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ECONOMICS AND POLICY IN DIABETES (AA BAIG AND N LAITEERAPONG, SECTION EDITORS)

Diabetes Disparities and Promising Interventions to Address Diabetes in Native Hawaiian and Pacific Islander Populations

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Abstract

Purpose of Review The Native Hawaiian and Pacific Islander (NHPI) population is rapidly growing in the USA. NHPIs face significant health disparities and have a high prevalence of diabetes compared to the general US population.

Recent Findings Recent culturally-adapted diabetes interventions have shown promise in addressing these disparities among NHPI communities. The interventions showed success by utilizing a community-based approach that honored NHPIs' collectivist culture, addressed social determinants of health that influence disease control and prevention, and utilized NHPI community health workers (CHWs) and peer educators for key roles in implementation of the intervention.

Summary To address health disparities in the NHPI community, much can be learned from existing, successful interventions. Promising interventions share several attributes. The interventions were: culturally adapted using a community-based participatory research approach; addressed specific social determinants of health (i.e., cost of healthy food, transportation, access to health care) that influence disease control and prevention; honored the collectivist culture of NHPI communities by integrating social networks and extended family members; and utilized NHPI community members, including peer educators and CHWs, for intervention implementation. Further investment to scale these interventions for regional and national implementation is needed to address the significant diabetes disparities that NHPIs face.

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Introduction

From 2000 to 2010, the Native Hawaiian and Pacific Islander (NHPI) population grew by 40% [1–3] making NHPIs the second fastest growing population in the United States (US). People indigenous to the Pacific regions of Polynesia (e.g., Hawai'i, Tonga, Sāmoa, and Aotearoa New Zealand), Melanesia (e.g., Fiji and Vanuatu), and Micronesia (e.g., the Marshall Islands, the Federated States of Micronesia, Guam, and Palau) are considered NHPIs [4]. Over one million Pacific Islanders reside in the US, and the US Census Bureau estimates the population will reach two million by 2030 [5]. The majority of the NHPI population is concentrated in Hawai'i, California, Washington, and Utah [6]; however, there has also been significant growth of the NHPI population in southern and Midwestern states such as Arkansas, Kansas, Nevada, and Oklahoma [3]. While NHPIs are an increasing population, they are underrepresented in health research [7]. Their underrepresentation in research is compounded by the historical practice of aggregating NHPIs with Asian Americans in population-based health data, which masks the marked disparities that exist between these two heterogeneous populations [8–12]. Despite being underrepresented in research, the available literature on NHPIs provides strong evidence to suggest that the NHPI population experiences substantial disparities in health and healthcare access compared to the general US population [13–19]. In this article, the authors will examine what is known about diabetes disparities among NHPIs and review interventions that have demonstrated promise in addressing diabetes disparities.

Diabetes Disparities

The Centers for Disease Control and Prevention's (CDC) National Health Interview Survey (NHIS) documented the prevalence of self-reported diagnosis of diabetes among NHPIs as ranging from 12.0 to 19.1% compared to 9.4% in the general US population [20–23]. The CDC's Behavioral Risk Factor Surveillance System (BRFSS) from 2011 to 2014 showed state-level prevalence of self-reported diabetes diagnosis among NHPIs ranged from 13.4–13.9% (New York and Hawaii) to 19.1% (California) [24]. Studies focused on NHPI subpopulations indicate that the prevalence is even higher than these national surveys. For example, a study of 401 Marshallese adult participants in Arkansas found that 32.6% had glycated hemoglobin (HbA1c) levels indicative of pre-diabetes (5.7–6.4%) and 38.4% had levels indicative of diabetes (≥ 6.5%) [25]. Of those with HbA1c levels indicative of diabetes ($N = 152$ with HbA1c ≥ 6.5%), 54.6% had an HbA1c over 9%, which is considered poor glycemic control [25]. Most notably, 51.9% of those with HbA1c levels indicative of diabetes did not self-report a diagnosis of diabetes by a healthcare provider and diabetes was only confirmed through the study's measurement of HbA1c [25]. Therefore, many of the national studies of self-reported diabetes may underrepresent the prevalence of diabetes in the NHPI population and NHPI subpopulations [25, 26].

While NHPI community members have a high prevalence of diabetes, research suggests they face many challenges in accessing health care and education for diabetes prevention and management. The available literature documents low rates of adherence to self-management behaviors [27], limited access and participation in formal diabetes self-management education (DSME) [25, 27–31], and high rates of medication nonadherence [32–34]. Furthermore, NHPIs experience higher risks of end-stage renal disease and myocardial infarction as a result of uncontrolled diabetes [35, 36].

While the reasons for diabetes disparities are not well understood, studies document challenges at multiple social ecological levels [37]. NHPIs often face racism, linguistic barriers, and inadequate Pacific language translators constraining access to health care and health education [30, 38–44]. Some NHPI communities are less likely to have health insurance than the general US population [19, 45]. NHPIs who migrate to the US from Compact of Free Association (COFA) Countries in the US Affiliated Pacific Islands have especially high uninsured rates [25, 46–48]. For example, the COFA agreement between the US and the Republic of the Marshall Islands allows Pacific Islanders to enter, work, reside, and study in the US without a visa [49]. However, COFA migrants were deemed ineligible for Medicaid after the 1996 Personal Responsibility and Work Opportunity Reconciliation Act excluded them from the 'qualified migrants' category. While COFA migrants can purchase health insurance through their employers, many are unable to afford insurance [39, 50]. Additionally, NHPIs experience higher rates of poverty and lower educational attainment than the general US population [19, 51]. Population-based studies of NHPIs have documented a correlation between diabetes and diabetes-related risk factors, such as inadequate sleep, poor nutrition or eating habits, food insecurity and obesogenic food environments, and physiological distress, all of which may be consequences of economic instability [52–54].

NHPI community members have faced a significant nutrition transition with changes in lifestyle and food systems

resulting from colonization and nuclear testing, which has contributed to a higher prevalence of non-communicable diseases. The loss of traditional diet has led to a reliance on imported, canned, and processed foods that are high in saturated fat, sodium, and added sugars, and void of many essential nutrients and dietary fiber [55]. The Marshallese community provides an example of the impact of US colonization on NHPIs' lifestyle and food practices. From 1946 to 1958, the US military tested nuclear weapons in the USAPI [56]. The denotation of 67 fission and thermonuclear weapons equivalent to 7200 Hiroshima-sized bombs [56] contaminated local food sources and the Marshallese became reliant on imported commodity foods such as rice and canned meats [57, 58]. Studies have shown that nuclear exposure among the Marshallese has resulted in a transition to a diet high in simple carbohydrates and fat with a low consumption of fruits and vegetables [57, 59]. Additionally, environmental changes have caused a Marshallese diaspora as migrants relocate to the continental US where high carbohydrate and fatty foods continue to be staples of the Marshallese diet due to their low cost and familiarity [58].

Despite nuclear testing and environmental food changes, there have been no published epigenetic studies of NHPIs living in the US that explore the epigenetic correlates of diabetes or other cardio-metabolic diseases. The lack of epigenetic research with NHPIs in the US is particularly concerning because studies in the independent nation of Samoa and New Zealand have found important genomic risk and protective factors with obesity and cardio-metabolic conditions [60, 61]. Epigenetic studies with Samoans show promise and may provide insights on how nutrition, health, and societal transitions may influence human biology and health [60]. However, genetic studies among NHPI populations have been sporadic resulting in a low-level of understanding of genetic contributions to cardio-metabolic diseases [61].

Promising Interventions

While NHPIs in the US have been underrepresented in research, there is an emergence and strengthening of some academic centers with an explicit focus on the NHPI population [62–65]. Out of these centers, some promising interventions have emerged. Three of these interventions include: (1) Partners in Care (PIC) tested among NHPIs in Hawaii; (2) Partnerships for Improving Lifestyle Interventions (PILI) 'Ohana Program Diabetes Prevention Program Lifestyle Intervention (DPP-LI) tested among NHPIs in Hawaii; and (3) Culturally-Adapted Family Model DSME (Family-DSME) tested among Marshallese in Arkansas.

Partners in Care (PIC)

The PIC intervention integrates the American Diabetes Association Standards of Care into a culturally adapted community-based DSME program for NHPIs [66]. Based upon community input, PIC was held in a group setting to increase social support, and to offer classes in a convenient community location to overcome transportation barriers for study participants. Peer educators delivered the 3-month intervention in 12 weekly, 1 hour group lessons in community settings. The PIC curriculum is written in plain English and in a conversational tone, and features images of NHPIs engaging in self-management behaviors. The curriculum materials are intended to be read verbatim to ensure fidelity across several different sites and peer educators. The PIC peer educators used local language, images, and examples to engage participants and encourage self-management behaviors. Analogies and "talk story" was used to convey some of the educational content.

A study designed to evaluate the PIC intervention enrolled 82 NHPI participants who were randomly assigned to either the intervention or wait list control group. In the intention-to-treat analyses, baseline HbA1c was 9.9% and 9.8% for the intervention and wait list control group, respectively. At 3 months data collection, the intervention group mean HbA1c was 8.9% compared to 9.4% in the wait list group. Participants in the intervention group experienced significant baseline adjusted reductions in HbA1c at 3 months compared to the wait list control group in both the intent-to-treat ($p = 0.001$) and complete case analyses ($p < 0.0001$). Intervention participants also increased their understanding of diabetes self-management ($p < 0.0001$), and performing diabetes self-management activities, such as medication adherence and foot care ($p = 0.001$) [66]. A subsequent trial of PIC was conducted with a semi-structured support group component to examine the effects of this support group on maintenance of improved glycemic control after receipt of the PIC intervention. Participants ($n = 47$) received PIC and were then randomized to either a 3-month, 6-session semi-structured support group, or a control group. Assessments were conducted at baseline, post-PIC (3-months), and post-support group (6-months). Baseline to 3-month results showed significant improvements in HbA1c (− 0.8; SD = 1.9), diabetes self-management knowledge, activities, and diabetes-related distress. However, there were no significant differences between the semi-structured support group and the control group. The semi-structured social support group experienced a significant decrease in systolic blood pressure (− 8.4 mmHg; SD = 16.2) from 3-months to 6-months while the control group did not (− 6.3 mmHg; SD = 17.9) [67]. Materials for PIC can be found at: http://www2.jabsom.hawaii.edu/pili.

Partnerships for Improving Lifestyle Interventions (PILI) 'Ohana Program Diabetes Prevention Program Lifestyle Intervention (DPP-LI)

The PILI DPP-LI is a culturally-informed DPP-LI that was adapted using a community-based participatory research (CBPR) approach to integrate NHPI cultural perspectives as well as family- and community-focused components to encourage long-term weight loss maintenance [68]. Both surface structure modifications (e.g., use of images familiar to NHPIs and ethnic-specific food examples) and deep structure changes (e.g., modifications to how the lessons were delivered and presented) were made [69]. Based on community input, two additional topic areas were added to the DPP-LI, which focused on the economics of healthy eating (i.e., how to eat healthily within your budget) and talking with your doctor (i.e., communicating effectively with your healthcare provider). To make the PILI-DPP-LI feasible to be delivered across different community settings with limited resources, it was condensed from the original 16 lessons to eight lessons while maintaining all the original lessons, strategies, and foci (i.e., the core components) and designed to be delivered by community peer educators [69].

In a pilot study of the PILI DPP-LI among 169 NHPI adults who were overweight or obese, the average weight loss from pre- to post-3-month follow-up was − 1.5 kg (95% CI = − 2.0, − 1.0), with 26% losing > 3% of their baseline weight [69]. In a larger study, 239 NHPI overweight/obese adults yielded an average weight loss of − 1.7 kg (SD = 3.5) after 3 months of the PILI DPP-LI with improvements in systolic (− 3.3 mmHg; SD = 18.6) and diastolic (− 3 .4mmHg; SD = 12.5) blood pressure, physical functioning (106.6 ft; SD = 238.4), and exercise frequency, and reductions in dietary fat intake [69]. The PILI DPP-LI was also further modified as a worksite intervention for Native Hawaiian serving organizations [70]. Among 112 employees (60% were NHPI) who were overweight/obese across 15 worksites, PILI DPP-LI yielded significant weight loss (− 1.18 kg; SD = 2.63), reductions in systolic (− 2 .8 mmHg; SD = 12.5) and diastolic (− 2.0 mmHg; SD = 8.0) blood pressure, improvements in physical functioning (74.7 ft; SD = 154.7), exercise frequency, and reductions in dietary fat intake [70]. Importantly, both of the PLP-DPP-LI interventions were delivered by peer educators who were members of or were employees of the participating community organizations, and a majority were NHPI. The PILI DPP-LI materials can be accessed at http://www2.jabsom.hawaii.edu/pili/. The PILI DPP-LI is currently being tested in a comparative effectiveness trial with Marshallese in Arkansas [71].

Culturally-Adapted Family Model DSME (Family DSME)

The Family DSME intervention was culturally adapted for Marshallese participants using a community-engaged approach with multiple qualitative pilot studies [72–74]. The resulting intervention included 10 hours of education delivered over 8 weeks. The culturally-adapted Family DSME was consistent with the National Standards from the American Diabetes Association and American Association of Diabetes Educators, and covered the topics of healthy eating, being active, understanding blood glucose and taking medications, problem-solving, reducing risks and healthy coping, mitigating complications of diabetes, and goal setting [75]. The Family DSME was adapted to a family context as well as Marshallese cultural practices [74, 76], was asset-based, and worked to overcome barriers facing Marshallese participants by leveraging culturally-specific facilitators of healthy behavior change. The intervention included family members as participants and focused on family motivational interviewing, family goal setting, and family behavioral change. The intervention also focused on how to access affordable healthy foods and free or low-cost health services. The intervention was delivered by community health workers (CHWs) in participants' homes to overcome transportation barriers.

The results of the pilot study showed patients with diabetes had a significant change in HbA1c from a mean baseline of 9.7 to 9.0% post-intervention [76]. A fully-powered randomized controlled trial ($n = 221$) examining the comparative effectiveness of culturally-adapted Family DSME compared to standard DSME has recently been tested. Participants were Marshallese adults with HbA1c indicative of diabetes (≥ 6.5). Adjusted linear mixed effects regression models showed that there were significantly greater declines in HbA1c for the culturally-adapted Family DSME arm compared with the Standard DSME arm at immediate post-intervention and 12 months post-intervention ($P = 0.038$ and $P = 0.013$, respectively). The culturally-adapted Family DSME yielded significant reductions in HbA1c from baseline to immediate post-intervention, 6 months, and 12 months ($P < 0.001$). The Family DSME materials can be accessed at https://northwestcampus.uams.edu/chr/resources/.

Common Attributes of Interventions that Have Shown Promise

The interventions that demonstrated effectiveness among NHPIs have several common attributes. First, cultural adaption of the intervention using a community-engaged approach was an effective strategy used across all studies. The promising interventions all included cultural adaptations that focused on integrating specific NHPI cultural elements such as NHPI

analogies based on nature and use of "talk story" (i.e., sharing of stories and experiences without being limited by an agenda). The success of culturally-adapted diabetes interventions has also been documented in other racial and ethnic groups [77–80] and may be particularly important for non-western cultures and populations who have experienced historical trauma [81–83]. The use of community-engaged approaches to culturally adapt the interventions is particularly important because it involves community members in the intervention adaptation and subsequent research design [81–84]. Community members serve as key advisors and members of the research team to contribute their expertise and knowledge to intervention development, implementation, and dissemination [81–83].

Second, each of the promising interventions made an effort to address social determinants of health. Based upon pilot studies that showed barriers to healthy food, lack of health insurance coverage, and limited access to transportation to buy healthy food or go to healthcare appointments [37, 66, 69], each of the interventions sought to mitigate these barriers. Promising interventions educated participants on how to choose healthy, inexpensive food items and connected participants with low-cost or free food programs that provided healthy foods. The interventions worked with healthcare centers that provided free or low-cost health care and referred patients without a healthcare provider to these services, and all interventions held classes in or near participants' homes to remove the barrier of transportation costs.

Third, engaging social support networks and including family members in the intervention was an important cultural aspect that each intervention integrated. NHPIs are interdependent with characteristics ascribed to a collectivist culture [85•, 86–88]. Decisions regarding food and exercise behaviors are often strongly influenced by extended family members [28, 29, 89, 90]. The three promising interventions are consistent with a growing body of evidence that documents the primary context of diabetes prevention and self-management resides within the social context of family [91–95, 96•, 97–99]. Through their communications and behaviors, family members influence patients' decisions to follow prevention, treatment, and self-care management behaviors [95, 96•, 97–99]. By engaging extended family members in behavioral interventions, positive improvements in prevention and self-management are increased [93–95, 96•, 97–99].

Finally, each intervention hired and trained NHPI community members as peer educators or CHWs. The peer educators recruited participants and delivered the education, which was cited as an important part of the success of the promising interventions. Community members who work as peer educators or CHWs can serve as an important "cultural bridge" between participants and researchers. Diabetes self-management interventions are often delivered by certified diabetes educators who are registered nurses, registered dietitians, or pharmacists with an additional 2000 hours of specialized education. However, the three studies discussed in this article suggest that peer educators and CHWs are effective in addressing diabetes disparities in the NHPI community through the delivery of DSME and DPP-LI [80, 100, 101•]. Diabetes interventions delivered by CHWs have been shown to be effective in other populations, and are particularly effective when there are significant cultural and linguistic differences between the patients and the majority population [100].

Conclusion

Disproportionally high rates of self-reported diabetes diagnosis have been documented across multiple population-based studies that include NHPIs, and studies that captured both self-reported diabetes diagnosis and HbA1c measures suggest that the actual prevalence of diabetes could be much higher because of undiagnosed diabetes [25, 26]. Data aggregation and underrepresentation in health research have impeded the development and testing of interventions and hampered policy and resource apportionment necessary to address the health of NHPI populations [7–12]. The inadequate investment in NHPI research and programs as well as multiple social ecological barriers has perpetuated the diabetes disparities. Additional investment in research with the NHPI population and specific NHPI subpopulations is needed to understand and address these significant diabetes disparities. Agencies such as the National Institutes of Health, Patient-Centered Outcomes Research Institute, and Centers for Disease Control and Prevention must focus strategic investments towards addressing the significant disparities in type 2 diabetes for the NHPI community.

As we consider future research and programs to address health disparities in the NHPI community, much can be learned from existing, successful interventions. These promising interventions share several attributes. The interventions were: culturally adapted using a CBPR approach; addressed specific social determinants of health (i.e., cost of healthy food, transportation, access to health care) that influence disease control and prevention; honored the collectivist culture of NHPI communities by integrating social networks and extended family members; and utilized NHPI community members, including peer educators and CHWs, for intervention implementation. These promising interventions can and should be scaled for regional and national implementation. In addition, additional interventions should be tested with appropriate cost-effectiveness data to understand the value of CHWs and inclusion of family members in the interventions.

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Compliance with Ethical Standards

Conflict of Interest Pearl A. McElfish, Rachel S. Purvis, Monica K. Esquivel, Ka'imi A. Sinclair, Claire Townsend Ing, Nicola L. Hawley, Lauren K. Haggard-Duff, and Joseph Keawe'aimoku Kaholokula declare that they have no conflict of interest.

Human and Animal Rights All reported studies/experiments with human or animal subjects performed by the authors have been previously published and complied with all applicable ethical standards (including the Helsinki declaration and its amendments, institutional/national research committee standards, and international/national/institutional guidelines).

Informed Consent Informed consent was obtained from all individual participants included in the studies described.

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