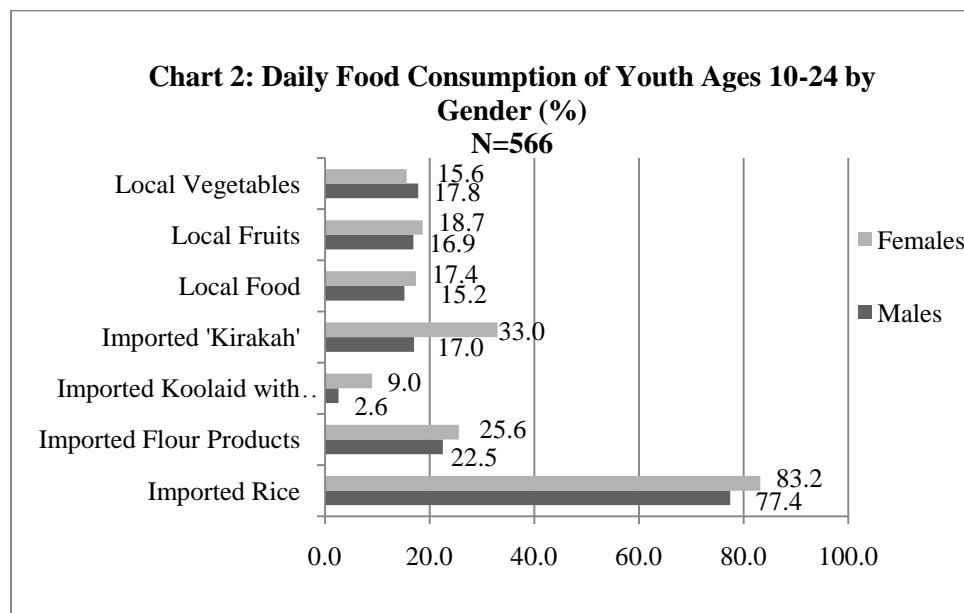


Table 5: Proportion of participants by age who reported consuming food daily in the last week, %

Age groups	Rice			Local food			Flour Products		
	Females	Males	p-value	Females	Males	p-value	Females	Males	p-value
10-24 (n=566)	83.2	77.4	0.1776*	17.4	15.2%	0.3768	25.6	22.5	0.0025
10-14 (n=185)	81.0	80.3	0.767*	17.5	9.4%	0.3803	18.2	14.1	0.0507
15-17 (n=200)	87.6	78.2	0.1598*	16.5	16.5%	0.9456	39.5	39.2	0.1411
18-24 (n=181)	80.4	73.9	0.2988*	18.5	18.2%	0.6503*	17.4	13.6	0.4118

† Chi-square test excludes missing data
*p-value for Fisher's Exact Test

Table 6: Proportion of participants by age who reported consuming food daily in the last week, %

Age groups	Fruits			Vegetables		
	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	18.7	16.9	0.5676	15.6	17.8	0.0030
10-14 (n=185)	16.7	10.9	0.0522	8.3	9.4	0.0142
15-17 (n=200)	25.0	21.5	0.7317	18.2	25.3	0.2275
18-24 (n=181)	13.0	17.1	0.5346	21.7	17.1	0.5577

^aChi-square test excludes missing data

Table 7: Proportion of participants by age who reported consuming food daily in the last week, %

Age groups	Kirahka			Koolaid with Ramen		
	Females	Males	p-value	Females	Males	p-value
10-24 (n=566)	33.0	17.0	<.0001	9.0	2.6	<.0001
10-14 (n=185)	36.7%	20.6%	0.0368	6.6%	1.6%	0.0925*
15-17 (n=200)	26.5%	11.5%	<0.0001	7.5%*	2.53%*	<0.001*
18-24 (n=181)	37.0%	19.3%	0.0002	14.1%	3.4%	<0.001*

†Chi-square test excludes missing data

*p-value for Fisher's Exact

Test

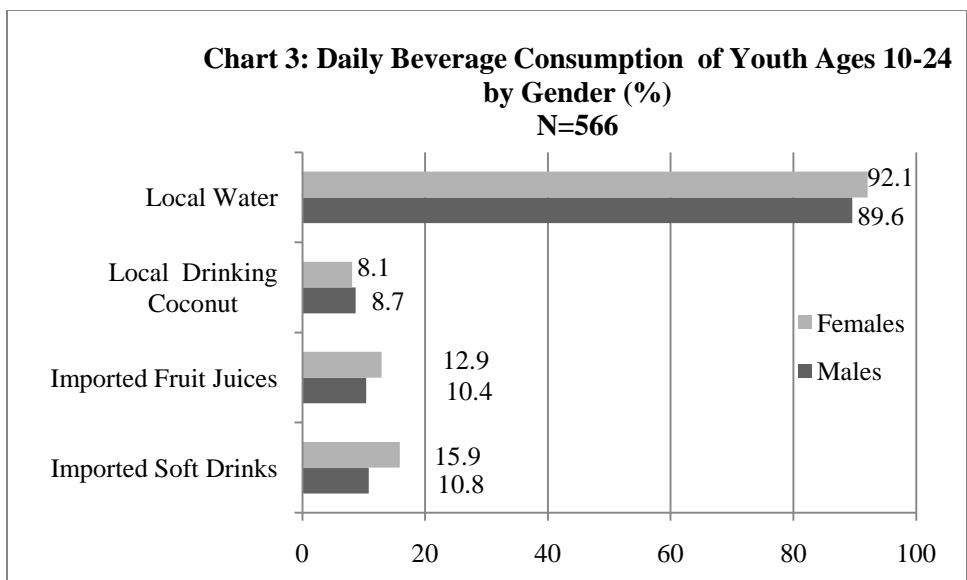


Table 8: Proportion of participants by age who reported consuming drinks daily in the last week, % (95% confidence intervals)
(N=566)

Ages	Water		Soft drinks			Coconut			Imported Fruit Juices			
	Females %	Males %	p-value	Females %	Males %	p-value	Females %	Males %	p-value	Females %	Males %	p-value
10-24 N=566	92.1	89.6	0.0268 *	15.9	10.8	0.1579	8.1	8.7	0.0039	12.9	10.4	0.0298
10-14 N=185	92.4	89.1	0.2088 *	12.4	7.8	0.2789	7.6	7.8	0.2316	6.7	6.3%	0.9852
15-17 N=200	92.4	88.6	0.613*	15.7	10.1	0.6675	12.4	8.9	0.0012	19.0	16.5%	0.5918
18-24 N=181	91.3	90.9	0.0894 *	20.7	13.6	0.0730	3.3	9.1	0.3080*	13.0	8.0%	0.0080

† Chi-square test excludes missing data

*p-value for Fisher's Exact Test

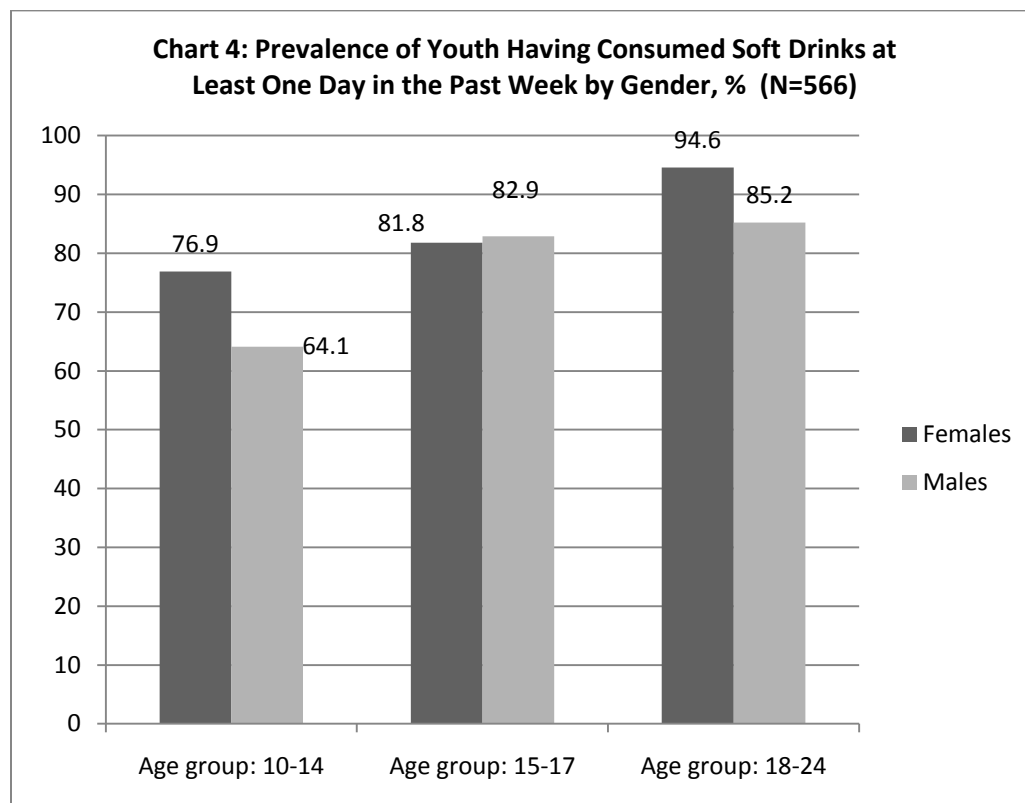


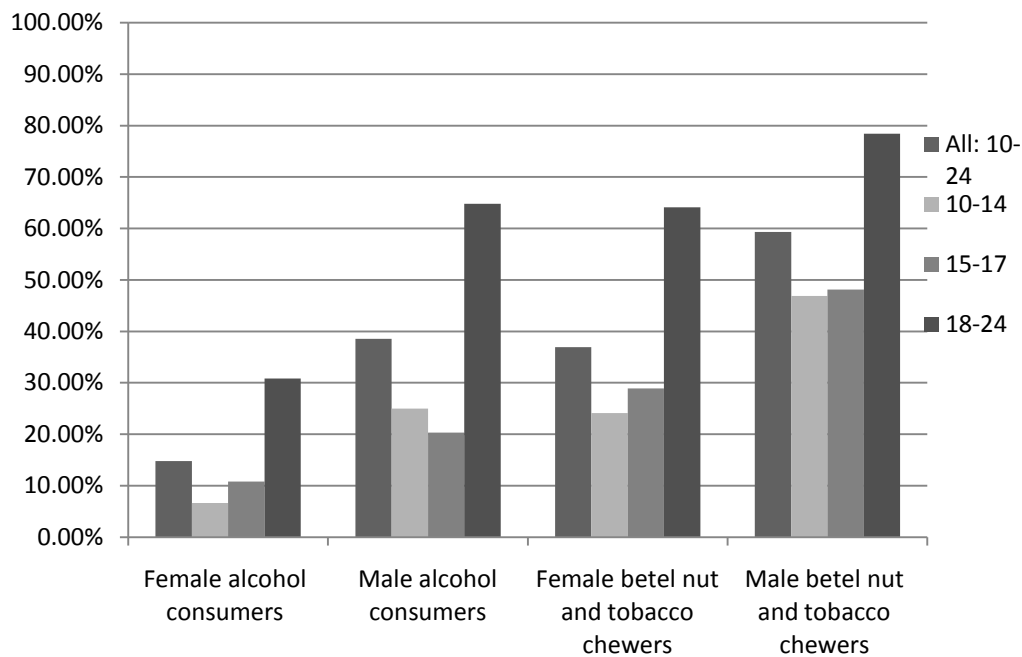
Table 9: Proportion of participants by age who reported consuming alcohol and chewing tobacco at least one day in the past week, %

Age groups	Alcohol			Betel nut with Tobacco		
	Females	Males	p-value	Females	Males	p-value
All: 10-24 (n=566)	14.76	38.53	<0.0001	36.9	59.3	<0.0001
10-14 (n=185)	6.6	25.0	0.0017*	24.1	46.9	0.0127
15-17 (n=200)	10.8	20.3	0.2292*	28.9	48.1	0.0225*
18-24 (n=181)	30.8	64.8	<0.0001*	64.1	78.4	0.0903

‡ Chi-square test excludes missing data

*p-value for Fisher's Exact Test

Chart 5: Prevalence of male and female consumption of alcohol and betel nut and tobacco use at least one day in the past week by age-group (N=566)



Appendix VI—Terminology

The following terms are defined for additional clarification and are used throughout the document.

Adults	Defined for the purpose of this thesis as any individual older than 24 years of age.
BMI	Body Mass Index (BMI) is an indicator of body fatness. It does not measure body fat directly but correlates to direct measures of body fat, and is therefore an alternative for direct measures of body fat. BMI is a reliable indicator of body fatness for most children and teens. It is sex and age-specific and is commonly referred to as BMI-for-age. ⁵³
Duration	Length of time, usually expressed in minutes, in which a physical activity is performed. ^{49, 52}
Exercise	A subcategory of physical activity that is structure, planned and purposeful. ⁴⁹
Frequency	The number of times an exercise or activity is performed. Frequency is generally expressed in sessions, episodes, or bouts per week ⁴⁹ .
Imported Foods	Food items that are produced and packaged outside the FSM and are imported to Pohnpei for sale. The foods used in the survey's food frequency question (see Appendix I) are white rice, flour products including bread, snacks called <i>kirahka</i> in Pohnpei, which is the local term for snacks such as cookies and chocolates, and Kool-Aid with Ramen noodles which are common snack foods.
Imported Beverages	Beverage items that are produced and packaged outside the FSM and are imported to Pohnpei for sale. The drinks listed in the survey's food frequency question (see Appendix I) are soft drinks, fruit juices, and alcohol such as beer, liquor and wine.

Intake	Youth reported consumption of foods
Intensity	Refers to the rate at which a physical activity is being performed or the level of effort required to perform an activity. For instance as a low, moderate or vigorous intensity. ⁴⁹
Island Food Community of Pohnpei	
	The Island Food Community of Pohnpei (IFCP) was founded in 2004 to allow Pohnpeians to “live in a productive environmentally sound island where a diversity of locally grown island food is produced and consumed, providing food security, sustainable development, economic benefits, self-reliance, improved health, cultural preservation, and human dignity, and at the same time protecting the natural resources.” Website: www.islandfood.org
Local Foods	Foods locally produced or attained in Pohnpei, Micronesia. On the food frequency question in the survey (see Appendix I), this term is used to mean local starches (such as yam varieties, hard and soft taro and breadfruits varieties) and local protein foods (including fresh fish, pork and chicken). Other local foods are locally grown fruits (including hundreds of banana varieties, pandanus fruit) and locally grown vegetables including Chinese cabbage and cucumbers. Local fruits and vegetables are listed separately from ‘local food’ in the food frequency question.
Local drinks	Beverage items that are produced or attained in Pohnpei. On the food frequency question in the survey (see Appendix I), these drinks are listed as water and drinking coconut.
Nutrient dense	These include foods and beverages which have substances such as minerals and vitamins that may have positive health effects, and are absent of any added substances such as sugars and fats. They are low in solid fats, and calories, and are also in forms that retain naturally occurring components like dietary fiber. Some examples include all fruits, vegetables, whole grains, beans and peas, and fat-free and low-fat milk and milk products. ⁴³

Obesity	<p>A term used to categorize excessive fat accumulation that may impair health. For youth, obesity can be determined using BMI calculations. BMI that ranges above a normal weight may indicate obesity depending on age, sex, weight and height. BMI ranges take into account normal differences in body fat between boys and girls.⁵³ Can be calculated using the Center for Disease Control's BMI Percentile Calculator at:</p> <p>http://apps.nccd.cdc.gov/dnpabmi/Result.aspx?&dob=5/21/1994&dom=1/14/2010&age=188&ht=63&wt=150&gender=1&method=0&inchtex=0&wttext=0</p>
Physical Activity	<p>This is any bodily movement produced by skeletal muscles that requires energy expenditure³⁸.</p>
Traditional Physical Activity	<p>This term is used for the purpose of the survey to refer to a variety of traditional activities that are of moderate to vigorous intensity and which include agrarian work such as planting, maintaining and harvesting local crops, climbing coconut trees, and preparing local foods which could require chopping wood (see Appendix I). Not included in the survey but also a common type of traditional physical activity is fishing inside the reef and outside the reef barrier in the open ocean.</p>
Type of physical activity	<p>Physical activity can take on many forms such as aerobic , balance, strength. For the purpose of this study, the types refer to traditional, school-related and leisure time.⁴⁹</p>
Type 1 Diabetes Mellitus	<p>Type 1 Diabetes Mellitus (T1DM) is insulin dependent diabetes. It occurs most commonly in children and young adults.</p>
Type 2 Diabetes Mellitus	<p>Type 2 Diabetes Mellitus (T2DM) as it is commonly referred to as non insulin dependent diabetes. It occurs in mature adults but is increasingly affecting all ages, including children. In the Western Pacific Region, T2DM accounts for approximately 85 to 90% of all diabetes cases. T2DM and its risk factors in the Pohnpeian youth population is the primary topic of this research study.</p>

Vigorous Physical Activity This thesis defines it as activities that makes one sweat and breathe hard. Some examples are basketball, soccer, farming, fishing, walking far distances, chores, running, swimming laps, fast bicycling, paddling, fast dancing and aerobic exercises. It is however by definition an activity that is typically performed 6.0 or more times the intensity of rest for adults and 7.0 or more times for youth.⁴⁹

Youth Youth refers to all individuals between the ages of 10 and 24 years for the purpose of this thesis.