Current status of research on diabetes mellitus and associated risk factors in Native Hawai'ians

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Introduction

Kanaka maoli, the indigenous people of Hawai'i, comprise the single largest ethnic group of Pacific Islanders and are one of the last native populations to be recognized in the U.S.[1]. Earlier publications of diabetes in Hawai'i have reported rates of diabetes 4 to 7 fold higher in Hawai'ians (pure and part) than Caucasians and consistently showed higher rates of obesity and other associated risk factors among Native Hawai'ians [2, 3, 4]. Although these alarming health statistics were reported as early as the 1950s, few studies have provided further data on the current rates of diabetes prevalence and its risk factors. Thus, little scientific data are currently available on the impact of diabetes on the overall health status of the Native Hawai'ian population and the appropriate means to decrease or control this health burden.

This article aims to 1) review recent investigations on the prevalence of diabetes and associated risk factors in Native Hawai'ians, 2) describe current research projects aimed at controlling or preventing diabetes in Native Hawai'ians and 3) outline potential areas of future research to improve the health of Native Hawai'ians with or at-risk for diabetes mellitus (DM).

Review of diabetes and associated risk factors in Native Hawai'ians

The Native Hawai'ian Health Research (NHHR) Project, an ongoing National Institutes of Health (NIH)-funded epidemiological study, was initiated in 1991 to determine diabetes and heart disease risk factors in Native Hawai'ians. In conducting the NHHR Project, University of Hawai'i researchers partnered with existing Native Hawai'ian Health Care organizations such as *Papa Ola Lokahi* (the administrative arm), and the two study communities, *Hui Malama Ola Na 'Oiwi* of North Kohala on the island of Hawai'i and *Ho'ola Lahui Hawai'i* of west Kaua'i. A total of approximately 1100 Native Hawai'ian adults, 30 years old or older, were identified in both communities via door-to-door census. Five hundred seventy four, representing 53% of eligible Native Hawai'ians from both communities volunteered to participate in a three to four hour examination performed by trained community staff members at the research clinic on-site. Research methods and procedures used in the NHHR Project have been described previously [5-7]. Briefly, glucose tolerance status was determined by a standard 2-hour oral glucose tolerance test using World Health Organization (WHO) criteria for the diagnosis of diabetes mellitus and impaired glucose tolerance (IGT)[8].

Based on data collected from the NHHR Project, we found the overall prevalence of DM in Native Hawai'ians ≥30 years old to be 22.4%. The overall prevalence of impaired glucose tolerance was 15.6% and although prevalence of IGT was no different between communities, the rate was significantly higher in women than in men (see Figure 1). By comparison, the prevalence of DM and IGT in the U.S. population was 7.8% and 7-15%, respectively[9]. Thus, Native Hawai'ians have a DM prevalence nearly 3 fold higher than the general U.S. population and similar or higher rates of IGT. Among Native Hawai'ians, the prevalence of glucose intolerance (DM and IGT) increased with advancing age and was consistent with similar trends observed in other minority and Caucasian populations (see Figure 2).

The prevalence of overweight [Body Mass Index (BMI) ≥27.5 kg/m^2] and central adiposity [waist-hip ratio (WHR) ≥0.9 for men, and ≥0.8 for women] was also high when compared to the U.S. general population and was consistent with previous reports in Native Hawai'ian adults on the island of Moloka'i [2]. Hypertension (blood pressure ≥ 140 systolic and/or ≥ 90 diastolic) was detected in approximately 40% of participants, and abnormal lipid levels (total cholesterol ≥ 200 mg/dL, or TG ≥ 200 mg/dL, or HDL ≤ 35 mg/dL) were measured in 70 percent of participants. We also examined the relationship between the clustering of hypertension, central adiposity, dyslipidemia, and glucose intolerance in association with fasting insulin levels as a proxy for insulin resistance. We found the incremental clustering of these cardiovascular risk factors to be associated with fasting hyperinsulinemia, thus providing the first epidemiological data to support the existence of the insulin resistance syndrome (IRS) among Native Hawai'ians. Similar to other minority populations at-risk for DM, the importance of the

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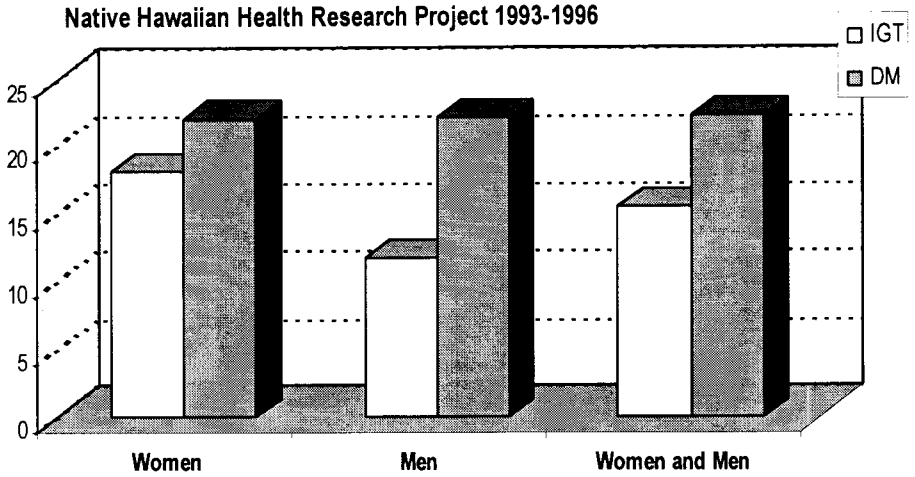
Figure 1. Age-standardized prevalence of diabetes mellitus (DM) and impaired glucose tolerance (IGT) in two Native Hawaiian communities*. Native Hawaiian Health Research Project 1993-1996



**Participants > 30 years old*

IRS and its role in the pathogenesis of cardiovascular risk and disease has yet to be determined.

When examining the association of dietary intake and physical activity to total glucose intolerance (DM and IGT), a significant association was found with sedentary levels of physical activity and the prevalence of total glucose intolerance (TGI) adjusted for BMI, gender and daily dietary intake[10]. Interestingly, we were not able to detect a significant association between dietary kilocalories, % fat, % carbohydrate, % protein or daily fiber with the presence of TGI. These findings are supported by other population-based studies in which an inconsistent association of various dietary components with the prevalence and/or incidence of DM was observed [11-17]. Physical inactivity has also been significantly associated with DM prevalence in cross-sectional designed studies in Pacific Islanders, Pima Indians and a multi-ethnic population in Mauritius and is further supported by results found among Native Hawai'ians [18-21]. Prospective studies among primarily Caucasian populations, have also shown a protective effect of increased physical activity to the development of new cases of DM (disease incidence) and these results are consistent with findings observed in Native Hawai'ians [22, 23].

In summary, current data from the NHHR Project have provided the strongest evidence to date on the increased rates of DM prevalence in Native Hawai'ian adults. Increased prevalence rates of other risk factors such as impaired glucose tolerance, obesity, central adiposity, hypertension, and lipid abnormalities were also confirmed. Further, the clustering of these risk factors in association with fasting insulin levels in Native Hawai'ians provides the first evidence for the existence of the insulin resistance syndrome (IRS) in this population. The potential role of the IRS to increased rates of heart disease risk and mortality has yet to be determined. Nonetheless, current data provide significant progress in confirming the excess burden of DM and its risk factors among Native Hawai'ians.

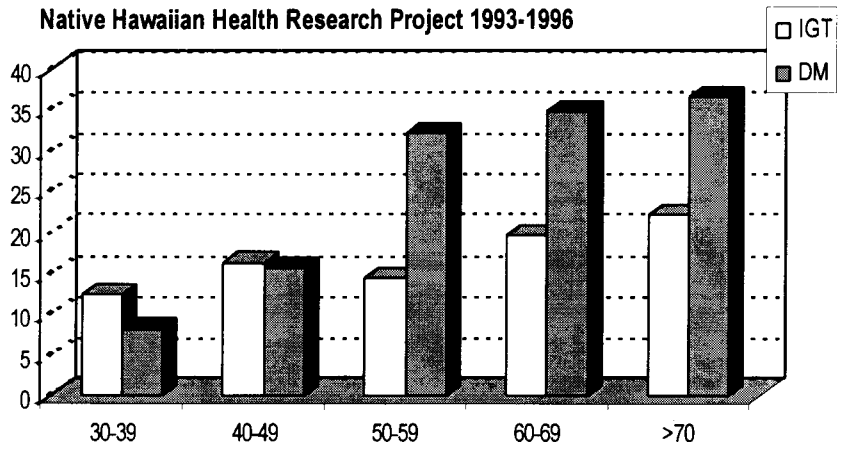
Current research aimed at controlling or preventing diabetes

In 1994-1995, two research initiatives were funded by the National Institute of Diabetes, Digestive and Kidney Diseases (NIDDK) to address the issues of controlling and/or preventing diabetes in Native Hawai'ians. This article provides a brief overview of both ongoing research initiatives.

The Native Hawai'ian Diabetes Intervention Program (NHDIP) is a four-year diabetes intervention aimed at developing and evaluating a culturally enriched diabetes-lifestyle program in Native Hawai'ians with or at-risk for diabetes. A total of 147 Native Hawai'ians from the communities of North Kohala and West Kaua'i, with or at-risk for diabetes, agreed to participate in the lifestyle intervention aimed at improving diet and exercise behaviors. The study group consisted of 72 Native Hawai'ian participants in West Kaua'i who were asked to identify a support person (friend or family member) to enroll in the study with them. The study group received a five-part teaching program that focused on promoting lifestyle changes through the help and support of family and friends. The control group in North Kohala included 75 Native Hawai'ian participants with or at-risk for diabetes who received a three-part modified lifestyle program on diet and exercise without emphasis on social support.

The lifestyle program entitled *Kulia Ola Kino Maika'i* (Strive for Good Health) was developed by a multi-disciplinary team of health professionals in collaboration with Native Hawai'ians living with diabetes, Native Hawai'ian community educators, existing Native Hawai'ian health care organizations and their communities. Through discussions with our Native Hawai'ian collaborators and other Native Hawai'ian community workers, it was determined that the curriculum of the program needed to provide simple and straightforward information on

Figure 2. Age-specific prevalence of diabetes mellitus (DM) and impaired glucose tolerance (IGT) in 2 Native Hawaiian communities*. Native Hawaiian Health Research Project 1993-1996



*Participants > 30 years old

making positive lifestyle changes with hands-on activities, cooking demonstrations and food tasting. The curriculum also needed to include culturally relevant components such as *'Olelo Hawai'i* (Hawai'ian language), traditional Hawai'ian views of health and illness such as *lokahi* (harmony), importance of *'ohana* (family) including *na keiki* (children), and incorporation of traditional values such as *'Olelo No'eau* (Hawai'ian proverbs) as positive motivators.[25]

The ongoing NHDIP is currently in the data-analysis phase of the study and has plans for presenting the results of this study to the participating Native Hawai'ian communities, other Native Hawai'ian organizations and the scientific community at study completion.

The Diabetes Prevention Program (DPP) is a seven-year, multi-centered, double-blind, randomized control trial to test whether the onset of diabetes mellitus can be prevented in individuals at high risk. A total of 3,000 participants will be enrolled in the study nation-wide with the goal of at least 50% of the participants being from ethnic minority groups in the U.S. In Hawai'i, the DPP is recruiting eligible individuals from O'ahu with a specific focus on recruiting Native Hawai'ians, Asian Americans and other Pacific Islanders to the study. The design of the study is to randomize enrollees to one of the three treatment arms and to follow these individuals for three to six years. The treatment arms of the study are:

1) intensive lifestyle with target goals of maintaining a 7% weight loss and a minimum of 150 minutes of aerobic exercise per week;
2) healthy lifestyle instruction and Metaformin; and
3) healthy lifestyle with placedo.

The DPP is approaching the end of the recruitment period. The study is expected to be completed by the Year 2002 and given the growing epidemic of diabetes in the U.S. and the world, the results of this study will likely have a significant impact on the management of individuals with impaired glucose tolerance. Undoubtedly, it will also have a major impact on minority populations at highest risk for diabetes such as Asian Americans, Native Hawai'ians and other Pacific Islanders.

Areas of future research in diabetes in Native Hawai'ians

This brief overview of recent developments in diabetes research among Native Hawai'ians in the past seven to eight years are indicative of the significant strides that have been made in characterizing diabetes and heart disease risk in the Native Hawai'ian population. The current prevalence rates of DM and impaired glucose tolerance provides important data to State government agencies and Native Hawai'ian health programs to assist them in meeting the needs of Native Hawai'ians currently affected with DM and associated risk factors. The intervention and prevention studies involving Native Hawai'ians will also provide important methods on how to effectively reach this high-risk population and may provide important insights into the mechanisms of disease in this population. However, much work remains to be done to improve the overall health status of the Native Hawai'ian population.

For example, the leading cause of mortality among Native Hawai'ians remains cardiovascular disease (CVD) [24]. Among Native Hawai'ians with or at-risk for DM, the leading cause of death is also CVD. Now that we know that the insulin resistance syndrome (IRS) does exist in Native Hawai'ians, what role does the IRS have in the pathogenesis of CVD in those with or without diabetes? If the IRS has a major role in the development of CVD, will insulin sensitizers not only improve glucose tolerance but also ameliorate CVD risk?

Further, many of the diseases that afflict Native Hawai'ians today such as hypertension, heart disease, diabetes and cancer are mediated in part by changes in diet and exercise habits. What is the ideal diet to prevent or treat these

common diseases in Native Hawai'ians? Will the promise of a traditional diet hold the key for Native Hawai'ians with diabetes today? Can these diets be easily attainable in the hectic pace of modern living? What role does exercise have in preventing and controlling diabetes and other chronic diseases affecting Native Hawai'ians? How can programs designed to improve these lifestyle habits be self-sustaining in Native Hawai'ian communities? More research is needed to understand not only the mechanisms of disease but how to translate that scientific knowledge into practical applications for use in the ordinary day-to-day lives of Native Hawai'ians.

In the end, it is the opinion of this author, that more competent, committed and culturally appropriate researchers, physicians and other health professionals are needed to examine and explore the answers that will enhance the health of all *Kanaka Maoli*.

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