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The Commonwealth of the Northern Mariana Islands' Department of Public Health submits its response herein to the Funding Opportunity Announcement No. CDC-RFA-09DP-902, the five-year US Affiliated Pacific Island Collaborative Performance Agreement for Tobacco Control, Diabetes Prevention and Control, and the Behavioral Risk Factor Surveillance System.

**CNMI Department of Public Health submits its Statement of Intent to conduct a Behavioral Risk Factor Surveillance System survey (BRFSS survey).** The CNMI Department of Public Health also submits its statement of intent to conduct a Behavioral Risk Factor Surveillance System survey in CY2009 and requests technical assistance from the Centers for Disease Control and Prevention during the planning/preparation, implementation and evaluation/analysis of the survey.

This application is divided into four main parts:

- Part A: Needs assessment
- Part B: Work plans
- Part C: Budget narratives with justifications
- Part D: Appendices

**Integrated programmatic goal:**

**To promote a healthy lifestyle and decrease the morbidity and mortality from non-communicable diseases in the CNMI through collaborative and organized preventive health care services which focus on the inherent and unique risks and benefits of being a member of a Pacific Island community.**

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## Background

### Geography

The Commonwealth of the Northern Mariana Islands (CNMI) is a U.S. commonwealth formed in 1978, formerly of the United Nation's Trust Territory of the Pacific region of Micronesia within Oceania. The CNMI is comprised of 14 islands with a total land area of 176.5 square miles spread out of 264,000 square miles of the Pacific Ocean. The commonwealth's population lives primarily on three islands; Saipan, the largest and most populated island, is 12.5 miles long and 5.5 miles wide. The other two populated islands are Tinian and Rota, which lie between Saipan and Guam. The nine far northern islands are very sparsely inhabited with few year-round inhabitants and no infrastructure services.

[Please see maps in Appendix A]

### Population

Total general population figures in this grant application are based on the 2005 CNMI Household, Income and Expenditure Survey (2005 HIES)<sup>1</sup>. The estimated total population in the CNMI in October 2005 was 65,927. The estimated total population for the island of Saipan was 60,608, Tinian was 2,829 (4.3%), and Rota was 2,490 (3.8%). The CNMI's total area could be compared to 2.5 times the size of Washington, DC. The nearest U.S. tertiary medical center for referral is in Honolulu, Hawaii, over 8 hours away by air. The isolation and disparities apparent in the CNMI create unique and challenging barriers to a struggling health care system.

Local residents are primarily Chamorro and Carolinian, which are considered the two ethnic groups indigenous to the CNMI. Additionally, the U.S. "Compacts of Free Association" permit the free movement of people between the freely associated states, flag territories, Hawaii and the mainland United States. These "Compact" islands include the Republic of Palau; the Republic of the Marshall

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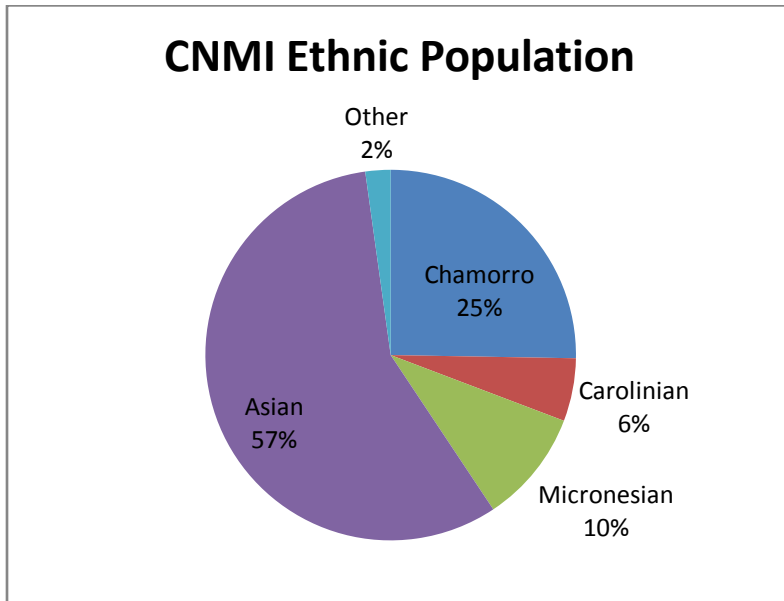
<sup>1</sup>CNMI Department of Commerce, Central Statistics Division, 2005 Household, Income and Expenditure Survey. Saipan: 2008.

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Islands; and the islands comprising the Federated States of Micronesia, Kosrae, Chuuk, Pohnpei, and Yap.

Figure 1. CNMI Population by Ethnicity



The impact of meeting the chronic health care needs of these Micronesia residents within the struggling CNMI health care system plays an important role in overwhelming the capacity of the system.<sup>2</sup> Foreign contract workers from Asia (primarily Chinese and Filipino) comprise over half of the jurisdiction's population. These contract laborers work in CNMI's private and public sector in difficult-to-fill positions. While the CNMI has maintained control over its own labor and immigration regulation and enforcement, recent federal legislation has mandated a federal takeover of CNMI labor and immigration be implemented, beginning in June 2009.<sup>3</sup> The recent federalization of the CNMI immigration system is expected to significantly decrease the number of foreign workers in the CNMI.

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<sup>2</sup> Feasley, J., Lawrence, R. editors. *Pacific Partnerships for Health: Charting a New Course*. J. Feasley & R. Lawrence, editors. Washington, D.C.: National Academy Press, 1998.

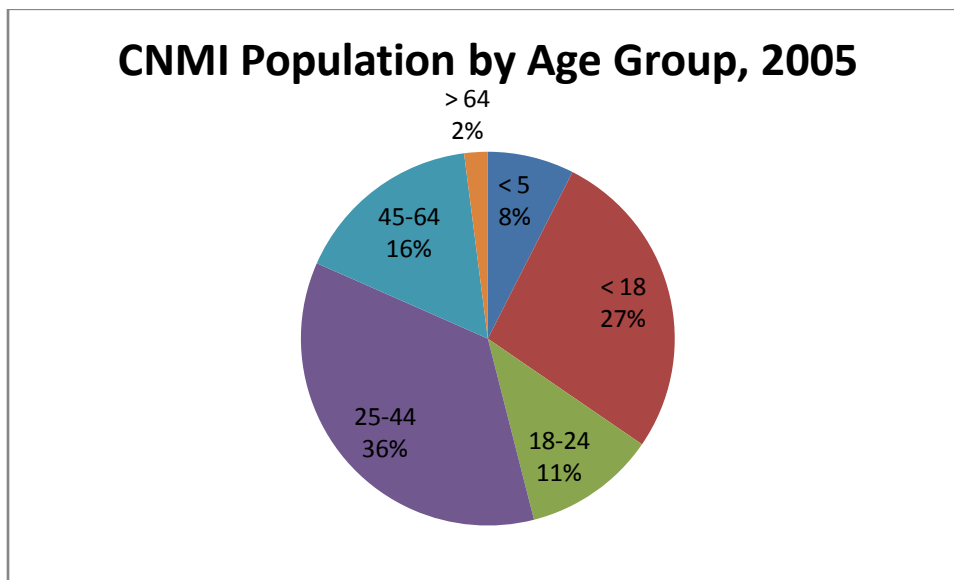
<sup>3</sup> U.S. Public Law 110-229, Title VII.

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Of the entire CNMI population in 2005, 8.1 percent are under 5 years old, 29.3 were under 18 years, 12.4 percent were between 18-24 years, 38.5 percent were 25-44 years, 17.7 percent were between 45- 64 years, and only 2.2 percent were 65 years and older.<sup>4</sup> The largest proportion of the population is in the 25-44 years age group because this is the predominant age group of immigrant workers in the CNMI.<sup>5</sup> Within the CNMI, 54% of individuals and 47% of families reported 2004 incomes below poverty level.<sup>6</sup>

Figure 2. CNMI Population by Age Group



Source: 2005 CNMI HIES

## History

Among the 14 islands of the CNMI, Saipan and Tinian were the sites of fierce engagement between the U.S. and the Japanese military forces during World War II. After World War II, the United Nations accorded the U.S. trusteeship authority over CNMI and many other Micronesian islands as the Pacific Islands Trust Territory. The covenant to establish the Commonwealth of the Northern Mariana

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<sup>4</sup> CNMI Department of Commerce, Central Statistics Division, 2005 *Household, Income and Expenditure Survey*. Saipan: 2008.

<sup>5</sup> CNMI Department of Commerce, Central Statistics Division, 2002 *Statistical Yearbook*. Saipan: 2003.

<sup>6</sup> *Ibid.*

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Islands was signed by President Gerald R. Ford in 1976, and the CNMI constitution was ratified in 1977, followed by the election and installation of the government in 1978. **It is paramount to realize that the Commonwealth, its governing system and its infrastructure as an independent entity within a commonwealth agreement with the United States is only 30 years old.**

The CNMI's residents (excluding foreign contract workers) are U.S. citizens but do not vote in federal elections. In addition to funds received from the United States, the economy of the CNMI depends in large part on tourism from Japan and other Asian countries, and revenue from tourism has declined significantly in recent years with the downturn of the Asian economy.

## **Health Care Delivery System**

The CNMI Department of Public Health (DPH) is responsible for health services in the CNMI. DPH is comprised of three divisions: the Division of Public Health Administration which provides preventive and community health programs – many of which are federally funded, the Hospital Division which focuses on medical diagnostic and curative services, and the Community Guidance Center which provides mental health and substance abuse prevention and counseling programs. The Commonwealth Health Center, an 86-bed Medicare-certified hospital is the only hospital in the CNMI and is located on Saipan. It is primarily local government-financed and staffed by government-employed physicians, including physicians board-certified in internal medicine, pediatrics, obstetrics and gynecology, surgery, anesthesiology, emergency medicine, and nephrology.

The Department of Public Health also operates several outpatient facilities, providing an estimated 80 percent of all outpatient health care in the CNMI. Several clinics are physically located at the hospital, including adult clinics (providing internal medicine, surgery, orthopedics, and ear-nose-and-throat services), hemodialysis unit, a women's clinic focusing on obstetric and gynecologic care, a

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pediatric clinic for children from birth to age 16, an emergency department, and a walk-in acute-care clinic. The Department of Public Health also supports a community-based clinic in the southern end of Saipan. Additionally, a DPH adolescent health center is located within Marianas High School. There is a clinic/small hospital on Tinian and another on Rota without surgical abilities, each is staffed by two physicians and midlevel clinicians. There are fewer than ten private-practice physicians in the CNMI, working through approximately five private outpatient clinics. Homecare nursing services are available through two private sector agencies.

Health insurance is available in the CNMI through several mechanisms. Private health insurance is available for purchase. CNMI government-sponsored health insurance is available for government employees and government retirees. Although there is a Medicaid program, the federal dollar contribution to Medicaid is capped at a total dollar amount, regardless of the number of people enrolled. Medicare is also available, but due to the small number of older adults in the CNMI, it is not a significant source of health insurance coverage.

Complex medical cases that cannot be managed in the CNMI may be referred to a facility outside of the CNMI for care. Most of the off-island referrals are to Guam, Manila, Honolulu and Nagoya, Japan, dependent upon the clinical nature of the referral and health insurance coverage.<sup>7</sup> The burden of chronic diseases, including complications associated with diabetes mellitus and cardiovascular disease, in addition to cancer, is very evident within the medical referral process. Budget cuts have resulted in a reduction of available off-island services. Of all medical referrals in 2007, over 50 percent were for care related to cardiology, oncology, and radiology, due in part to a lack of medical specialists within the CNMI.<sup>8</sup>

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<sup>7</sup> CNMI Department of Public Health, *2008 Health Data Report*. Saipan: 2008.

<sup>8</sup> *Ibid.*



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## Evolution of NCD Prevention Strategies and Interventions in the CNMI

*Tanapag Village Study of Cardiovascular Risk Factors in a Pacific Island Population* “Just after World War II, a naval survey of the islands found no cases of diabetes.<sup>9</sup> The story is much different today. The CNMI Department of Public Health began initial steps to look at the prevalence of NCDs in 2000, when it undertook a health assessment of 1,218 residents of Tanapag village on Saipan. As the foundation of DPH’s endeavors in its chronic disease prevention interventions, this study examined the prevalence of specific health indicators directly linked to NCDs. The primary investigator, Richard Brostrom, MD-MSPH, Division of Public Health Medical Director, carried out a systematic examination of NCDs and their risk factors in a typical village setting.

In the *Tanapag Village Study of Cardiovascular Risk Factors in a Pacific Island Population* (2000), 1,218 villagers were evaluated for the presence of cardiac risk factors, including body mass index (BMI), diabetes mellitus, hypertension, tobacco abuse, and cholesterol levels<sup>10</sup>. This study found that prevalence rates for NCDs and their risk factors were higher than expected in adults > 40 years old.

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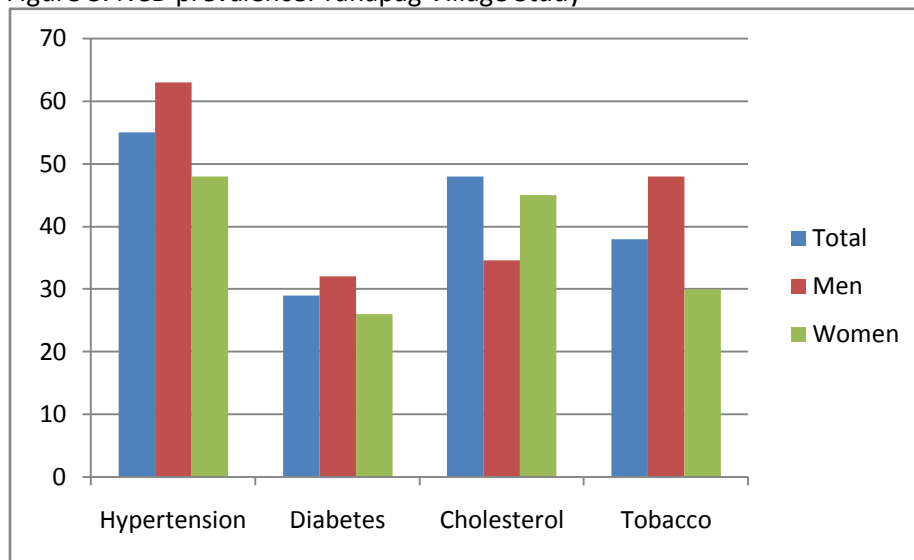
<sup>9</sup> Institute of Medicine. *Pacific Partnerships for Health: Charting a New Course*. J. Feasley & R. Lawrence, editors. Washington, D.C.: National Academy Press, 1998.

<sup>10</sup> CNMI Department of Public Health. *The Tanapag Study of Cardiovascular Risk Factors in a Pacific Island Population*. Richard Brostrom, MD, MS-PH, primary investigator. Unpublished. Saipan: 2001.

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Figure 3. NCD prevalence: Tanapag Village Study



Source: *Tanapag Village Study of Cardiovascular Risk Factors in a Pacific Island Population* (2000)

The Tanapag Village Study is further discussed in the needs assessment that follows.

**Walk on Wednesday (WOW).** What started out as a simple Diabetes Awareness activity by the CNMI Diabetes Prevention and Control Program during Diabetes Awareness Month in November 2002 has continued to be a weekly community-screening and outreach clinic. The original campaign was to get people to be more aware of their blood glucose and blood pressure numbers and understand what they mean. “What’s Your Number?” was the theme of the campaign. Blood pressure and blood glucose screening is conducted coupled with counseling on healthy behaviors on physical activity, nutrition and tobacco smoking under an open-air pavilion. On an average, WOW sees 45 people per week, the majority of whom do not have health insurance. The program has grown to include other prevention programs and organizations that have from time to time provided other services such as diabetic foot inspections (DPH Physical Therapy department), cancer awareness education (Breast and Cervical Cancer Screening program), tobacco cessation awareness (TCP) cooking demonstrations using healthier options, and eye examinations. The WOW program takes place along a scenic beachfront-walking

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pathway facing the western lagoon and Saipan's Pacific sunsets, so it is a natural setting for physical activity awareness and participation activities for the proposed project.

**Wise Women Village Project.** Previous efforts to reach indigenous women and provide health screening were met with little success, especially women who were no longer in their childbearing years. It is not uncommon for women to leave the health care system with the birth of their last baby and not return until they enter through the emergency room in a crisis. Various efforts to increase cervical cancer screening of indigenous and other Pacific Islander women were attempted, but each time the intervention failed to reach this target group. In the Spring of 2007, DPCP formed a partnership with the Family Planning Program to implement a pilot project they named "Wise Women Village Project" (WWVP). Health screening would include hypertension, hypercholesterolemia, and diabetes in addition to clinical breast exam and cervical cancer screening (using liquid cytology and routine HPV testing because of the high risk population). DPCP, Family Planning Program, the Breast and Cervical Cancer Screening Program, Maternal-Child Health Program, and the Tobacco Control Program partnered to provide staffing and cover the costs of screening. An ambitious project, DPH partnered with the Diocese of Chalan Kanoa to visit each village parish church in Saipan, Rota and Tinian, spending three Saturdays of the month in the village church's social hall for screening, exams, and education on NCDs and their risk factors. Additionally, nutrition advice and tobacco abuse assessment and referral are provided. The village project traveled to Rota and Tinian as well. In all, the WWVP provided services and education to almost 400 women.

The Wise Women Village Project has developed a collaborative model that includes NCD health screening, education and referral services to the community, working in collaborative partnerships. The WWVP target group is indigenous women, aged 25-65, who have not had cervical cancer screening in

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four or more years. However, this year, we plan to broaden the participant eligibility criteria and will be providing NCD screening to women and men as well during selected outreach activities.

Further, the WWVP data concurred with the data in female subjects of the Tanapag study data collected on women, reinforcing the validity of prevalence data from one village extrapolated to assess the community at-large.

## Needs assessment

### Overview

WHO estimates that more than half of deaths from NCDs are attributable to three main risk factors: tobacco use, raised blood pressure and poor diet. “At least 80% of heart disease, stroke and type 2 diabetes, as well as 40% of cancer, could be avoided through healthy diet, regular physical activity and avoidance of tobacco use.”<sup>11</sup> But creating and implementing programs that can reverse this statistic can be difficult to implement in low socioeconomic populations. One concern is that the impact of outreach and prevention services will be decreased/mitigated because many don’t have access to follow up care due to financial concerns and transportation. Even if they were able to access a health care provider regularly many often can’t afford the medication that is prescribed unless they are Medicaid recipients. Recently, a poignant reminder of these disparities was obvious when the CNMI DPH Wise Women Village Project conducted an annual NCD rescreening campaign that resulted in only approximately 10 percent of original project participants contacted responding to an invitation for cost-free rescreening services despite a generous incentive package.<sup>12</sup> The challenge remains – to change the community’s health belief model from one of external control to an internalized belief that health care in an ongoing process and that they are equal partners with the health care system in meeting their

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<sup>11</sup> World Health Organization. *Integrating Poverty and Gender into Health Programmes*. Manila: 2007.

<sup>12</sup> CNMI Department of Public Health. Wise Women Village Project data. 2008.

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health care needs while expanding ongoing access to care. Our planned Diabetes Care Center is one of the measures we are taking to address these issues.

The CNMI is a paradox. Beneath the veneer of a tropical island paradise, the indigenous population is suffering from a great burden of chronic health conditions. Much of this has been imposed on them from the outside through factors that are too large and fast-paced to be prevented. Like many Pacific Island jurisdictions, the indigenous population of the CNMI die young. Only 2 percent of the population is older than 64 years<sup>13</sup> compared to 12% of older mainland Americans.<sup>14</sup> But this is not for the reasons commonly associated with the developing world. There is no famine here and infectious diseases rate as only the fifth leading cause of death here. The big killer in the CNMI is “New World Syndrome”, a constellation of conditions brought on not by microbes or parasites, but by the assault of rapid Westernization on traditional cultures. Diabetes, heart disease and hypertension, once the exclusive bane of affluent societies, have only recently appeared.

In the place of fresh fish and breadfruit we have substituted canned goods. A visit to any store on Saipan will reveal rows of Spam, corned beef and Vienna sausages in fancy tins, cake mixes from the United States and ramen noodles from Asia. Cases of Budweiser are stacked in convenient locations near the checkout along with candy bars and potato chips. This newfound convenience comes at a high price. Levels of obesity, sedentary lifestyle and tobacco use are at historical highs along with their attendant consequences of hypertension, diabetes and cardiovascular disease. The hemodialysis unit is full, running 3 shifts from 5AM to 9PM daily.

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<sup>13</sup> CNMI Department of Commerce, Central Statistics Division, 2005 *Household, Income and Expenditure Survey*. Saipan: 2008.

<sup>14</sup> United States Census Bureau. "[United States - Age and Sex](http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2006_EST_G00_S0101&-ds_name=ACS_2006_EST_G00_&-redoLog=false)". 2006 *American Community; S0101. Age and Sex*. Retrieved on 12/26/2008 via Internet site: [http://factfinder.census.gov/servlet/STTable?\\_bm=y&-geo\\_id=01000US&-qr\\_name=ACS\\_2006\\_EST\\_G00\\_S0101&-ds\\_name=ACS\\_2006\\_EST\\_G00\\_&-redoLog=false](http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2006_EST_G00_S0101&-ds_name=ACS_2006_EST_G00_&-redoLog=false).

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However, to undertake a comprehensive assessment, we should adopt a lifespan perspective, beginning at the beginning – in utero.

## **Gestational diabetes and adequacy of prenatal care**

In 2007, with 1,403 live births, 67 percent were classified as having had inadequate prenatal care using the Adequacy of Prenatal Care Utilization Index (Kotelchuck) compared to 16 percent of US mainland live births in 2002-2004.<sup>15</sup> Only 43.5% of women began prenatal care in the first trimester, and almost 40% attended less than half of the prenatal visits expected, regardless of when prenatal care was instituted.<sup>16</sup> Therefore, we are less confident of our gestational diabetes (GDM) prevalence which has been reported in the range of 4.2<sup>17</sup> to 7 percent<sup>18</sup>. While the health system may have seen an increase in prenatal care initiation in the first trimester, the poor attendance rates through delivery indicates missed opportunities for GDM screening, diagnosis and management. Additionally, we have poor follow-up in the postpartum period that may lead to a second lost opportunity to determine whether the GDM mother has reverted to a normal blood glucose level or transitioned into diabetes. Poor screening rates also point to making that difficult-to-diagnose pregnant woman with pre-existing diabetes even more difficult to find.

Further, almost 20 percent reported smoking at least 100 cigarettes within two years of pregnancy and 16 percent of those smokers reported smoking during the last trimester of their pregnancy with 12 percent reporting smoking at least one cigarette per day in the last trimester per the CNMI Pregnancy Risk Assessment Monitoring System (PRAMS) interviews for the same year.<sup>19</sup>

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<sup>15</sup> National Center for Health Statistics. Table 7. Prenatal care for live births, by detailed race and Hispanic origin of mother: United States, selected years 1970–2004. Accessed via Internet at [http://www.cdc.gov/nchs/data/07.pdf#007](http://www.cdc.gov/nchs/data/hus/07.pdf#007) on 12/26/2008.

<sup>16</sup> Grant, Jeanolivia, MD, MPH. Assessment of Prenatal Care at Commonwealth Health Center. 2008.

<sup>17</sup> Taitano, Genia, MPH-candidate. Gestational Diabetes Mellitus (GDM) in the CNMI, 2005-2007. A case-control study. 2008.

<sup>18</sup> Department of Public Health, Dietetics Division, Gestational Diabetes data, 2007-2008.

<sup>19</sup> Department of Public Health. Pregnancy Risk Assessment Monitoring System Report. 2007.

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## **Breastfeeding**

In one study examining breastfeeding practices in the CNMI, 75% of the study children had been breastfed, 53% were still breastfeeding at six months and 22% at one year of age. Fifty-six percent (230/413) had introduced complementary foods before six months. Breastfeeding is negatively associated with child BMI which means it has a protective effect for childhood obesity. It is recommended that all babies are fed breast milk exclusively for the first 6 months of life. In the CNMI, this only happens 53% of the time.<sup>20</sup>

Figure 4. Breastfeeding and Complementary Feeding Practices

	<b>≤ 2 months</b>	<b>3 – 6 months</b>	<b>&gt; 6 months</b>	<b>7 – 12 months</b>	<b>&gt;12 months</b>
Duration of breast feeding (n=302)	25%	28%		25%	22%
Duration of Exclusive breast feeding (n=287)	46%	45%	9%		
Age at which complementary food was introduced (n=413)	8%	47%		41%	2%

Source: Novotny et al., Breastfeeding

## **Diet and Nutrition in our Children**

In older children the intake of fruits and vegetables are well below recommended intakes, with children consuming less than one serving of fruit daily, compared to the recommended two servings and only one of the three recommended vegetable servings.<sup>21</sup> This trend continues as the children get older.

<sup>20</sup> Novotny, R, PhD, RD; Coleman, P.; Tenorio, L.; Davison, N., MSc; Camacho, T.; Ramirez, V, MA; Vijayadeva, V, MBBS, MPH; Untalan, P., MHA; Tudela, M.D. Breastfeeding is associated with lower body mass index among children of the Northern Mariana Islands. J Am Diet Assoc. 2007; 107:1743-1746.

<sup>21</sup> Novotny, R. University of Hawaii, Northern Marianas College, Dept. Public Health CNMI: Dietary characteristics of children in the CNMI. Final Report. Unpublished. July 31, 2007.

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Figure 5. Food group intake of children 4 yr - 6 yr ( $\geq 4\text{yr} - <7\text{yr}$ )

Food Group	Unit	Mean	Standard deviation	Recommendations (daily)
<b>Discretionary fat</b>	g/day	<b>45</b>	$\pm 27$	Choose lower fat options
<b>Dairy total</b>	Servings/day	<b>0.8</b>	$\pm 1.0$	2 servings
<b>Fruits total</b>	Servings/day	<b>0.6</b>	$\pm 1.7$	2.3 servings
<b>Grains total</b>	Servings/day	<b>5.2</b>	$\pm 2.5$	7 servings
<b>Meat, Poultry, Fish, Beans, Eggs &amp; Nuts total</b>	Ounce/day	<b>5.5</b>	$\pm 2.9$	2.1 servings <sup>†</sup>
<b>Vegetables total</b>	Servings/day	<b>1.0</b>	$\pm 1.2$	3.3 servings

\* for children 4-6 years, based on a recommended energy intake of 1800 kcal

† one serving of meat equals 2.5 ounces of lean meat/fish/poultry

Source: Novotny, Dietary Characteristics

Figure 6. Food Group Intake of children 7 yrs and over ( $\geq 7\text{yr}$ )

Food Group	Unit	Mean	Standard deviation	Recommendations (daily)
<b>Discretionary fat</b>	g/day	<b>49</b>	$\pm 35$	Choose lower fat options
<b>Dairy total</b>	Servings/day	<b>0.7</b>	$\pm 0.8$	2 servings
<b>Fruits total</b>	Servings/day	<b>0.9</b>	$\pm 1.9$	2.7 servings
<b>Grains total</b>	Servings/day	<b>7.1</b>	$\pm 4.3$	7.8 servings
<b>Meat, Poultry, Fish total</b>	Ounce/day	<b>6.4</b>	$\pm 4.0$	2.3 servings <sup>†</sup>
<b>Vegetables total</b>	Servings/day	<b>1.0</b>	$\pm 1.3$	3.7 servings

\* for children 7-10 years, based on a recommended energy intake of 2000 kcal

† one serving of meat equals 2.5 ounces of lean meat/fish/poultry

Source: Novotny, Dietary Characteristics

For all age groups the increased consumption of protein is closely associated with increases in fat and sodium. This is indicative of the high intake of processed meats which contain high protein, fat and sodium levels. It has been shown that in children with similar diets, fatty streaks the early precursor to atherosclerotic disease, can be demonstrated grossly in children at autopsy.<sup>22</sup>

Although factors leading to this dietary change have not been studied it more than likely is driven by the ready availability of processed meats at a cheaper price than fresh fruits and vegetables. A more traditional diet with fresh fish as a protein source, or fresh meat with no added fat or sodium,

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<sup>22</sup>Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*. 1999;103 :1175 –1182

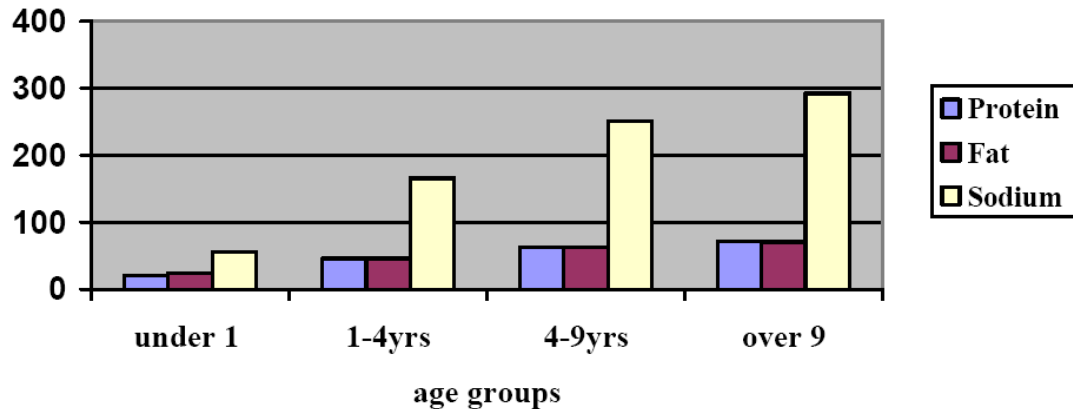


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would not result in such a large increase in fat and sodium intakes with the increased protein intake as shown in the graph below.

Figure 7. Protein, fat and sodium intake per childhood age group.

**g of protein & fat,  
mg sodium (x10)**



Source: Novotny, Dietary Characteristics

Results from analysis of diets of children in CNMI between 2 years and 10 years old shows that, 2% of the children had diets classified as "Good" (HEI score greater than 80), 54% had diets that were classified as "Needs Improvement" (HEI score between 51 and 80) and 44% of the children had diets that were classified as "Poor" (HEI score less than 51). The mean overall (total) HEI score was 56.4 and the median HEI score was 57.6, which indicates that on average, diets of children in the CNMI need improvement, and many diets are poor.<sup>23</sup>

<sup>23</sup> Novotny, R. University of Hawaii, Northern Marianas College, Dept. Public Health CNMI: Dietary characteristics of Children in the CNMI. Final Report July 31, 2007.

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Figure 8.

**Healthy Eating Index Rating for CNMI Children, 2005**

**Healthy Eating Index rating, U.S. population, 1999-2000**



The **HEALTHY EATING INDEX (HEI)** consists of 10 components, each representing different aspects of a healthful diet: Components 1-5 measure the degree to which a person’s diet conforms to serving recommendations for the five major food groups of the Food Guide Pyramid (grains, vegetables, fruits, milk, and meat); Components 6 and 7 measure total fat and saturated fat consumption, respectively, as a percentage of total food energy intake; Components 8 and 9 measure total cholesterol and sodium intake; and Component 10 examines variety in a person’s diet. The maximum overall score for the 10 components combined is 100. An HEI score over 80 implies a “good” diet, an HEI score between 51 and 80 implies a diet that “needs improvement,” and an HEI score less than 51 implies a “poor” diet. The Healthy Eating Index measures overall diet quality but does not necessarily reflect over consumption.

Compared to children in the CNMI, more people in the U.S. are eating a ‘good’ diet, a larger proportion of the U.S. population has diets that ‘need improvement’ but fewer have a ‘poor’ diet compared to children in the CNMI.<sup>24</sup>

## Obesity among our Children

Results of inadequate breastfeeding and poor diets high in protein and fat, low in fruits and vegetables is reflected in the BMI of our children. Childhood obesity is putting the future of our children’s health at risk as discussed below.

Figure 9. Summary of BMI according to CDC and WHO-IOTF cutoffs

	<b>BMI for age based on CDC cutoffs</b>	<b>BMI for age based on IOTF cutoffs</b>
Overweight	15%	18%
Obese	19%	14%

Source: International Obesity Task Force (IOTF), Centers for Disease Control and Prevention (CDC)

<sup>24</sup> Ibid.

# Tobacco Control, Diabetes Prevention & Control and BRFSS

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Overweight children are at higher risk for developing non-communicable diseases in the future. A cohort study of 16000 children in Bogalusa, Louisiana<sup>25</sup> showed that obese children frequently remain obese through adulthood<sup>26</sup> and identified a number of significant long-term consequences of childhood obesity for cardiovascular health.<sup>27,28</sup>

## **Physical Activity in our Children**

In addition to our high rate of overweight children we also have a low rate of physical activity among our children. According to the American Heart Association, physical inactivity is a major risk factor for developing coronary artery disease.

Overweight and obesity, influenced by physical inactivity and poor diet, are significantly associated with an increased risk of diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status.<sup>29</sup> Physical inactivity increases the risk of dying prematurely, dying of heart disease, and developing diabetes, colon cancer, and high blood pressure.<sup>30</sup>

Novotny reports that 17 % of children did not engage in any physical activity, whether at school or outside of school. Forty-seven percent (47%) of children were active on only one to three days per week.<sup>31</sup>

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<sup>25</sup> National Heart Lung and Blood Institute. The Bogalusa Heart Study. Available at: [www.nhlbi.nih.gov/resources/deca/descriptions/bhs.htm](http://www.nhlbi.nih.gov/resources/deca/descriptions/bhs.htm).

<sup>26</sup> Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. *Pediatrics*. 2005;115 :22 –27.

<sup>27</sup> Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*. 1999;103 :1175 –1182.

<sup>28</sup> The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*. 1999;103 :1175 –1182.

<sup>29</sup> Mokdad AH, Ford ES, Bowman BA, et al. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Journal of the American Medical Association* 2003;289(1):76-79.

<sup>30</sup> U.S. Department of Health and Human Services. *Physical activity guidelines advisory committee report*. Washington, DC: U.S. Department of Health and Human Services, 2008.

<sup>31</sup> Novotny, R. University of Hawaii, Northern Marianas College, Dept. Public Health CNMI: Dietary characteristics of Children in the CNMI. Final Report. Unpublished. July 31, 2007.

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Figure 10. Number of days children 5-10 years old engaged in any physical activity (in school or outside school)

Days children engaged in physical activity	Number of children	Percent %
None	34	16.7
1	41	20.2
2	37	18.2
3	17	8.4
4	3	1.5
5	50	24.6
Don't know	21	10.3
Total	203	-

Watching television and lack of physical education have been linked to childhood obesity. A recent article on preschool children, physical activity and obesity concluded that watching more than two hours per day of television or videos in US preschool-age children was associated with a higher risk of being overweight or at risk for overweight and higher adiposity.<sup>32</sup> These findings support the national guidelines to limit preschool children's media use. According to our 2007 Youth Risk Behavior Survey, the amount of time spent watching television puts our children at risk (see below).

In addition, the school setting offers multiple opportunities for students to enjoy physical activity outside of physical education class, including recess periods for unstructured play in elementary schools, after-school programs, intramural sports programs, and physical activity clubs. But more could be done with our school-based physical education programs as the statistics from our 2007 Youth Risk Behavior Survey (YRBSS) points out:

In the CNMI middle school 2007 YRBS:

- 34% watched three or more hours per day of TV on an average school day

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<sup>32</sup> *International Journal of Behavioral Nutrition and Physical Activity* 2007, 4:44doi:10.1186/1479-5868-4-44

# Tobacco Control, Diabetes Prevention & Control and BRFSS

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- 59% attended physical education (PE) classes one or more days during an average school week

In the CNMI high school 2007 YRBS:

- 32% watched three or more hours per day of TV on an average school day
- 44% attended physical education (PE) classes on one or more days in an average week when they were in school

(Source: 2007 CNMI Youth Risk Behavior Survey Report)

## **Socioeconomic Status**

In the CNMI:

- 47.3% of families lived below the poverty level.
- The median family income is only \$19,600.
- 20% have not graduated from high school.
- Of the estimated total 16 years and older persons in 2005, 79% were in the labor force.<sup>33</sup>

The low socioeconomic status (SES) of most of our inhabitants has been shown to be a factor in the prevalence of multiple risk factors for chronic diseases. The following have been shown through BRFSS to confer an increased risk:

- Education with less than a high school diploma (or equivalent) with more education showing a decreased risk
- Household income with fewer risk factors as income increased
- Employment (retirement) status with the lowest prevalence among employed persons.<sup>34</sup>

The rate of poverty is not only a risk factor for development of the chronic diseases of hypertension and diabetes it also makes it more difficult to treat and monitor these patients.

Socioeconomic characteristics and the availability of resources influence health behaviors and the

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<sup>33</sup> CNMI Department of Commerce, Central Statistics Division. 2005 HIES Report. Saipan: 2008

<sup>34</sup> MMWR February 11, 2005 / 54(05);113-117A Prospective Study of Childhood and Adult Socioeconomic Status and Incidence of Type 2 Diabetes in Women. *American Journal of Epidemiology*. 2007; 165(8):882-889

# Tobacco Control, Diabetes Prevention & Control and BRFSS

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development of disease above and beyond an individual's SES.<sup>35</sup> In particular, disadvantaged neighborhoods appear to confer a higher risk of coronary heart disease<sup>36</sup> and undesirable aspects of the environment could also inhibit individuals from engaging in healthy behaviors that contribute to the risk of chronic disease.<sup>37</sup>

In women, a study indicates that women with lower childhood or adult SES have an increased risk of developing type 2 diabetes. It has also been shown that lower childhood or adult socioeconomic status confers an increased risk of developing type 2 diabetes.<sup>38</sup> In a recent review article<sup>39</sup> that highlighted the significance of SES in the development of diabetes as well as its affect on obtaining appropriate diabetes care to prevent the development of diabetes complications, the impact of SES was found to be extremely important even after the development of type 2 diabetes. Other studies suggest that socio-economic and family needs must be addressed before patients can attempt traditional diabetes self-management.<sup>40, 41</sup>

## **From Childhood to Adulthood**

There is a continuum of increasing risk factors for non-communicable diseases, including diabetes, as the population ages. Specifically, the risk factors we're most concerned about are obesity, physical activity and tobacco use.

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<sup>35</sup> Batts ML, Gary TL, Huss K, Hill MN, Bone L, Brancati FL. Patient priorities and needs for diabetes care among urban African American adults. *Diabetes Educ* 2001;27:405–12.

<sup>36</sup> Diez Roux AV. Investigating neighborhood and area effects on health. *Am J Public Health* 2001;91:1783–89.

<sup>37</sup> Diez Roux AV, Merkin SS, Arnett D *et al*. Neighborhood of residence and incidence of coronary heart disease. *N Engl J Med* 2001;345:99–106.

<sup>38</sup> A Prospective Study of Childhood and Adult Socioeconomic Status and Incidence of Type 2 Diabetes in Women. *American Journal of Epidemiology*. 2007; 165(8):882-889

<sup>39</sup> Ibid.

<sup>40</sup> Brown AF, Ettner SL, Piette J *et al*. Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. *Epidemiol Rev* 2004;26:63–77.

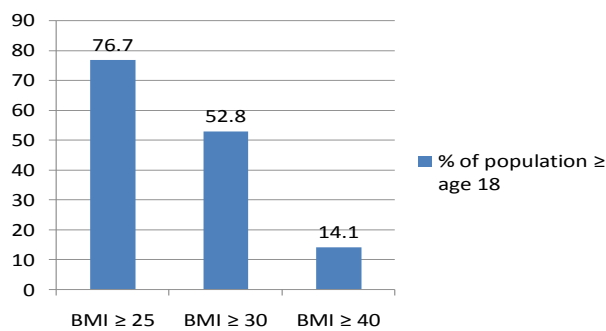
<sup>41</sup> Batts ML, Gary TL, Huss K, Hill MN, Bone L, Brancati FL. Patient priorities and needs for diabetes care among urban African American adults. *Diabetes Educ* 2001;27:405–12.

## Obesity in Adults

Obesity, due to poor nutrition and lack of physical activity, is a major contributor to myocardial infarction, stroke, type 2 diabetes and an increase in overall mortality. The CNMI, like many islands in the Pacific, has a very high rate of overweight and obesity in the adult population:

Figure 11. Prevalence of Overweight and Obese

## Prevalence of Overweight and Obese

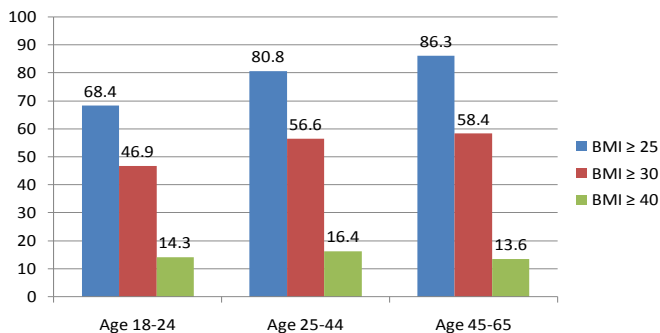


Source: Tanapag Study 2001

The BMI in the adult population increases as the cohort ages.

Figure 12.

## Increasing Prevalence of Overweight and Obesity with Age



Source: Tanapag Study 2001

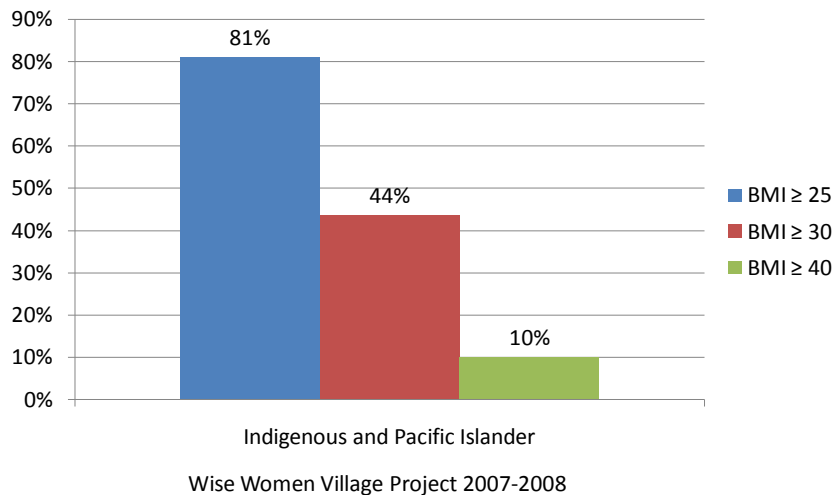
# Tobacco Control, Diabetes Prevention & Control and BRFSS

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The Wise Women Village Project, which screened women on all three inhabited islands, Rota, Tinian and Saipan, also found a high rate of overweight and obese women:

Figure 13.

## Prevalence of Overweight and Obese Women Aged 24-65



To combat the epidemic of obesity in the CNMI, we need to improve the diet, as mentioned earlier, as well as increasing the level of physical activity. Increasing physical activity has consistently been shown to decrease the level of obesity and type 2 diabetes.

### Physical Activity in Adults

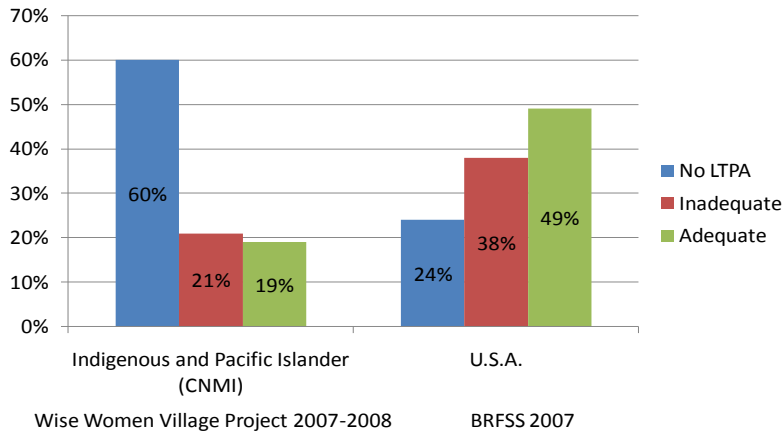
Currently, the level of physical activity is extremely low. Through the Wise Women Village Project we were able to determine the level of physical activity using standardized BRFSS questions:

Sixty percent (60%) of the respondents stated that they do not engage in any Leisure Time Physical Activity (LTPA). This is compared to 24% in the United States. Also, the proportion of the indigenous CNMI population that engages in adequate LTPA is very low at 19% compared to the US rate of 49%.



Figure 14.

## Adult Physical Activity CNMI vs. U.S.



Source: <http://apps.nccd.cdc.gov/PASurveillance/StateSumV.asp>  
MMWR Weekly: **November 23, 2007 / 56(46); 1209-1212**

### Tobacco Use in Children and Adults

Tobacco use is the single most preventable cause of death and disease in the United States. People begin using tobacco in early adolescence; almost all first use occurs before age 18.<sup>42</sup> The CNMI has also become part of the tobacco use epidemic. Here tobacco use also begins at an early age. According to our 2007 YRBS:

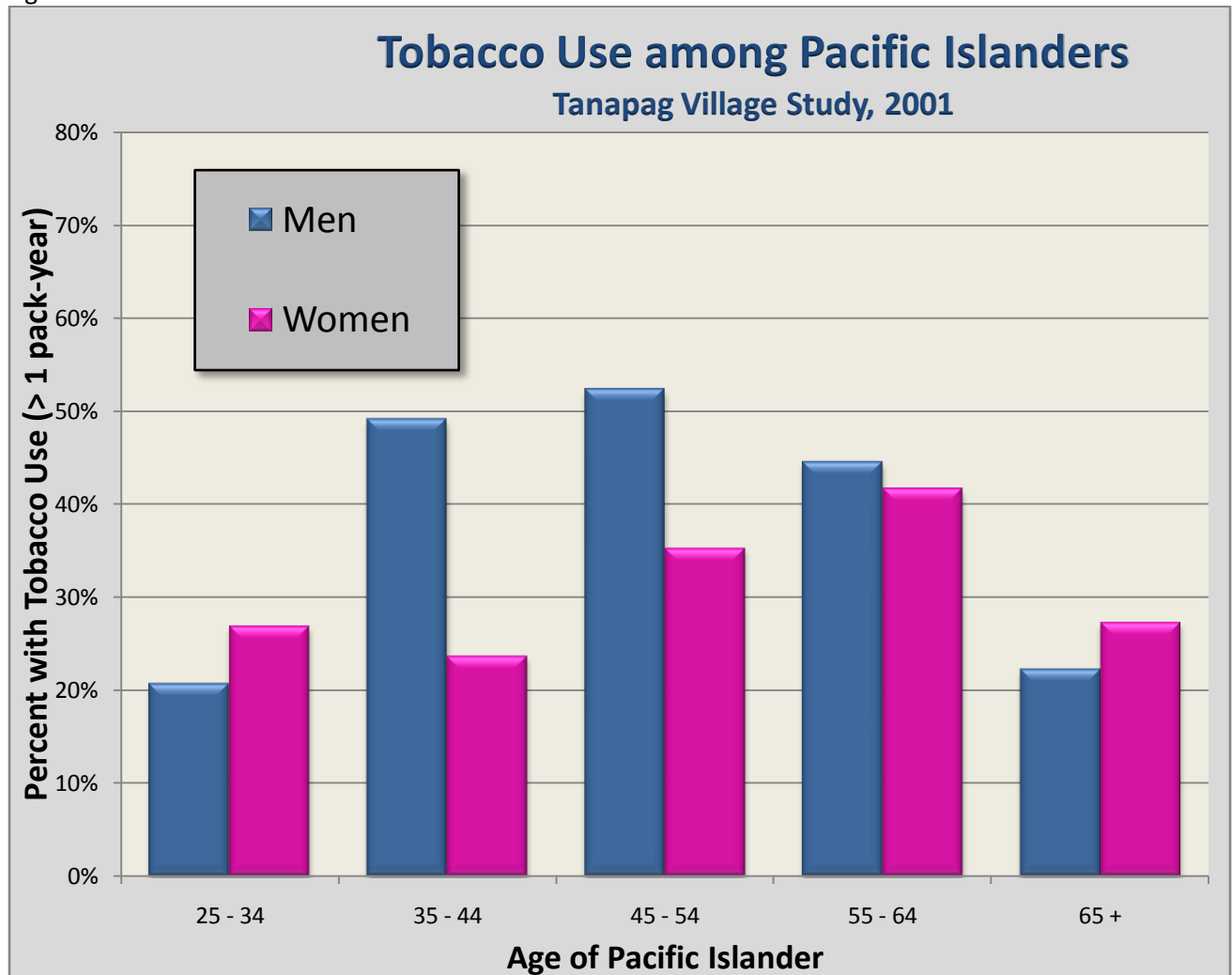
- 12% of 6<sup>th</sup> graders smoked cigarettes on one or more of the past 30 days
- 20% of 7<sup>th</sup> graders smoked cigarettes on one or more of the past 30 days
- 23% of 8<sup>th</sup> and 9<sup>th</sup> graders smoked cigarettes on one or more of the past 30 days
- 30% of 10<sup>th</sup> graders smoked cigarettes on one or more of the past 30 days
- 37% of 11<sup>th</sup> graders smoked cigarettes on one or more of the past 30 days
- And by 12<sup>th</sup> grade over 40% of the students have recently smoked cigarettes.
  
- 29% of these students smoked their first cigarette before the age of 13!

<sup>42</sup> Centers for Disease Control and Prevention. *Best Practices for Comprehensive Tobacco Control Programs—2007*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; October 2007.

## Tobacco Control, Diabetes Prevention & Control and BRFSS

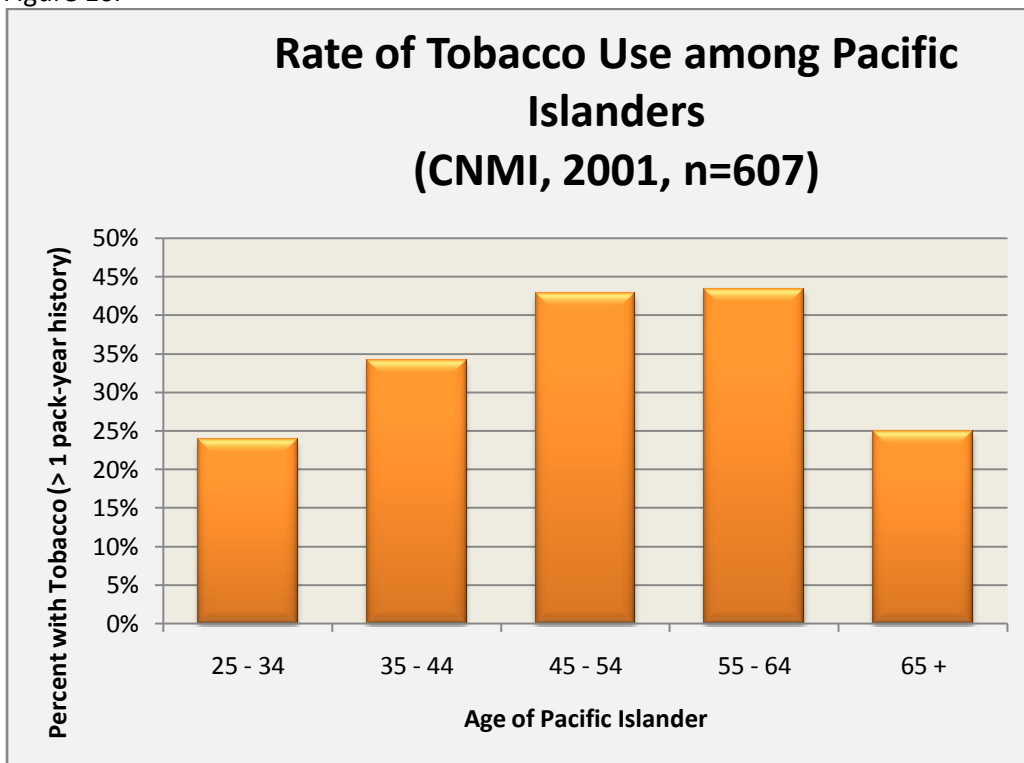
The risks of tobacco use are well known and the benefits from tobacco cessation have shown a reversal in cancer rates and cardiovascular disease. Despite this knowledge, the prevalence of tobacco use among the adult population is also high.<sup>43</sup>

Figure 15.



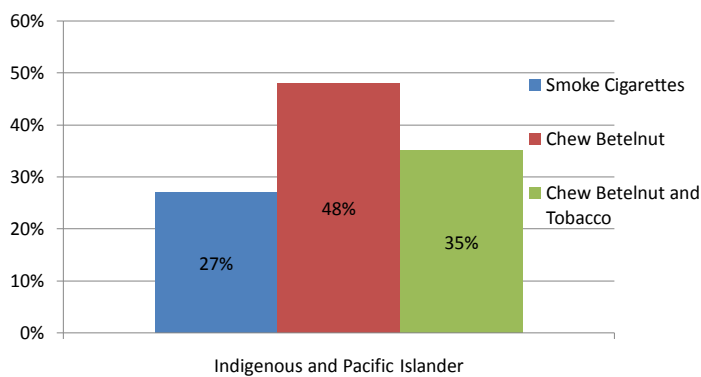
<sup>43</sup> Tanapag Village Survey 2001

Figure 16.



Source: Tanapag study, 2001.

### Tobacco and Betelnut Use



Source: Wise Women Village Project 2007-2008  
Figure 17

# Tobacco Control, Diabetes Prevention & Control and BRFSS

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Betelnut is often combined with oral tobacco - this not only increases the incidence of oral cancers, but has also been associated with an increase in the incidence of type 2 diabetes.<sup>44, 45</sup>

## NCDs in the CNMI

Because of our high prevalence of risk factors for hypertension, diabetes and cardiovascular disease it should come as no surprise that our prevalence of these diseases in the CNMI is also high. Together these diseases, along with tobacco use, are associated with the top four causes of death in the CNMI.

## Top 5 Causes of Death in the CNMI 2003-2005

Cause of Death	2003	2004	2005
<b>Total</b>	<b>144</b>	<b>164</b>	<b>183</b>
1. Heart Disease	19	27	36
2. Cancer	19	21	22
3. Stroke	17	15	23
4. Kidney Disease	13	10	18
5. Infection	13	18	12

#1, #3 and #4 are related to hypertension and diabetes

Source: Health and Vital Statistics Office, Division of Public Health, 2008  
Figure 18.

But these NCDs are also responsible for much of the morbidity and health care costs in the CNMI. It has been shown that 70% of the patients admitted to the medical and surgical wards at the Commonwealth Health Center, carry the diagnosis of diabetes. We also have 110 patients with end

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<sup>44</sup> Benjamin, A.L. Community screening for diabetes in the National Capital District, PNG: Is belanut chewing a risk factor for diabetes? *Papua New Guinea Medical Journal*, 2001; 44: 3-4, 101-107.

<sup>45</sup> Tung, T.H., Chiu, Y.H., Chen, L.S., Wu, H.M., Boucher, B.J., Chen, T.H. A population-based study of the association between areca nut chewing and type 2 diabetes mellitus in men (Keelung Community-based Integrated Screening programme No. 2). *Diabetologia*, 2004; 47: 10, 1776-1781.

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stage renal disease who are on dialysis. The primary diagnosis for 70% of those patients is type 2 diabetes. This high rate contrasts sharply with the reported prevalence in the United States of 32.1%. The disproportionate burden that diabetes contributes to the morbidity in the CNMI is partially explained by our prevalence of diabetes which is among the highest in the world, up to 40% in our older age group.

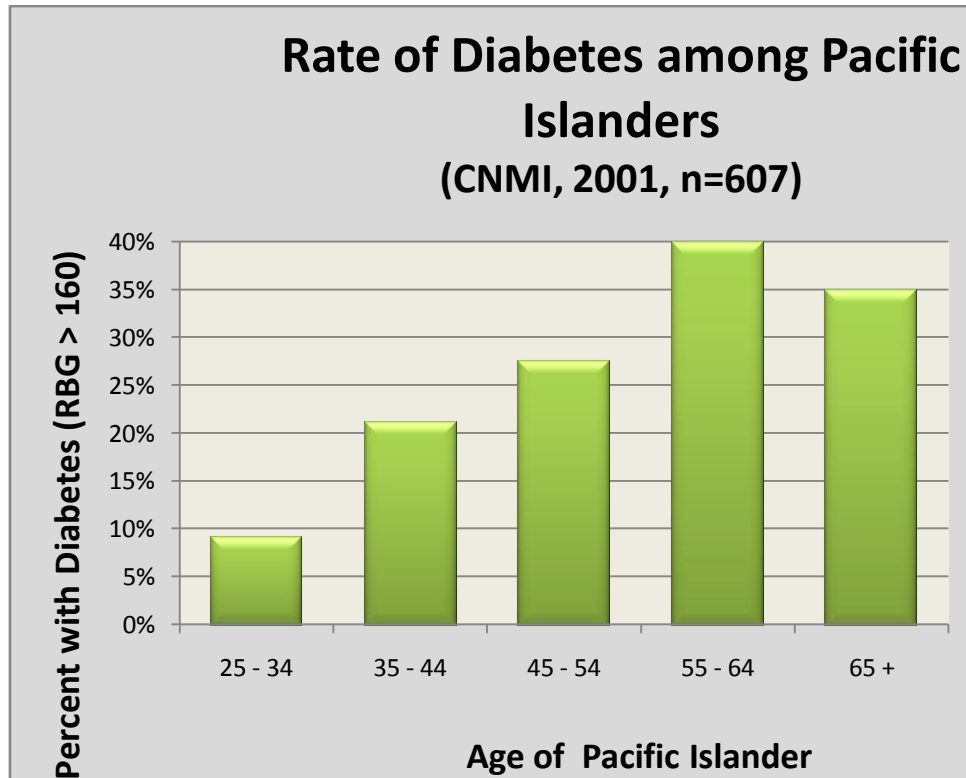


Figure 19. Source: Tanapag study, 2001.

Much emphasis in the past has been placed on increasing physical activity to reduce the consequences of diagnosed type 2 diabetes and improve glycemic control. A recent literature review on chronic disease concluded that "... physical activity improves cardiac function, reduces blood pressure, creates insulin sensitivity, and reduces total fat and abdominal fat, thus addressing the metabolic syndrome including "pre-diabetes and pre-hypertension." <sup>46</sup>

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<sup>46</sup> Literature Review on Diabetes, Diabetes Risk Factors, and the National Public Health Initiative on Diabetes and Women, December 2005, retrieved from [www.chronicdiseases.org](http://www.chronicdiseases.org) on 12/24/2008.

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The Finnish Diabetes Prevention Study and the Diabetes Prevention Program both found that increased leisure time physical activity reduces the risk of type 2 diabetes with impaired glucose tolerance.<sup>47</sup> Focus on physical activity and diet can decrease diabetes by 32-58%. The results of these trials are striking and tell health care professionals and the public that diet, exercise, and changing behaviors can reduce the risk.<sup>48</sup>

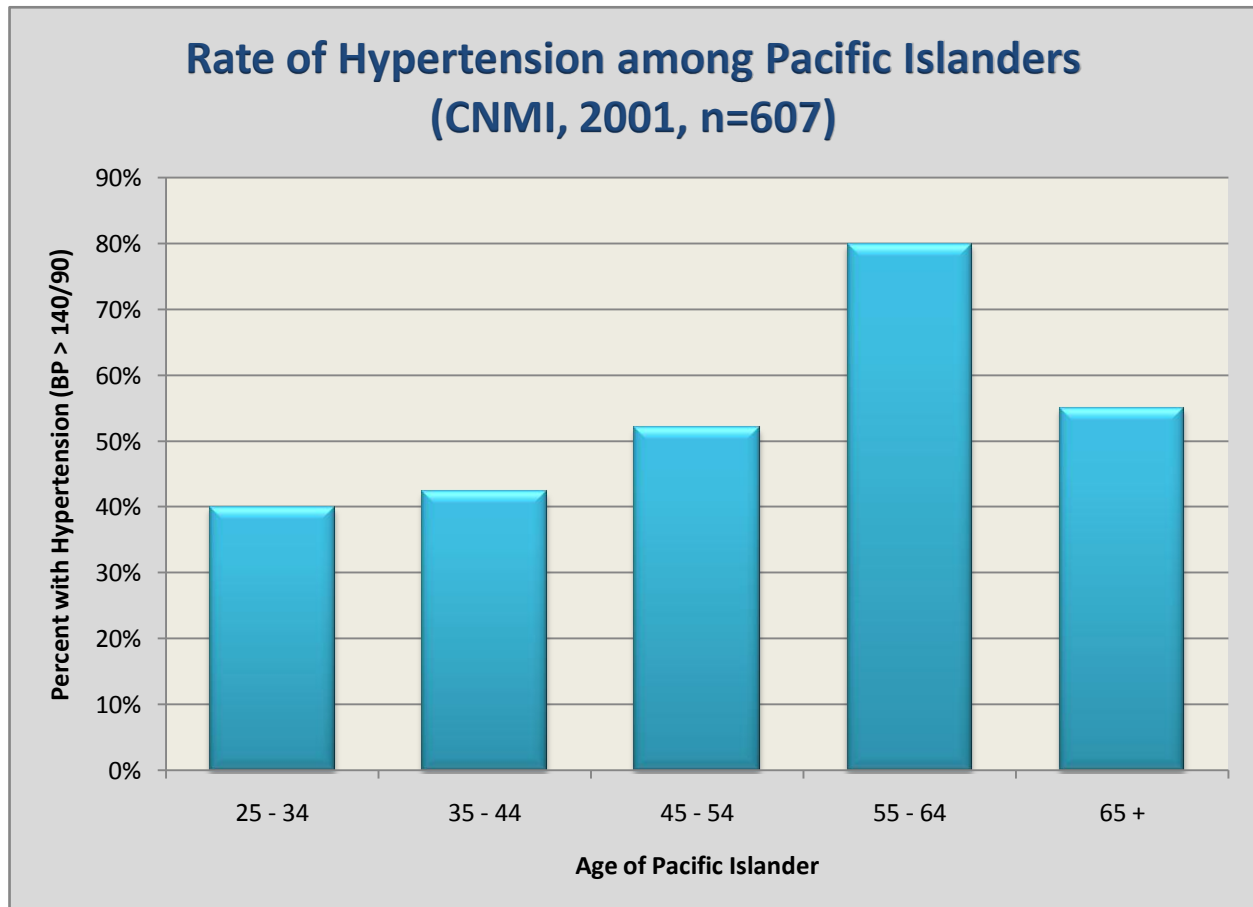


Figure 20. Source: Tanapag study, 2001

Adoption of healthy lifestyles by all persons is critical for the prevention of high BP and is an indispensable part of the management of those with hypertension. Major lifestyle modifications shown

<sup>47</sup> Ibid.

<sup>48</sup> Ibid.

## Tobacco Control, Diabetes Prevention & Control and BRFSS

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to lower blood pressure include weight reduction in those individuals who are overweight or obese,<sup>49, 50</sup> adoption of the Dietary Approaches to Stop Hypertension (DASH) eating plan which is rich in potassium and calcium, dietary sodium reduction,<sup>51, 52, 53</sup> physical activity,<sup>54,55</sup> and moderation of alcohol consumption.<sup>56</sup> Lifestyle modifications reduce blood pressure, enhance antihypertensive drug efficacy, and decrease cardiovascular risk. For example, a 1,600 mg sodium DASH eating plan has effects similar to single drug therapy. Combinations of two (or more) lifestyle modifications can achieve even better results.

In general, the treatment of hypertension is similar for all demographic groups, but socioeconomic factors and lifestyle may be important barriers to blood pressure control in some minority patients. In the CNMI, access to health care and the cost of medicines prevent many from achieving recommended blood pressure control.

Public health approaches, such as reducing calories, saturated fat, and salt in processed foods and increasing community/school opportunities for physical activity can potentially reduce the morbidity, mortality, and the lifetime risk of an individual's becoming hypertensive. These public health approaches can provide an attractive opportunity to interrupt and prevent the continuing costly cycle of

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<sup>49</sup> The Trials of Hypertension Prevention Collaborative Research Group. Effects of weight loss and sodium reduction intervention on blood pressure and hypertension incidence in overweight people with high-normal blood pressure. The Trials of Hypertension Prevention, phase II. *Arch Intern Med.* 1997;157:657-67.

<sup>50</sup> J, Whelton PK, Appel LJ, Charleston J, Klag MJ. Long-term effects of weight loss and dietary sodium reduction on incidence of hypertension. *Hypertension.* 2000;35:544-9.

<sup>51</sup> Sacks FM, Svetkey LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med.* 2001;344:3-10.

<sup>52</sup> Vollmer WM, Sacks FM, Ard J, et al. Effects of diet and sodium intake on blood pressure: Subgroup analysis of the DASH-sodium trial. *Ann Intern Med.* 2001;135:1019-28.

<sup>53</sup> Chobanian AV, Hill M. National Heart, Lung, and Blood Institute Workshop on Sodium and Blood Pressure: A critical review of current scientific evidence. *Hypertension.* 2000;35:858-63.

<sup>54</sup> Kelley, GA, Kelley, KS. Progressive resistance exercise and resting blood pressure: A meta-analysis of randomized controlled trials. *Hypertension.* 2000;35:838-43.

<sup>55</sup> Whelton SP, Chin A, Xin X, He J. Effect of aerobic exercise on blood pressure: A meta-analysis of randomized, controlled trials. *Ann Intern Med.* 2002;136:493-503.

<sup>56</sup> Kelley et al.

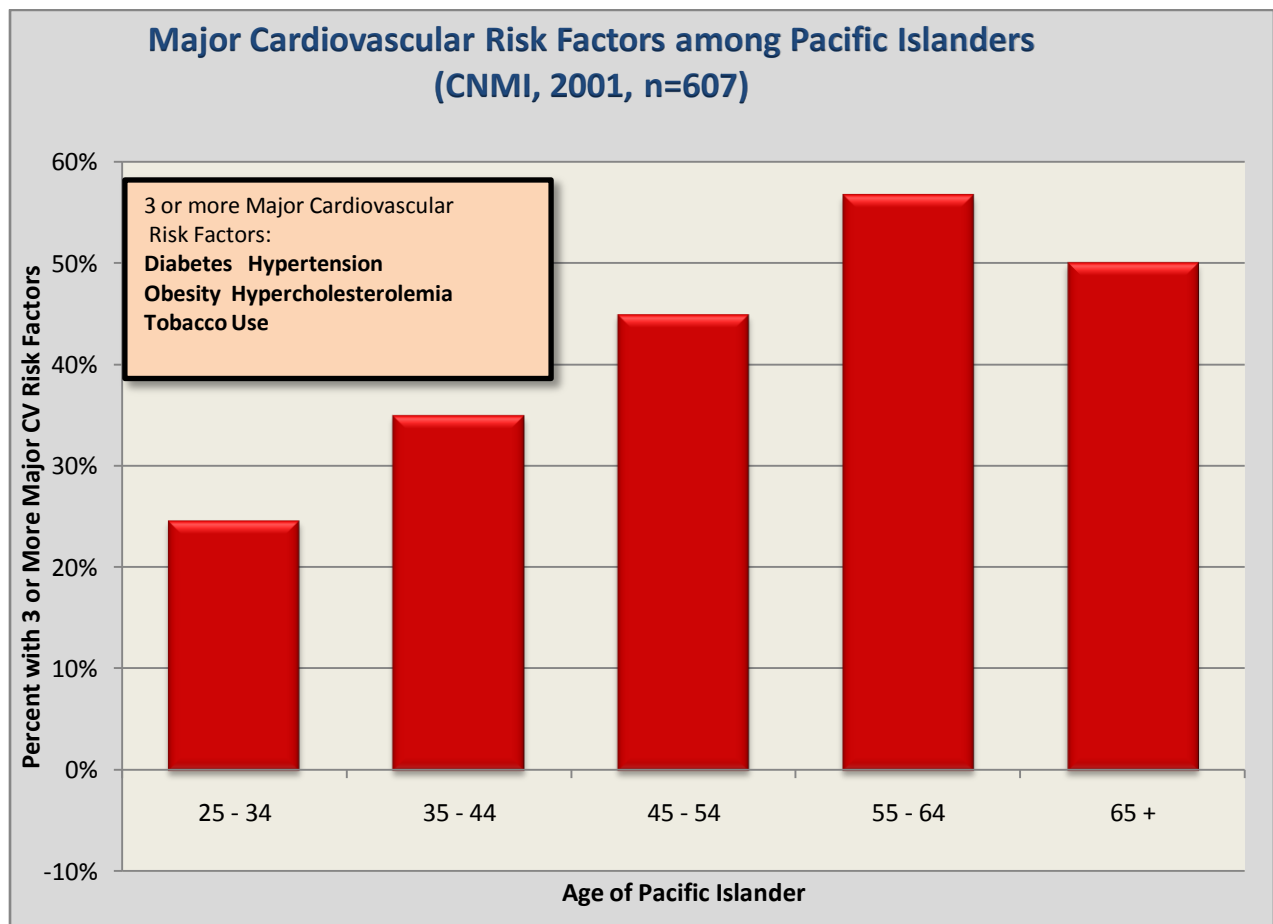
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managing hypertension and its complication. Given the healthcare limitations we have in the CNMI and the level of poverty this needs to be a focus now to have a significant effect in the future.

## Risk factors for Cardiovascular disease

Both hypertension and diabetes are independent risk factors for cardiovascular disease. With our high prevalence of both of these chronic diseases, along with our high prevalence of obesity and tobacco use, it can be assumed that our risk of cardiovascular disease is also high. The Tanapag data shows the prevalence of adults who have 3 or more risk factors for cardiovascular disease.

Figure 21.





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There is no easy solution to this dilemma and, in fact, it will take a good deal of effort to simply slow the progression of morbidity and mortality due to these conditions. We must start our prevention efforts with our children while getting the message to the adults. We must develop a better system to detect, treat and monitor patients with these chronic conditions. We must consider the impact of poverty (access to care, insurance coverage, ability to buy medication) and address disparities.

Our chronic disease programs, such as DPCP and TCP, must collaborate with other programs to address diseases for which tobacco, obesity and lack of physical activity plays a major role, such as cancer, heart disease and stroke, and end stage renal disease. This collaboration will be beneficial in three ways:

- To alleviate the existing burden of disease from tobacco and diabetes.
- Incorporation of tobacco prevention and cessation messages into broader public health activities ensuring wider dissemination of tobacco control strategies.
- Finally, tobacco use in conjunction with other diseases and risk factors, such as sedentary lifestyle, poor diet, and diabetes, poses a greater combined risk for many chronic diseases than the sum of each individual degree of risk. Collaboration in these areas has the potential to synergistically increase the success of our efforts.