Hawai‘i Journal of Health & Social Welfare

A Journal of Pacific Health & Social Welfare

October 2021, Volume 80, No. 10, ISSN 2641-5216

Hawai‘i Journal of Health & Social Welfare

ISSN 2641-5216 (Print), ISSN 2641-5224 (Online)

Aim:

The aim of the Hawai‘i Journal of Health & Social Welfare is to advance knowledge about health and social welfare, with a focus on the diverse peoples and unique environments of Hawai‘i and the Pacific region.

History:

In 1941, a journal then called The Hawai‘i Medical Journal was founded by the Hawai‘i Medical Association (HMA). The HMA had been incorporated in 1856 under the Hawaiian monarchy. In 2008, a separate journal called the Hawai‘i Journal of Public Health was established by a collaborative effort between the Hawai‘i State Department of Health and the University of Hawai‘i at Mānoa Office of Public Health Studies. In 2012, these two journals merged to form the Hawai‘i Journal of Medicine & Public Health, and this journal continued to be supported by the Hawai‘i State Department of Health and the John A. Burns School of Medicine.

In 2018, the number of partners providing financial backing for the journal expanded, and to reflect this expansion the name of the journal was changed in 2019 to the Hawai‘i Journal of Health & Social Welfare. The lead academic partners are now the six units of the UH College of Health Sciences and Social Welfare, including the John A. Burns School of Medicine, UH Public Health, the Thompson School of Social Work & Public Health, the School of Nursing and Dental Hygiene, the UH Cancer Center, and the Daniel K. Inouye College of Pharmacy. Other partners are the Hawai‘i State Department of Health and the UH Office of the Vice Chancellor for Research. The journal is fiscally managed by University Health Partners of Hawai‘i.

The HJH&SW Today:

The Hawai‘i Journal of Health & Social Welfare is a monthly peer-reviewed journal. Full-text articles are available on PubMed Central. The HJH&SW cannot be held responsible for opinions expressed in papers, discussion, communications, or advertisements. The right is reserved to reject editorial and advertising materials that are submitted. Print subscriptions are available for an annual fee of $250.Please contact the journal for information about subscriptions for locations outside of the US.

The HJH&SW is financially supported by the academic units within the UH College of Health Sciences and Social Welfare, the UH Office of the Vice Chancellor for Research, the Hawai‘i State Department of Health, and by advertising. However, the journal’s editorial board maintains editorial independence from these entities for the acceptance and publication of research articles. All editorial decisions regarding the selection and editing of research articles are made by the members of the journal’s editorial board. The decisions of the editorial board are not influenced by nor subject to the approval of these entities.

The aim of the columns of the HJH&SW is to provide a space for the entities that financially support the HJH&SW to diseminate information regarding their research, programs, goals, or current issues facing their respective fields. Columns are edited by the HJH&SW contributing editors, who are employees of the agencies that support the HJH&SW.

The aim of the Hawai‘i Journal Watch is to highlight recent research of the entities that finacially support the HJH&SW. The research articles that are covered in the Hawai‘i Journal Watch are selected by both the HJH&SW and by researchers in the units that support the HJH&SW. The researchers whose articles are covered in the Hawai‘i Journal Watch are given the opportunity to fact check the news brief.

Journal Contact Information:

Mailing Address: Hawai‘i Journal of Health & Social Welfare
University of Hawai‘i John A. Burns School of Medicine
Medical Education Building, 224F
651 Ilalo Street
Honolulu, Hawai‘i 96813
Website: http://hawaiijournalhealth.org/
Email: hjhsw@hawaii.edu

Assessment of Diabetes-Related Health Disparities among the Marshallese Living in the Republic of the Marshall Islands

Pearl A. McElfish PhD; Jennifer A. Andersen PhD; Brett Rowland MA; Jack Niedenthal BS; Henry Otuafi BS; Sheldon Riklon MD; Ainrik George BS; Edlen Anzures BS; James Selig PhD; Wana Bing BS; and Holly Felix PhD

Abstract

There is a high prevalence of type 2 diabetes mellitus (T2DM) among the Marshallese in the Republic of the Marshall Islands (RMI). However, no prior literature has examined self-reported health indicators, self-management activities, barriers to care, diabetes knowledge, and family support for diabetes management. This study examined health indicators among participants with T2DM (n=41). Clinical measures included glycated hemoglobin (HbA1c) and fasting glucose level, blood pressure, pulse pressure, and cholesterol levels. Survey items included participants' self-reported health indicators, self-management activities, barriers to care, diabetes knowledge, and family support for diabetes management. Clinical health indicators demonstrate the poor health status of the participants, including uncontrolled fasting glucose levels and HbA1c levels (61.9% had an HbA1c ≥9.0%), high blood pressure, elevated pulse pressure (65.9% had pulse pressure >40 mmHg), and high total cholesterol. Participants report limited knowledge and participation in diabetes self-management behaviors, limited family support, and faced numerous barriers to medical care, medications, and supplies. This study provides insight into the T2DM disparities experienced by Marshallese in the RMI. This study is the first to document the self-reported health indicators, self-management activities, barriers to care, diabetes knowledge, and family support for diabetes management. The results highlight the need for T2DM management interventions and will be used to refine a culturally adapted intervention for delivery in the RMI.

Keywords

type 2 diabetes mellitus, self-management, health indicators, barriers to care, diabetes knowledge, family support

Abbreviations and Acronyms

BMI = body mass index
CVD = cardiovascular disease
DSMES = diabetes self-management education and support
F-DSMES = family (model of) diabetes self-management education and support
HbA1c = glycated hemoglobin
T2DM = type 2 diabetes mellitus
RCT = randomized controlled trial
RMI = Republic of the Marshall Islands

Introduction

The Republic of the Marshall Islands (RMI) includes 28 coral atolls located between Hawai'i and New Zealand, with a population of approximately 58 000. The population of the RMI faces health disparities after several historical traumas, including the testing of nuclear weapons on the atolls by the United States in the 1940s and 1950s. The resulting nuclear fallout and subsequent colonization by the American military drastically altered the lifestyle of the Marshallese, including changes in diet and physical activity related to food acquisition.[1,2] Due to the contamination of the RMI from nuclear testing, the Marshallese transitioned from a diet sourced through active sustenance farming and local fresh fruits, vegetables, and fish, to a sedentary lifestyle and a diet reliant on highly processed food imported from the continental United States.[2-6] One particular concern is the high rates of type 2 diabetes mellitus (T2DM) among the Marshallese. The International Diabetes Federation has ranked the RMI with the highest age-adjusted T2DM rate in the world (30.5%) compared to lower rates in the United States (13.3%) and globally (9.3%).[7-12] The RMI's health care system is remote and underfunded, with only 2 hospitals across the 28 atolls.[13]

The high rate of T2DM is also of concern for the Marshallese community in Northwest Arkansas. To address the disparate rates of T2DM in the Marshallese community in Arkansas, the authors developed a culturally appropriate family model of diabetes self-management education and support (F-DSMES) intervention in partnership with the community.[14-19] Culturally appropriate F-DSMES addresses diabetes self-management through motivational family interviewing, goal setting, and education on supportive behaviors while focusing on behavioral changes in the family context.[14-19] Engagement in diabetes self-care and compliance with treatment recommendations are often determined by one's social environment. Given the collective nature of the Marshallese community, cultural traditions around food, and the importance of family in Marshallese culture, family-based interventions are an important part of culturally appropriate care. A comparative effectiveness randomized controlled trial (RCT) tested a standard model of diabetes self-management education and support (DSMES) intervention against the culturally adapted F-DSMES intervention. The F-DSMES significantly lowered mean glycated hemoglobin (HbA1c) level immediately post-intervention, with a 1.15% reduction in mean HbA1c ($P < .001$) and 0.87% reduction sustained over twelve months.[14] The promising results of the F-DSMES in Arkansas led to a pilot test of the F-DSMES curriculum in the RMI to understand if additional adaptations are needed.

The purpose of this study is to report the participants' baseline clinical health indicators, diabetes self-management knowledge, and family support behaviors for the Marshallese with T2DM, expanding the literature documenting T2DM disparities in the RMI.[20]

Methods

Participant Recruitment, Enrollment, and Consent

Participant recruitment took place in 4 churches on Majuro Atoll in the RMI. Informed consent and all study materials were available to participants in both Marshallese and English, and bilingual trained research staff was available for questions. Participants were required to meet the inclusion criteria: (1) self-identified Marshallese descent, (2) 18 years or older, (3) a diagnosis of T2DM by a physician or a current HbA1c greater than or equal to 6.5%, (4) at least 1 family member living in the same household willing to participate in the program with the participant, and (5) a commitment to participate in all educational sessions and data collection events.

The study protocol and materials were reviewed and approved by the University of Arkansas for Medical Sciences' Institutional Review Board (#239272), adapted from the instruments and protocol developed as part of the Adapted Family Model of DSME RCT (UAMS IRB#203482) (Clinical Trial #NCT02407132) and reviewed and approved by the RMI Ministry of Health and Human Services.[20]

A total of 126 individuals were screened for participation in the F-DSMES intervention. One individual was deemed ineligible due to a preexisting health condition, and 10 individuals required waivers from the intervention team's physician. Overall, 125 individuals were enrolled in the intervention. Twenty-eight participants did not return for the pre-intervention data collection, and 56 family member participants were not included in this study, leaving a total sample of 41 participants with T2DM. The results presented in this article include the 41 participants with HbA1c indicated or diagnosed with T2DM and are designated as "primary participants." Although 41 participants with HbA1c indicated diabetes at the time of study enrollment or physician-diagnosed T2DM participated in the F-DSMES program, only the 30 participants who reported being diagnosed with T2DM by a physician were administered the survey questions regarding clinical diabetes care, diabetes knowledge, family support, and diabetes self-care behaviors at baseline. All 41 participants completed biometric measures.

Data Collection

Research staff trained in the proper techniques for obtaining HbA1c, blood pressure, weight, and height measurements collected biometric data for the 41 participants with diabetes. A Rapid A1c test kit (Siemens DCA Vantage Analyzer; Malvern, PA) was used to measure HbA1c and fasting glucose levels via finger prick blood collection.[20] With the participant seated, an OMRON digital blood pressure monitor (Kyoto, Japan) was used to measure systolic and diastolic blood pressure automatically, with 2 measures taken 1 to 5 minutes apart. Participants' height and weight were collected without shoes. Height was measured to the nearest inch using a portable stadiometer (0 to 81 inches), and weight was captured to the nearest 0.1lb (0.045 kg) using a calibrated digital scale. Height and weight were then used to calculate body mass index (BMI) ([weight in pounds/{height in inches}^{2}]*703). Pulse pressure, an indicator of elevated cardiovascular disease (CVD) risk at >40 mmHg, was calculated by subtracting the diastolic from the systolic blood pressure value for each participant.[21-23] In addition, 30 participants who had been diagnosed with diabetes by a physician before the study completed a survey instrument previously piloted in the Arkansas F-DSMES program, which included questions adapted from the Behavioral Risk Factor Surveillance Survey's Diabetes and Healthcare Access Modules and the Diabetes Care Profile.[14, 24] Surveys were conducted by bilingual staff. Participants could refuse any portion of the survey or biometric data collection and continue in the study. All participants were provided with a copy of their biometric screening results, confidential health counseling, and referral information to a local health care provider as needed.

Analytical Methods

The descriptive statistics report the mean and standard deviation for continuous variables and the proportions for categorical variables for participant demographics, initial clinical health characteristics, and self-reported health characteristics. In addition, descriptive statistics of the participants' self-management activities, barriers to care, diabetes knowledge, and family support for diabetes management are reported. The analyses were conducted using STATA version 16 (College Station, TX).[25]

Results

Demographic Data

The mean age of the participants was 52.2 years (±10.8). Females made up about three-quarters of the sample (73%), and over half of the participants were married or cohabitating. Sixty-eight percent of the participants had not obtained a high school diploma, and 70% were unemployed. Many of the participants lived in large households, with most households having at least 6 to 10 people, including 9 participants who lived in a household with more than 10 people.

Clinical Health Indicators

Table 1 reports the clinical health indicators for the participants with T2DM. The mean BMI was in the obese range at 30.5 (±6.1). Indicators of T2DM included an elevated mean HbA1c level at 10.1% (±2.5%; reference level, <7%), and a mean finger stick glucose of 200 mg/dL (±77.3 mg/dL; reference range, 70–99 mg/dL). More than 60% of participants had an HbA1c greater than 9.0%, indicating uncontrolled T2DM. Mean total cholesterol levels were elevated at 170.9 mg/dL (±32.7 mg/dL).

Table 1. Clinical Health Indicators (N=41)				
Measure	**Mean**	**SD**	**Min**	**Max**
BMI[a], kg/m^2	30.5	6.1	20.4	43.0
HbA1c, %	10.1	2.5	6.5	14.0
Fingerstick glucose, mg/dL	200.0	77.3	96.0	437.0
Total cholesterol, mg/dL	170.9	32.7	99.0	255.0
Systolic blood pressure, mmHg	129.4	26.6	92.0	198.0
Diastolic blood pressure, mmHg	76.5	12.0	52.0	99.0
Pulse pressure, mmHg	52.9	22.5	25.0	128.0
	n (%)			
HbA1c >9.0%	25 (61)			
Pulse pressure >40 mmHg	27 (66)			

Abbreviations: BMI, body mass index; HbA1c, glycated hemoglobin; SD, standard deviation; min, minimum; max, maximum

[a] One participant was physically unable to complete height and weight measurements to calculate BMI.

The mean systolic blood pressure was elevated at 129.4 mmHg (±26.6 mmHg), and the mean diastolic blood pressure was 76.5 mmHg (±12.0 mmHg). Pulse pressure had a mean difference of 52.9 mmHg (±22.5 mmHg).[21-23] In addition, 66% of the participants had a pulse pressure over 40 mmHg (Table 1).

Self-reported Health Indicators

Table 2 presents the descriptive statistics for self-reported health indicators for the participants. Seventy-three percent of the participants reported previously being told they had T2DM by their doctor; however, about a quarter of the participants (27%) with HbA1c indicative of T2DM did not report a prior diagnosis. One in 5 (22%) reported having at least 1 other comorbidity, and an additional 20% reported having 2 or more comorbidities. High blood pressure and back pain were the most common comorbidity reported (Table 2).

The majority of the participants reported their health as good (56%) or fair (39%). Twenty participants (49%) stated their health was about the same as it was a year ago, and 10 (24%) reported they felt their health was worse than it was a year ago (Table 2). Ninety-three percent of participants stated they "feel healthy enough to do what they need to do on a day to day basis;" however, 16 participants (39%) reported "not being too tired to do what they want or need to do."

Self-management Activities

Eighty-three percent of the participants reported seeing the doctor at least once for their diabetes in the past 12 months (see Table 2). Table 2 reflects that the number of participants who reported that their HbA1c had been checked at least once in the previous year is 5 (17%). The number in the text (7, 24%) corresponds to the amount of people who had a health professional check their feet once in the past year. Seventeen

Table 2. Self-Reported Health Indicators of People with Diagnosed Diabetes (N=41)[a]	
	n (%)
Has a doctor told you that you have…? (n=41)	
Diabetes	30 (73)
High Blood Pressure	11 (27)
Back Pain	4 (10)
Kidney Disease	3 (7)
Heart Disease	2 (5)
Arthritis	1 (2)
Blindness	1 (2)
Stroke	1 (2)
Lung Disease	1 (2)
Asthma	1 (2)
Number of Comorbidities (n=41)	
None	24 (59)
One	9 (22)
Two or More	8 (20)
Would you say that in general your health is…? (n=41)	
Good	23 (56)
Fair	16 (39)
Poor	2 (5)
Compared to one year ago, how would you rate your health in general now? (n=41)	
Much better now than 1 year ago	1 (2)
Somewhat better now than 1 year ago	10 (24)
About the same	20 (49)
Somewhat worse now than 1 year ago	10 (24)
Do you feel healthy enough to do what you want or need to do? (n=41)	
No	3 (7)
Do you feel too tired to do what you want or need to do? (n=41)	
No	16 (39)
About how many times in the PAST 12 MONTHS…	
Have you seen a health care provider for your diabetes? (n=30)	
No	5 (17)
Have you had your HbA1c checked? (n=30)	
Never	5 (17)
Once	5 (17)
More than once	2 (7)
Never heard of an A1c Test	17 (57)
Don't Know/Not Sure	1 (3)
Has a health professional checked your feet?[b] (n=29)	
Once	7 (24)
More than once	2 (7)
Never/Not Sure	20 (67)
Has a doctor ever told you that diabetes has affected your eyes? (n=30)	
Yes	8 (27)

[a] Number of responses may vary depending on the question.

[b] One participant physically unable to complete foot check.

participants (57%) had never heard of an A1c test before, and 20 (67%) reported never having their feet checked by their doctor. Just over a quarter of participants (27%) reported being told by a health care provider T2DM had affected their eyes or that they had retinopathy.

Barriers to Care

Barriers to medication, supplies, and care included lack of transportation, being unable to afford the cost, lack of needed medications or supplies (eg, glucometers, test strips), and being unable to make an appointment or pick up medication due to unavailable staff or the pharmacy/provider's office being closed. Although 11 of the participants (27%) reported 'no medication needed or prescribed,' 73% of the participants reported dealing with at least 1 barrier, and 27% reported 2 or more barriers to medication necessary for treating their T2DM. Ten participants (24%) faced at least 1 obstacle to obtaining needed diabetes supplies, and 6 (15%) reported 2 or more obstacles to obtaining their needed diabetes supplies. Twelve participants (29%) reported not needing or delaying medical care, but those who needed medical care faced at least 1 barrier that prevented it (32%). Sixteen participants (38%) reported 2 or more barriers to obtaining needed medical care.

Diabetes Knowledge

Most of the participants (87%) have never attended a course or class on how to manage their T2DM and reported only knowing a little about diabetes management (Table 3). Overall, most participants reported knowing little (70%) or nothing (23%) about how diet and exercise affect their blood glucose levels. Further, the majority of the participants reported having little (67%) or no (30%) knowledge of how to prevent or treat a high or low blood glucose monitor reading. However, 33% of the participants reported knowing a lot about how to use the results of blood sugar monitoring. Thirty percent of the participants reported knowing a lot about how to take their diabetes medications correctly.

Table 3. Descriptive Statistics of Diabetes Knowledge (N=30)

	n (%)
Have you ever taken a course or class in how to manage your diabetes yourself?	
No	26 (87)
How well do you understand...	
How to manage your diabetes?	
Not at all	3 (10)
A little	26 (87)
A lot	1 (3)
How to cope with stress?	
Not at all	7 (23)
A little	19 (63)
A lot	4 (13)
How to eat for blood sugar control?	
Not at all	9 (30)
A little	19 (63)
A lot	2 (7)
The role of exercise in diabetes care?	
Not at all	7 (23)
A little	19 (63)
A lot	4 (13)
How to take your medications correctly?	
Not at all	7 (23)
A little	14 (47)
A lot	9 (30)
How to use the results of blood sugar monitoring?	
Not at all	10 (33)
A little	10 (33)
A lot	10 (33)
How diet, exercise, and medicines affect blood sugar levels?	
Not at all	7 (23)
A little	21 (70)
A lot	2 (7)
How to prevent and treat high blood sugar?	
Not at all	9 (30)
A little	20 (67)
A lot	1 (3)
How to prevent and treat low blood sugar?	
Not at all	9 (30)
A little	18 (60)
A lot	3 (10)
How to prevent long-term complications of diabetes?	
Not at all	8 (27)
A little	20 (67)
A lot	2 (7)
How to take care of your feet?	
Not at all	7 (23)
A little	17 (57)
A lot	6 (20)
The benefits of improving blood sugar control?	
Not at all	8 (27)
A little	19 (63)
A lot	3 (10)

Family Support for Diabetes Management

Table 4 describes the family support behaviors reported by the participants. Many of the participants rely on a spouse (57%) or another family member (33%) to help them care for their diabetes. Overall, participants reported their families are at least "a little," if not "a lot," supportive of the need for them to follow a meal plan, get enough physical activity, take their medications as directed, and check their blood sugar levels. Participants also reported their families helped them to handle their feelings about T2DM a lot (37%). Family members, however, were rated less supportive of foot care, with nearly three-fourths of participants reporting little (37%) or no (37%) help or support for foot care.

Table 4. Descriptive Statistics for Family Support for Diabetes Management (N=30)

	n (%)
Who helps you the most in caring for your diabetes?	
Spouse	17 (57)
Other Family Members	10 (33)
Health Care Provider	2 (7)
No one	1 (3)
My Family helps me to…?	
Follow my meal plan	
Not at all	5 (17)
A little	11 (37)
A lot	14 (47)
Take my medicine	
Not at all	5 (17)
A little	14 (47)
A lot	11 (37)
Take care of my feet	
Not at all	11 (37)
A little	11 (37)
A lot	8 (27)
Get enough physical activity	
Not at all	5 (17)
A little	12 (41)
A lot	12 (41)
Test my sugar	
Not at all	5 (17)
A little	13 (43)
A lot	12 (40)
Handle my feelings about diabetes	
Not at all	4 (13)
A little	15 (50)
A lot	11 (37)

Discussion

The cross-sectional analysis of the data provides significant insight into the T2DM disparities experienced by the Marshallese population in the RMI. Overall, the clinical health indicators demonstrate elevated glucose, blood pressure, and cholesterol levels. Nearly two-thirds of the participants with T2DM had an HbA1c greater than 9.0%, indicative of poorly controlled T2DM, compared to an estimated 50% of people with uncontrolled T2DM living in the United States.[26] Additionally, almost 66% of the participants had an elevated pulse pressure (>40 mmHg), which is indicative of potential cardiac impairment, including an increased risk of developing congestive heart failure.[21-23, 27] An elevated pulse pressure increases the risk of organ damage and risk of death from cardiovascular events.[21, 28]

Participants reported limited knowledge of diabetes care behaviors: 57% of the participants reported that they never heard of an HbA1c test, 67% had never had a diabetes foot exam during a visit to the doctor's office, and nearly 87% of those with diagnosed T2DM have never attended a diabetes education course. This limited knowledge of diabetes care behaviors is worse than is documented in the United States or internationally.[29, 30] Comparatively, the Marshallese in Arkansas reported higher compliance with recommended diabetes self-care behaviors, including annual foot checks (48%) and attending a diabetes education course (38%).[31] The limited knowledge of diabetes care behaviors may be in part due to the lack of Certified Diabetes Educators and diabetes education programs available in the RMI.

Further, many participants faced numerous barriers to medication, diabetes supplies, and health care visits in the RMI. The barriers may be due to high (36%) unemployment in the RMI—which was extremely high in the study sample (70%)—and a low national minimum wage, leading to difficulties in paying for medical care and medical supplies.[1] Moreover, transportation is often an issue, as many Marshallese do not own or have access to personal transportation.[32,33] Given that many health care providers are not located within walking distance, it is difficult to attend needed medical visits without access or resources to pay for transportation. These findings are consistent with similar work evaluating barriers to medication adherence in the Marshallese community in Arkansas and highlight the importance of addressing financial and transportation-related barriers to care.[34-37]

The combination of uncontrolled glucose levels, high blood pressure, limited knowledge of treatment protocols and diabetes self-management standards, and barriers to health care places participants at greater risk of diabetes-related complications, including infections that could lead to lower limb amputation.[38] Further, the barriers to health care complicate both diabetes management and the prevention of complications, often lead-

ing to infections that progress beyond what debridement (eg, cleaning the wound and the removal of dead or diseased tissue) procedures can manage.[36] Given the results presented here, it is unsurprising T2DM-related foot procedures are the fourth most common surgical procedure at Leroj Atama Medical Center in Majuro, 1 of 2 public medical centers in the RMI.[38]

Despite the troubling results presented here, the participants with T2DM have a positive view of their health. Many participants reported their health as good and reported they have felt healthy enough to complete needed tasks. Cultural influences play a role in the perception of good health. For example, research with the Marshallese community in Arkansas has demonstrated that admitting to poor health is a source of stigma, and admitting to a diagnosis of diabetes is to invite shame and embarrassment.[36] In contrast to these responses, however, a third of the participants reported they are often too tired to do the things they need or want to do. Therefore, although participants might state they are healthy and self-rate their health as good to avoid stigma and shame, the fatigue related to their health conditions may be keeping many Marshallese from accomplishing important goals and tasks. Stigma and the perception of health are areas in need of future research in the RMI.

Limitations and Strengths

There are limitations to keep in mind when interpreting these results. The sample size is relatively small and is not a random sample. Therefore, it may not be representative of the Marshallese population in the RMI. Further, the data used in the analysis of the general health indicators, diabetes self-management knowledge, and family support of diabetes management is self-reported by the participant. Self-reported medical history does carry a risk of bias, including the adjustment of participant responses to be more socially desirable[39] if the interviewer knows the participant, as is often the case with community-based participatory research.[40] This limitation is reduced by the use of validated instruments. Although social desirability may play a role in the responses, prior work has shown the effect is limited even for sensitive questions (eg, substance use).[40]

Despite these limitations, this is the first study to document the clinical and self-reported clinical and self-reported diabetes-related health disparities and the need for interventions to address these disparities for the Marshallese community in the RMI. Further, the study is 1 of the first to explore the level of knowledge of diabetes self-management, self-care behaviors, and family support for diabetes care in the RMI. In addition, this study is the first to document the patient-reported barriers to diabetes care and supplies in the RMI.

Conclusions

Overall, the results presented here add to the literature on health disparities in the RMI. The results highlight the critical need for T2DM management and prevention interventions in the RMI, particularly ones that can address the numerous barriers to diabetes care.

Conflict of Interest

None of the authors identify a conflict of interest.

Acknowledgments

This study was made possible because of a community-based participatory research partnership with local Marshallese faith-based leaders, the RMI Ministry of Health & Human Services, Kora In Jiban Lolorjake Ejmour (KIJLE), and the Marshallese Consulate General in Springdale, Arkansas. Community engagement efforts were supported by University of Arkansas for Medical Sciences Translational Research Institute funding awarded through the National Center for Research Resources and National Center for Advancing Translational Sciences of the National Institutes of Health (NIH; number 1U54TR001629-01A1). The diabetes self-management education pilot study was supported by an award from the Sturgis Foundation.

Authors' Affiliations:
- College of Medicine, University of Arkansas for Medical Sciences Northwest, Fayetteville, AR (PAM, JAA, SR)
- Office of Community Health and Research, University of Arkansas for Medical Sciences Northwest, Fayetteville, AR (BR, WB)
- Republic of the Marshall Islands Ministry of Health & Human Services, Majuro, MH (JN, HO, AG, EA)
- Fay W. Boozman College of Public Health, University of Arkansas for Medical Sciences, Little Rock, AR (JS, HF)

Correspondence to:
College of Medicine, University of Arkansas for Medical Sciences Northwest, 1125 N College Ave, Fayetteville, AR 72703; Email: PAMcelfish@uams.edu

References

1. Central Intelligence Agency. The World Factbook: Australia-Oceania: Marshall Islands. Available from: https://www.cia.gov/the-world-factbook/countries/marshall-islands/. Updated April 30, 2021. Accessed June 2, 2020.
2. Guyer RL. Radioactivity and rights: clashes at Bikini Atoll. *Am J Public Health*. 2001;91(9):1371–1376. doi:10.2105/ajph.91.9.1371
3. Barker HM. *Bravo for the Marshallese: Regaining Control in a Post-Nuclear, Post-Colonial World*. Belmont, CA: Cengage Learning; 2012.
4. Pollock NJ. Health transitions, fast and nasty: the case of Marshallese exposure to nuclear radiation. *Pac Health Dialog*. 2002;9(2):275–282.
5. Gittelsohn J, Haberle H, Vastine AE, Dyckman W, Palafox NA. Macro- and microlevel processes affect food choice and nutritional status in the republic of the Marshall Islands. *J Nutr*. 2003;133(1):310S–313S. doi:10.1093/jn/133.1.310S
6. Ahlgren I, Yamada S, Wong A. Rising oceans, climate change, food aid, and human rights in the Marshall Islands. *Health Hum Rights*. 2014;16(1):69–80.
7. International Diabetes Federation (IDF). *IDF Diabetes Atlas*. Brussels: International Diabetes Federation; 2019. https://www.diabetesatlas.org/upload/resources/material/20200302_133351_IDFATLAS9e-final-web.pdf. Accessed July 14, 2020.
8. Compact of Free Association Community Advocacy Network. Citizens of Oceania: COFACAN Statement and Call to Action; 2014. Available from: http://www.pireport.org/articles/2014/04/17/cofacan-statement-and-call-action-basic-health-hawai%E2%80%98i. Accessed July 14, 2020.
9. Minegishi M, Fujimori K, Nakajima N, et al. Diabetes mellitus and obesity among participants receiving screening for cancer in the Republic of the Marshall Islands. Diabetes Rates Marshallese. *J Int Health*. 2007;22(3):133–141.
10. World Health Organization. Diabetes Fact Sheet. Geneva: World Health Organization; 2021. Available from: http://www.who.int/news-room/fact-sheets/detail/diabetes. Accessed January 13, 2021.

11. Hawley NL, McGarvey ST. Obesity and diabetes in Pacific Islanders: the current burden and the need for urgent action. *Curr Diab Rep*. 2015;15(5):29. doi:10.1007/s11892-015-0594-5.
12. Davis BC, Jamshed H, Peterson CM, et al. An intensive lifestyle intervention to treat type 2 diabetes in the Republic of the Marshall Islands: protocol for a randomized controlled trial. *Front Nutr*. 2019;6:79. doi:10.3389/fnut.2019.00079.
13. "Marshall Islands." The Global Health Observatory. Geneva: World Health Organization; 2021. Available from: https://www.who.int/data/gho/data/countries/country-details/GHO/marshall-islands?countryProfileId=a0dfaf30-81d1-4b3f-9915-7eef2f8ff414. Accessed January 13, 2021.
14. McElfish PA, Long CR, Kohler PO, et al. Comparative effectiveness and maintenance of diabetes self-management education interventions for Marshallese patients with type 2 diabetes: a randomized controlled trial. *Diabetes Care*. 2019;42(5):849–858. doi:10.2337/dc18-1985.
15. McElfish PA, Long CR, Bursac Z, et al. Diabetes self-management education exposure and glycated haemoglobin levels among Marshallese participants in a randomized controlled study. *Diabet Med*. 2020;37(2):319–325. doi:10.1111/dme.14189.
16. Purvis R, Long C, James L, et al. Dissemination protocol for community-based participatory research partnerships with Marshallese Pacific Islanders in Arkansas. *Progress in Community Health Partnerships*. 2020; [Under Review].
17. Yeary KH, Aitaoto N, Sparks K, et al. Cultural adaptation of diabetes self-management education for Marshallese residing in the United States: lessons learned in curriculum development. *Prog Community Health Partnersh*. 2017;11(3):253–261. doi:10.1353/cpr.2017.0030.
18. Kim Yeary KH, Long CR, Bursac Z, McElfish PA. Design of a randomized, controlled, comparative-effectiveness trial testing a family model of diabetes self-management education (DSME) vs. standard DSME for Marshallese in the United States. *Contemp Clin Trials Commun*. 2017;6:97–104. doi:10.1016/j.conctc.2017.03.007.
19. McElfish PA, Ayers BL, Felix HC, et al. How stakeholder engagement influenced a randomized comparative effectiveness trial testing two Diabetes Prevention Program interventions in a Marshallese Pacific Islander Community. *J Transl Med*. 2019;17(1):42. doi:10.1186/s12967-019-1793-7.
20. McElfish PA, Boyers J, Purvis RS, et al. Family model diabetes self-management education and support in faith-based organizations in the republic of the Marshall Islands study protocol. *Contemp Clin Trials Commun*. 2021;21:100710. doi:10.1016/j.conctc.2021.100710.
21. Said MA, Eppinga RN, Lipsic E, Verweij N, van der Harst P. Relationship of arterial stiffness index and pulse pressure with cardiovascular disease and mortality. *J Am Heart Assoc*. 2018;7(2):e007621. doi:10.1161/JAHA.117.007621.
22. Haider AW, Larson MG, Franklin SS, Levy D; Framingham Heart Study. Systolic blood pressure, diastolic blood pressure, and pulse pressure as predictors of risk for congestive heart failure in the Framingham Heart Study. *Ann Intern Med*. 2003;138(1):10–16. doi:10.7326/0003-4819-138-1-200301070-00006.
23. Homan TD, Bordes S, Cichowski E. Physiology, Pulse Pressure. In: StatPearls [Internet]. Treasure Island, FL: StatPearls Publishing; 2021. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482408/. Updated June 7, 2020. Accessed January 13, 2021.
24. Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2019. Available from: https://www.cdc.gov/brfss/index.html. Accessed July 14, 2020.
25. StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC.
26. Yang W, Dall TM, Tan E, et al. Diabetes diagnosis and management among insured adults across metropolitan areas in the U.S. *Prev Med Rep*. 2018;10:227–233. doi:10.1016/j.pmedr.2018.03.014.
27. Chae CU, Pfeffer MA, Glynn RJ, Mitchell GF, Taylor JO, Hennekens CH. Increased pulse pressure and risk of heart failure in the elderly. *JAMA*. 1999;281(7):634–639. doi:10.1001/jama.281.7.634.
28. Mancusi C, Losi MA, Izzo R, et al. Higher pulse pressure and risk for cardiovascular events in patients with essential hypertension: The Campania Salute Network. *Eur J Prev Cardiol*. 2018;25(3):235–243. doi:10.1177/2047487317747498.
29. Andersen JA, Gibbs L. Does insulin therapy matter? Determinants of diabetes care outcomes. *Prim Care Diabetes*. 2018;12(3):224–230. doi:10.1016/j.pcd.2017.11.004.
30. Degefa G, Wubshet K, Tesfaye S, Hirigo AT. Predictors of adherence toward specific domains of diabetic self-care among type-2 diabetes patients. *Clin Med Insights Endocrinol Diabetes*. 2020;13:1179551420981909. doi:10.1177/1179551420981909.
31. Felix H, Rowland B, Long CR, et al. Diabetes self-care behaviors among Marshallese adults living in the United States. *J Immigr Minor Health*. 2018;20(6):1500–1507. doi:10.1007/s10903-017-0683-4.
32. Carlin M, Mendoza-Walters A, Ensign K. Half an ocean away: health in the US-Affiliated Pacific Islands. *J Public Health Manag Pract*. 2016;22(5):492–495. doi:10.1097/PHH.0000000000000467.
33. Labriola MC. Marshall Islands. *The Contemporary Pacific*. 2020;32(1):201–212.
34. Balli ML, Dickey TA, Purvis RS, Warmack TS, Riklon S, McElfish PA. "You want to give the best care possible, and you know when they leave your pharmacy, you didn't give the best care possible most of the time" pharmacist- and community health worker-identified barriers and facilitators to medication adherence in Marshallese patients. *J Racial Ethn Health Disparities*. 2019;6(4):652–659. doi:10.1007/s40615-019-00563-2.
35. McElfish PA, Long CR, Payakachat N, et al. Cost-related nonadherence to medication treatment plans: Native Hawaiian and Pacific Islander National Health Interview Survey, 2014. *Med Care*. 2018;56(4):341–349. doi:10.1097/MLR.0000000000000887.
36. Hallgren EA, McElfish PA, Rubon-Chutaro J. Barriers and opportunities: a community-based participatory research study of health beliefs related to diabetes in a US Marshallese community. *Diabetes Educ*. 2015;41(1):86–94. doi:10.1177/0145721714559131.
37. McElfish PA, Hallgren E, Henry LJ, Ritok M, Rubon-Chutaro J, Kohler P. Health beliefs of Marshallese regarding type 2 diabetes. *Am J Health Behav*. 2016;40(2):248–257. doi:10.5993/AJHB.40.2.10.
38. Kool B, Ipil M, McCool J. Diabetes mellitus-related foot surgeries in the Republic of the Marshall Islands in Micronesia. *Hawaii J Med Public Health*. 2019;78(1):13–18.
39. Van de Mortel TF. Faking it: social desirability response bias in self-report research. *Aust J Adv Nurs*. 2008;25(4):40–48.
40. Habecker P, Ivanich J. Unintended Interviewer Bias in a Community-based Participatory Research Randomized Control Trial among American Indian Youth. In Olson K, Smyth JD, Dykema J, Holbrook AL, Kreuter F & West BT, ed. *Interviewer Effects from a Total Survey Error Perspective*. Boca Raton, FL: Chapman & Hall; 2020.

Case Study of Noni Extract in Men with Very Low-Risk or Low-Risk Prostate Cancer

Yosuke Hirasawa MD; Ian Pagano PhD; Jeffrey Huang PharmD; Yuka Sasaki PhD; Kaoru Murakami MD, PhD; Charles J. Rosser MD, MBA; and Hideki Furuya PhD

Abstract

The optimal treatment strategy for patients with early prostate cancer (PCa) is unknown. We explored the feasibility of administering noni supplementation to modify gene expression of a relevant clinical signature in the prostate of men on active surveillance for PCa. A total of 6 participants with low-risk (n=5) to very low-risk (n=1) PCa who were candidates for active surveillance received 6200 mg/day of noni in capsule form for 1 year; median age was 65.5 years (range, 58–75 years). Participants were tested for serum prostate-specific antigen (PSA) levels every 3 months. At 12 months, they underwent a repeat transrectal ultrasound-guided prostate biopsy. These biopsy samples were queried for expressing 12 key genes and rates of apoptosis, angiogenesis, and proliferation. The primary outcome was the change in expression of the 12 genes that comprise the Oncotype DX prostate cancer test from baseline to 12 months of noni supplementation. Noni was well tolerated, with only 1 participant reporting side effects of grade 2 diarrhea, requiring a drug holiday of 7 days. Median serum PSA slightly increased from 7.1 ng/mL (4.4–9.7 ng/mL) prior to therapy to 7.9 ng/mL (5.7–10.2 ng/mL) on therapy. Changes were observed in the expression levels of several genes, including FAM13C, KLK2 (associated with the androgen pathway), and GSTM2 (associated with cellular organization) at 12 months. Noni supplementation was associated with favorable clinical parameters, including stable serum PSA among most patients and no evidence of tumor on repeat biopsy, and correlated with modulation of numerous genes and proteins.

Keywords

Prostate Cancer, Active Surveillance, Noni

Abbreviations and Acronyms

AE = adverse events
AP-1 = activating protein-1
EGF = epidermal growth factor
MVD = microvessel density
NCCN = National Comprehensive Cancer Network
PIRADS = Prostate Imaging–Reporting and Data System
PSA = prostate-specific antigen
RT-PCR = reverse transcription polymerase chain reaction
TPA = tumor-promoting phorbal ester
TSA = tyramide signal amplification

Introduction

Prostate cancer (PCa) is the most common malignancy affecting men, with an estimated 191 930 cases per year in the United States.[1] Despite the high incidence, disease-related mortality statistics are quite favorable compared to other cancers. For example, fewer than one-third of men diagnosed with PCa will die of the disease, making it considerably less lethal than lung and colorectal cancers, which rank first and second respectively in terms of cancer-related deaths.[1] Prostate-specific antigen (PSA) is a serum-based biomarker used for PCa screening and detection. The high proportion of PSA-detected cancers in current clinical practice is mainly responsible for the stage migration since patients with early PCa are now diagnosed at a lower tumor stage and grade compared to PCa patients 1 or 2 decades ago.[2] Although PSA testing may allow for earlier curative therapy of potentially life-threatening disease; it also identifies a large group of patients with a relatively low risk of disease progression or relapse in whom radical therapy may be unnecessary and harmful due to its associated morbidity and costs.[3] Thus, the optimal treatment strategy for these patients with early PCa (ie, very low-risk and low-risk disease) is unknown.

Morinda citrifolia (noni), a traditional medicine of Native Hawaiians, Other Pacific Islanders, and Asian populations, has been used to treat various diseases for centuries.[4] Previously, noni has been reported to have significant antioxidant activity due to asperulosidic acid (an iridoid glycoside), damnacanthal (an anthraquinone), and scopoletin (a coumadin).[5] These compounds have been shown *in vitro* cellular and molecular biologic studies to inhibit cancer development and progression. Specifically, asperuloside was reported to suppress tumor-promoting phorbal ester (TPA)- or epidermal growth factor (EGF)-induced cell transformation and associated activating protein-1 (AP-1) transcription factor activity[6]; damnacanthal, which has strong tyrosine kinase-inhibitory effects, can support apoptosis, and has been shown to induce normal phenotypes in ras-transformed cells[7]; and scopoletin possesses antiproliferative effects.[8]

Therefore, based on the above data, we set out to conduct a case study in which we administered oral noni to test the hypothesis that noni supplementation would modify gene expression of a relevant clinical signature in the prostate of men on active surveillance for PCa.

Methods

Participants

Patients from 2 healthcare facilities (in Honolulu and Hilo, HI) with very low risk (<5% risk of disease relapse after primary treatment, criteria; cT1c, Gleason ≤6, PSA <10 ng/mL, fewer than 3 positive biopsy cores ≤50% cancer in any biopsy core, PSA density <0.15 ng/mL/g) or low risk (10% risk of disease

relapse after primary treatment, criteria; cT1-2a, Gleason ≤6, PSA <10 ng/mL)[9] prostate cancer, who were considering active surveillance were approached for study enrollment. Gleason score is the most common prostate cancer grading system used and is interpreted from a core biopsy, which is a procedure where a needle is passed through the skin to take a sample of tissue from a mass or lump. If a core biopsy is noted to harbor cancer, it is considered a positive core for cancer. Also, 2 key pre-study criteria must have been met. First, the commercial Oncotype DX prostate cancer test (Genomic Health, Redwood City, CA) had to have been performed and confirmed very low-risk or low-risk disease. Second, pre-study prostate multiparametric MRI must have demonstrated no extraprostatic disease and be devoid of PIRADS >3 lesions. All participants signed an institutional review board approved informed consent. The study (NCT02648919) was approved by Western IRB (WIRB #20151535) and received an Investigational New Drug application approval from the Food and Drug Administration.

Treatment

Participants in the study were enrolled at a single dose level of noni (620 mg tablets, Healing Noni, Hilo, HI) administered 3 times a day as 3 capsules with breakfast, 3 capsules with lunch, and 4 capsules with dinner, for a total daily dose of 6200 mg/day. This dose was determined by a previous phase 1 study in cancer participants to be safe.[10,11] All participants were evaluated for adverse events (AEs). AEs and laboratory values were graded using the National Cancer Institute's Common Terminology Criteria for Adverse Events, version 5.0. Dose de-escalation was not allowed. If an AE was reported, noni was held until resolution of the AE. If the hold of noni was >21 days, the participant was removed from the study. Also, noni was also permanently discontinued for grade 3 and 4 AEs, unless not related to therapy.

During the study, participants were asked to self-administer the study medication, avoid consumption of additional noni, and complete daily drug logs to record study agent intake and concomitant medications. Participants were expected to maintain ≥85% compliance with study agent intake; comply with dietary, medication, and supplement restrictions; and complete drug logs to the best of their ability. Participants were interviewed at quarterly clinic visits, and pill counts were performed to verify compliance with study requirements.

Follow-up

Participants were seen quarterly in urology clinics, and serum PSA levels were measured. Serum for blood chemical, hematological, and clotting analyses were obtained at baseline and study conclusion (month 12). Furthermore, at 12 months, the participants underwent a repeat transrectal ultrasound-guided prostate biopsy (minimal 10 cores), similar to the original diagnostic biopsy. Disease progression was defined as an increase in Gleason score, increased number of positive cores, or increased tumor volume.

Gene Expression

Gene expression allows the measurement of expression of certain genes associated with cancers ability to grow. Briefly, histologic evaluation of hematoxylin and eosin (H&E) pathology sections confirmed that the core prostate biopsy tissue used to assess gene expression contained viable tumor. Cores between 3 and 10 mg from each participant were homogenized with a QIAGEN TissueRuptor before total RNA was extracted with the QIAGEN RNeasy Mini kit. The resulting RNA was quality checked with an Agilent Bioanalyzer. From the RNA, cDNA was synthesized using ReverTra Ace™ qPCR RT Master Mix with gDNA Remover (Toyobo, Osaka, Japan). Real-time PCR was performed with CFX96 Touch Real-Time PCR Detection System (Bio-Rad Laboratories, Hercules, CA). Primers for the following 12 targets: androgen pathway (*AZGP1, KLK2, SRD5A2*, and *FAM13C*), cellular organization (*FLNC, GSN, TPM2,* and *GSTM2*), proliferation (*TPX2*), and stromal response (*BGN, COL1A1,* and *SFRP4*) along with 5 reference genes[12] for normalization are reported in Supplemental Methods.

Cytokine and Serum Scopoletin Levels

Cytokines, small secreted proteins released by cells allowing interactions and communications with other cells, were quantified in the serum of study participants. Many cytokines are related to inflammation, which is common in cancer, while noni is known to have anti-inflammatory properties. Whole blood was collected in sodium heparin tubes at baseline, 3, 6, 9, and 12 months. Within 2 hours, the blood was processed, separating buffy coat from serum. Both were snapped frozen and stored at -80^{0}C until further analysis. Then, 2 aliquots of serum from each participant at each time point were thawed, 1 aliquot was used for cytokine testing, and the other for scopoletin testing. Serum samples were profiled for 22 cytokines using a customized Luminex assay (Cat # FCSTM18-22, R&D Systems, Minneapolis, MN) as per assay instructions. Measurements were performed in duplicate using a Luminex 200 instrument (Luminex Corporation, Austin, TX) and were analyzed using a standard curve for each molecule (xPONENT® *software, Luminex Corp*oration). Serum scopoletin, a metabolite of noni and a surrogate to quantitatively assess drug compliance, was measured as previously reported.[11] Briefly, serum samples collected at baseline and 9 months were subjected to High Performance Liquid Chromatography with Electrochemical Detection (HPLC-ECD) as an objective marker of compliance to noni therapy.

Multiplex Immunofluorescence Staining

Multiplex immunofluorescence staining allows the analysis of several key molecules, in this case, CD31, cleaved caspase-3,

and Ki-67, which are surrogates for angiogenesis, apoptosis, and cellular proliferation, respectively, in a single biopsy sample from a participant. Multiplex immunofluorescence staining was performed automatically in the DISCOVERY ULTRA system (Ventana Medical Systems, Inc., Tucson, AZ) using individual tyramide signal amplification (TSA)-conjugated fluorophores to detect various targets. Paraffin-embedded tissue samples were stained with a prediluted mouse monoclonal anti-CD31 (Cat # 760-4378, Roche Diagnostics, Indianapolis, IN), a 1:2000 dilution of rabbit monoclonal anti-cleaved caspase-3 antibody (Cat # 9661, Cell Signaling, Danvers, MA), a prediluted rabbit monoclonal anti-Ki-67 antibody (Cat # 790-4286, Roche Diagnostics) and a prediluted mouse anti-cytokeratin 8/18 antibody (Cat # 760-4344, Roche Diagnostics) as previously reported.[13] Secondary OmniMap antibodies were purchased from Roche Diagnostics. The tyramide signal amplification (TSA) was purchased from Perkin Elmer, and the polymer amplification system was obtained from VECTOR labs. The immunofluorescent staining was performed with DISCOVERY RED610 kit (cleaved caspase-3: #760-245, Ventana Medical Systems, Inc.), DISCOVERY FAM kit (cytokeratin 8/18: #760-243, Ventana Medical Systems, Inc.), DISCOVERY DCC Kit (Ki-67: # 760-240, Ventana Medical Systems, Inc.), and DISCOVERY Rhodamine 6G Kit (CD31: # 760-244, Ventana Medical Systems, Inc.). Lastly, the slides were mounted in ProLong™ Gold Antifade Mountant with DAPI (Life Technologies, Carlsbad, CA). The slides were digitized on the high-resolution TissueFAXS 200 scanner system (Tissuegnostics, Vienna, Austria) with 20x magnification, and images were sequentially analyzed with NIH ImageJ.

Power Analysis

The study was designed to test feasibility (ie, whether subjects could be identified, recruited, followed, and samples collected for correlative studies); therefore, a single-arm design was chosen over a 2-arm with placebo control. The primary outcome was the change in expression of the 12 genes that comprise the Oncotype DX prostate cancer test from baseline to 12 months of noni supplementation. This prospective case study was to generate high-quality preliminary data and demonstrate feasibility. Pearson correlation coefficient tests with a 5% significance level (2-sided) and 80% power allows sample sizes of 6 participants to detect a difference between the null hypothesis correlation of 0 and the alternative hypothesis correlation of 0.76.[14] The maximum width of the 95% confidence interval for proportions associated with sample sizes of 6 is 0.63.[15]

Results

From January 1, 2016, to December 2017, 6 of 10 participants who were screened were enrolled. The mean age was 66.6 years, 83% (n=5) had low-risk cancer, and 17% (n=1) had very low-risk cancer. All 6 participants completed the 12-month intervention period. Baseline characteristics of the participants are depicted in Table 1. Noni supplement was well tolerated with only 1 participant (participant #5) experiencing a treatment-related AE (grade 2 diarrhea), which improved with a 7-day drug discontinuance (data not shown). Compliance with the daily administration of 6200 mg of noni was generally excellent based on the drug logs and returned drug vials, with a mean of <3% of doses missed per month per participant. Though we collected serum throughout the study for analysis, the 9-month serum was more representative of drug compliance as a noncompliant participant may begin to take the drug before the 12-month final visit, and thus reported. As such, the median serum scopoletin was 5.1 ng/mL (range, <0.5–15.0 ng/mL) at 9 months, up from a median of 2.1 ng/mL (range, <0.5–3.2 ng/mL) at baseline. One participant (participant #6) may have been noncompliant despite the drug logs and visual inspection of drug vials.

Table 1. Patient Demographics and Clinical Presentation (N=6)

Subject ID	Age	Race	Serum PSA	Clinical T Stage[a]	Risk Category	MRI[b]	GPS[c]
Ppt 1	62	White	4.4	T2a	Low	PIRADS 3, max 13 mm without ECE	37
Ppt 2	74	Asian	5.4	T1c	Low	PIRADS 3, max 11 mm without ECE	34
Ppt 3	75	Native Hawaiian/ Other Pacific Islander	7.3	T1c	Very low	PIRADS 3, max 14 mm without ECE	17
Ppt 4	62	White	9.7	T1c	Low	PIRADS 3, max 10 mm without ECE	36
Ppt 5	58	Unknown	6.9	T1c	Low	PIRADS 3, max 12 mm without ECE	38
Ppt 6	69	Asian	7.9	T1c	Low	PIRADS 3, max 19 mm without ECE	39

Abbreviations: ECE, extracapsular extension; GPS, genomic prostate score; MRI, magnetic resonance imaging; PIRADS, Prostate Imaging–Reporting and Data System; PSA, prostate-specific antigen. [a] Based on the results of the digital rectal exam. [b] PIRADS score based on size of lesion(s) and whether ECE is noted on MRI. [c] Analysis of initial prostate biopsy.

Only 1 of 6 participants (participant #1) experienced an overall increase in PSA levels of >30%, though his total PSA was still below 10 ng/ml, the other participants showed stable PSA levels (+/-15% from baseline; Figure 1). Though rising serum PSA levels are problematic, serum PSA is not used as a marker of treatment response except when definitive therapy (eg, prostatectomy, radiation therapy) is rendered.[16] No abnormalities were found in chemical, hematological, and clotting analyses in the 6 participants (data not shown).

All 6 participants underwent a repeat biopsy at 12 months, noted as post-therapy biopsy (Figure 2). At the time of biopsy, the palpable disease was not appreciated in any participant. Two participants did not have histologic evidence of cancer on biopsy, while 1 participant showed atypia. It has been reported that over 35% of men on active surveillance may have a negative prostate biopsy when a 12-month prostate biopsy is performed.[17] However, in the current study, 2 participants had increases in their Gleason score (6 to 7). Both of these participants also showed an increase in the absolute number of positive cores and an increase in the percentage of positive cores (Figure 2).

Furthermore, though underpowered, there was no significant difference between pre-treatment and post-treatment levels of markers of microvessel density (MVD also termed "angiogenesis"; CD31), apoptosis (cleaved caspase-3), and proliferation (Ki-67) (data not shown). Similarly, immunofluorescent staining of the pre-treatment and post-treatment biopsies depicts the spatial relationship between MVD, apoptosis, and proliferation (Figure 2).

Using RT-PCR, the gene expression of 12 transcripts, which comprise the Oncotype DX prostate cancer test, was queried. The alteration of androgen, cellular organization, proliferation, and stromal response pathways after noni therapy is illustrated with a heatmap (Figure 3). Two participants showed increased expression of *FAM13C, KLK2* (associated with androgen pathway), and *GSTM2* (associated with cellular organization) over the study period. However, no participants had reductions in common genes. Furthermore, serum analysis showed increases in IL6 and CXCL10 in 2 participants while on treatment, while most other cytokines were reduced while on treatment (Figure 4).

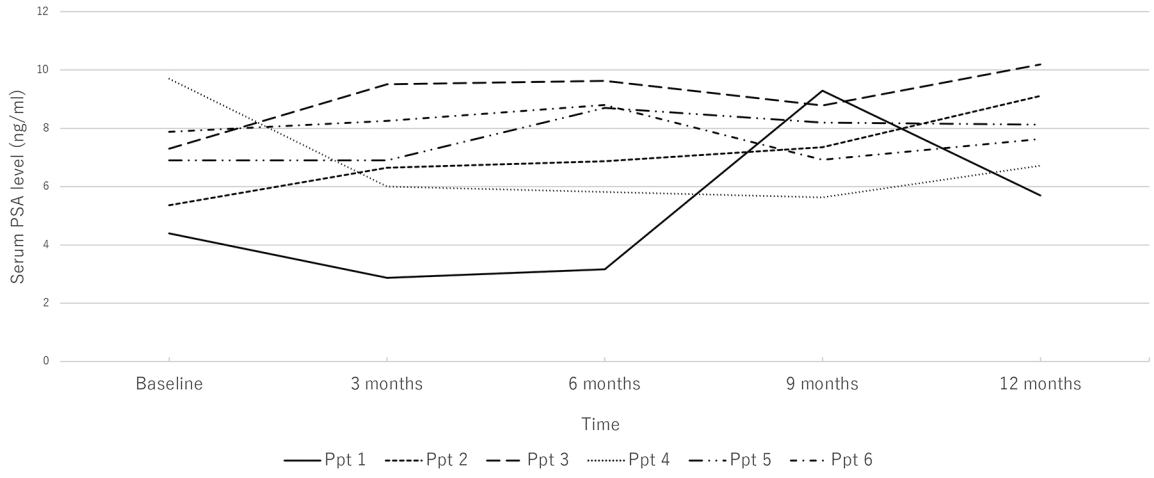

Figure 1. Serum PSA Spider Plot of Participants while Receiving Noni Treatment

Subject ID	Biopsy Status	Gleason Score	Number of Positive Cores	Percentage Positive Core
Ppt 1	Pre-therapy	3+3	1	12.5
	Post-therapy	3+3	6	75
Ppt 2	Pre-therapy	3+3	2	14.3
	Post-therapy	4+3	5	35.7
Ppt 3	Pre-therapy	3+3	1	12.5
	Post-therapy	4+3	3	33.3
Ppt 4	Pre-therapy	3+3	1	9.1
	Post-therapy	Atypia	0	0
Ppt 5	Pre-therapy	3+3	1	11.1
	Post-therapy	N/A	0	0
Ppt 6	Pre-therapy	3+3	1	8.3
	Post-therapy	N/A	0	0

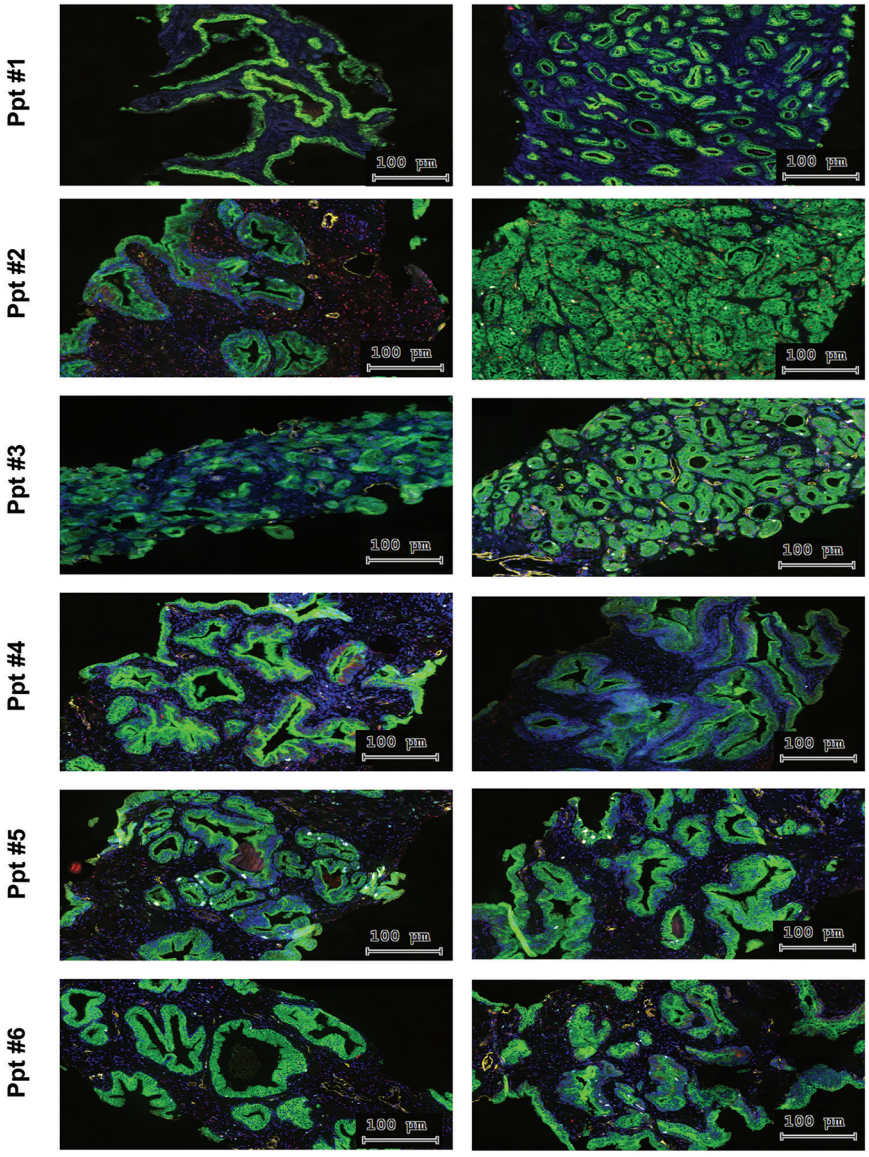

Figure 2. Histopathological Changes of Prostate Tissue Associated with Noni Treatment. The slides were digitized on the high-resolution TissueFAXS 200 scanner system (Tissuegnostics, Vienna, Austria). Right column, pre-therapy biopsy and left column post-therapy biopsy. 20x magnification immunofluorescence images of prostate tissues show staining with DAPI (blue), CD31 (angiogenesis marker, yellow), Ki67 (proliferation marker, sky blue), cleaved caspase 3 (apoptosis marker, red), and CK8/18 (epithelial marker, green)

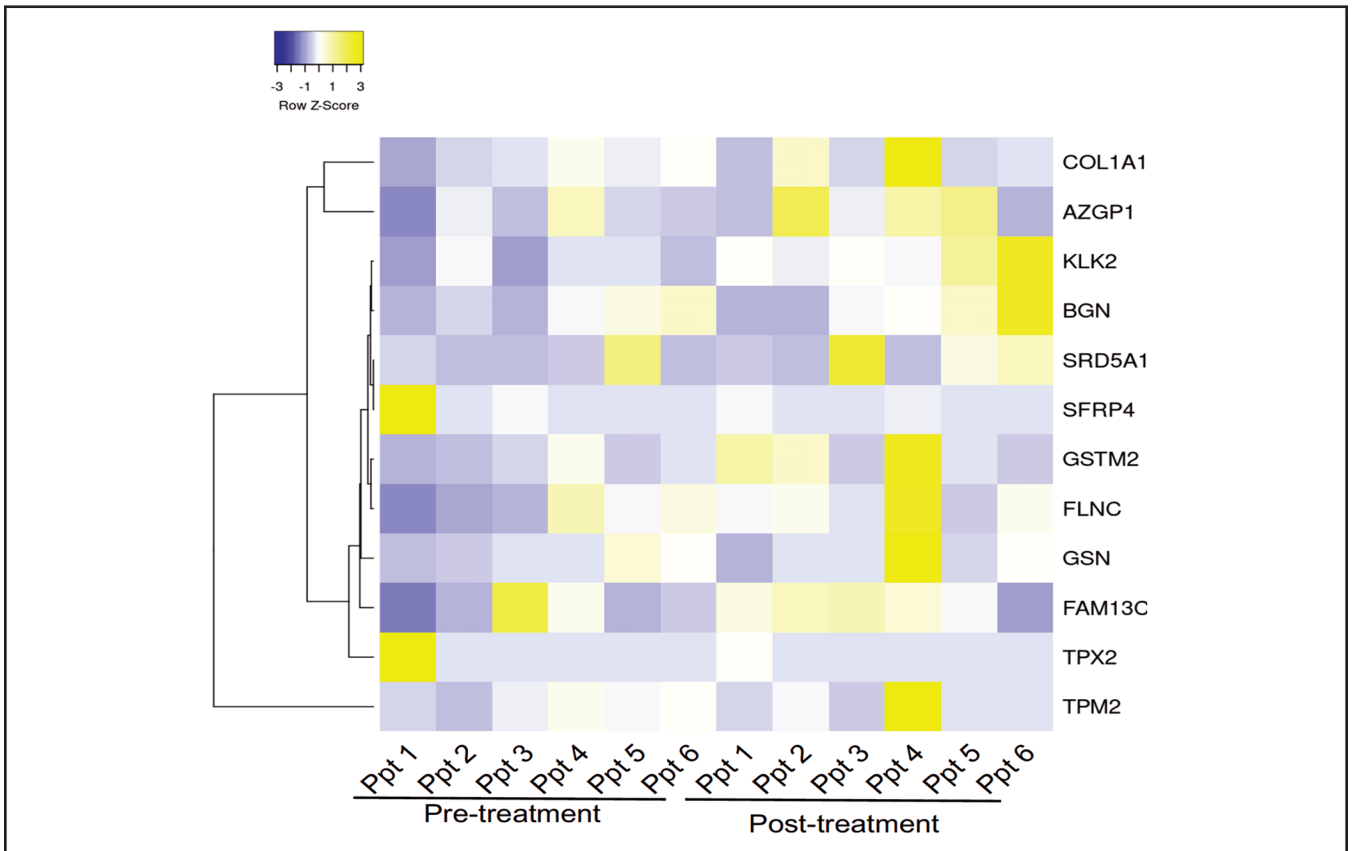

Figure 3. Heatmap Illustrating Differences in the 12-Transcript Expression Among the Six Participants. Cluster analysis of RT-PCR data profiling in six participants. Each row represents one of the 12 transcripts present in Oncotype Dx Prostate Cancer test and each column a participant. The scale represents standard deviations from the mean after a Z-transformation of signal values of a gene across all samples. Yellow represents a higher level of gene expression and blue a lower level, relative to the mean across all samples for each gene.

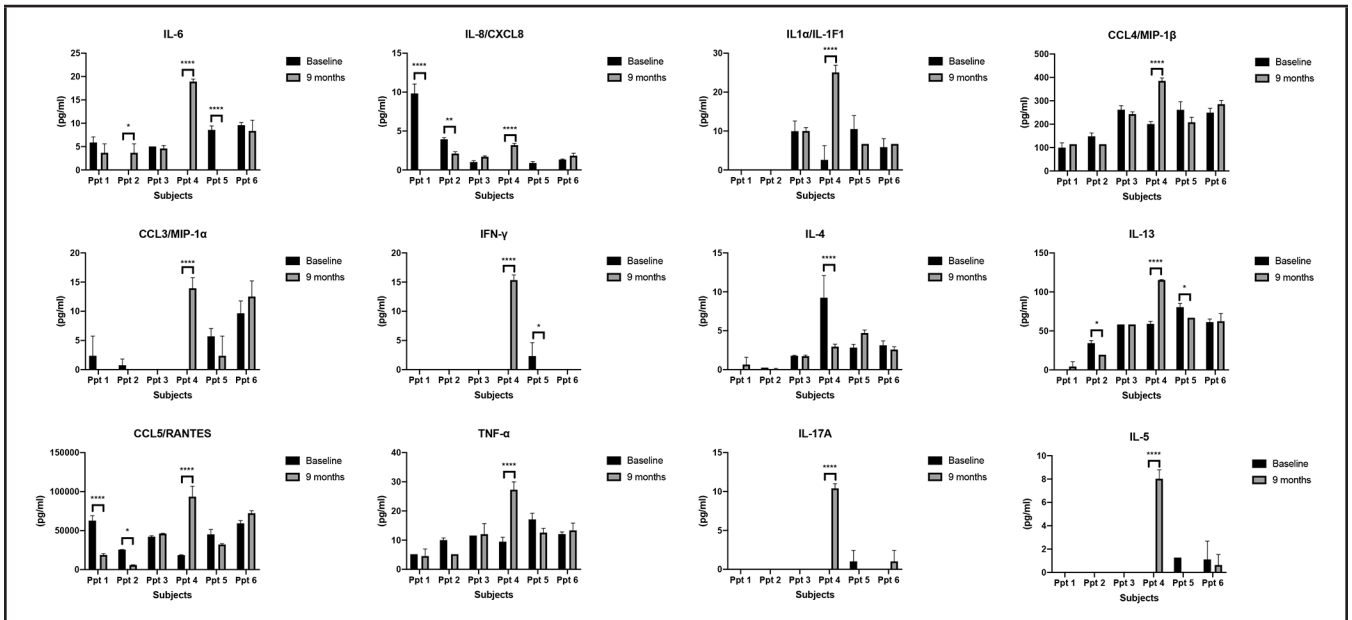

Figure 4. Changes in Serum Cytokine Profiles following Noni Treatment. A panel of cytokines were queried in serum samples collected at 9 months and compared to samples collected at baseline using the 22-plex customized human cytokine Luminex assay (R&D Systems).

Discussion

Identification of the suitable patient population is fundamental to the development of an appropriate treatment strategy. For patients with PCa, the outcome after therapy has been shown to be dependent on tumor stage, serum PSA, and Gleason score (grade).[18-20] Because of this association, PCa can be stratified as very low risk (<5% risk of disease relapse after primary therapy, criteria; cT1c, Gleason ≤6, PSA <10 ng/mL, fewer than 3 positive biopsy cores ≤50% cancer in any core, PSA density <0.15 ng/mL/g); low risk (10% risk of disease relapse after primary therapy, criteria; cT1-2, Gleason ≤6, PSA <10 ng/mL); intermediate risk (25% risk of disease relapse after primary therapy, criteria; cT2b-2c, Gleason 7, PSA 10–20 ng/mL) and high risk (>50% risk of disease relapse after primary therapy, criteria; cT3a, Gleason 8–10, PSA ≥20 ng/mL). Thus, it is important to tell patients with very low-risk and low-risk PCa that long-term survival is possible with conservative management. Despite this information, 56% to 91% of very low-risk or low-risk PCa are reluctant only to surveil their PCa.[21] Thus, an opportunity exists to incorporate a therapeutic option, with minimal side effects, into the armamentarium of physicians caring for patients with very low-risk and low-risk PCa.

We report that the administration of noni in men with very low-risk or low-risk PCa was feasible and well tolerated in most patients, which is aligned with previous studies from our group.[10,11] Critical molecular modulation associated with treatment includes reduced tumor vasculature (MVD) in Ppt 3 (P =.013) and 5 (P =.00011), reduced cellular proliferation in post-treatment decreased in Ppt 2 (P =.070) and 3 (P =.0036) and increased apoptosis, program cell death in Ppt 2 (P =.074). Furthermore, we noted modification in gene expression profile while on treatment. Specifically, *FAM13C* and *KLK2* (markers of androgen metabolism) and *GSTM2* (a marker of cellular organization) were increased over time in 2 participants, which may hint at noni-induced changes. Identifying a difference in gene expression with the initiation of noni will support the design of future studies with adequate power.

Diet has long been associated with PCa etiology.[22] The most provocative data supporting the influence of dietary factors on the incidence of PCa come from international studies and studies of immigrant populations in the United States. For example, historically, the incidence of PCa in Japan has been extremely low. However, as Japanese men migrate to Hawai‘i or the US mainland and subsequently adopt western culture, their incidence of PCa rapidly approaches that of whites.[23,24] The diets of native Japanese and other Asians are rich in fiber and low in saturated fat. These cultural differences may contribute to the lower rates of clinical PCa in Asia compared to Northern Europe and North America.

Furthermore, the influence of dietary interventions and their role in prevention and treatment have been highly speculated. Recently, the Men's Eating and Living (MEAL) Study (CALGB 70807 [Alliance]), a randomized clinical trial conducted at 91 US urology and medical oncology clinics that enrolled 478 men aged 50 to 80 years with biopsy-proven very low-risk or low-risk PCa, was reported. Patients were randomized to a counseling behavioral intervention promoting 7 or more daily vegetable servings or a control group. Among 478 patients randomized (mean age [SD], 64 [7] years; mean PSA level [SD], 4.9 [2.1] ng/mL), 443 (93%) eligible patients were included in the primary analysis. There were 245 progression events (intervention: 124; control: 121) with no significant difference in time to progression (unadjusted hazards ratio, 0.96 [95% confidence interval {CI}, 0.75–1.24]; adjusted hazard ratio, 0.97 [95% CI, 0.76 –1.25]) between the 2 groups.[25] We anxiously await novel correlative analysis from this study as it could shed light on the association between diet and cancers.

In our case study, we explored a well-known medicinal fruit from the Pacific, *Morinda citrifolia* or noni, in men with very low-risk or low-risk PCa. We treated 6 men with 6200 mg per day for 12 months. Our dose regimen was based on a previous phase 1 study, which we conducted.[10,11] Overall, the treatment was well tolerated. Serum PSA levels at study entry were not significantly different after 12 months of therapy (median, 7.1 ng/mL, [range, 4.4–9.7] versus median, 7.9 ng/mL [range, 5.7–10.23], respectively). Furthermore, 50% of participants had a negative prostate biopsy at 12 months.

Currently, gene expression CLIA assays (Oncotype DX®, Genomic Health, Redwood City, CA and Prolaris®, Myriad, Salt Lake City, UT) are available to assist clinicians in determining the likelihood of more aggressive cancer[26,27] or determining the likelihood of having metastatic disease[23] and have been incorporated into current National Comprehensive Cancer Network (NCCN) guidelines.[9] Thus, we sought to study the ability of noni supplementation to modify mRNA expression levels of the genes related to determining the likelihood of aggressive disease. Initially, Genomic Health was to perform the analysis on baseline tissue and then tissue obtained at 12-month biopsy. Unfortunately, Genomic Health could not run the assay on 12-month prostate biopsy samples in which active cancer was not identified. Even though Genomic Health performed GPS assay on all baseline prostate biopsies, our laboratory performed RT-PCR on 12-month and baseline (comparator) tissue. As evident in Figure 3, noni treatment was associated with increases in expression of *FAM13C* (Ppt 1 and 4), *KLK2* (androgen signaling, Ppt 2 and 4), and *GSTM2* (cellular structure, Ppt 1 and 3), and increases in serum cytokines IL6 and CXCL10.

Scopoletin is 1 of many metabolites of noni. Perhaps its presence in the blood occurs in patients who can better metabolize noni into its active components. A similar phenomenon has been reported with isoflavone supplements, with higher levels of free serum equol reported in patients who responded to isoflavone therapy.[28] If effective metabolism is the key, then

serum scopoletin levels may be a valuable surrogate to monitor molecular changes associates with noni.

There are several weaknesses of this study. First, the study is only a single-arm, pilot study, demonstrating the feasibility of deploying a dietary intervention to this population. Second, we could not verify any positive or negative clinical or molecular trends due to noni ingestion, mainly due to small sample size and interpatient variability.

We report in a case study that long-term noni treatment in men with very low-risk or low-risk PCa was feasible to perform and was associated with favorable gene expression changes. Consideration should be given for additional testing of noni in human clinical trials involving men with very low-risk and low-risk PCa.

Supplementary Method

Preamplification

The cDNA was preamplified using SsoAdvanced™ PreAmp Supermix (Bio-Rad Laboratories, Hercules, CA) and PrimePCR™ PreAmp for SYBR® Green Assays for each target gene according to the manufacturer's instructions (Supplementary Table 1). The preamplification was performed in a thermal cycler under the following conditions: 95°C for 10 min followed by 8 cycles of 95°C for 15 sec and 60°C for 4 min.

Quantitative Reverse Transcriptase-PCR

The amplified product was mixed with iTaq Universal SYBR Green Supermix, and 20 µl of the PCR reaction mix was applied into each well. qPCR was performed for 45 cycles in a CFX96 Touch Real-Time PCR Detection System (Bio-Rad) under the following conditions: enzyme activation (95°C, 15 min), amplification (95°C for 20 sec and 60°C for 45 sec; 45 cycles in total), and cooling (40°C, 5 sec). The level of expression was calculated with the crossing point (Cp) method. All gene assays were measured in duplicate.

Conflict of Interest

None of the authors identify any conflict of interest.

Disclosure Statement

This work was supported by a research grant from NIH/NCI, R01 CA1988887 (CJR).

Supplementary Table 1. List of Primers

Genes	Unique Assay ID
Target genes	
AZGP1	qHsaCED0056827
BGN	qHsaCID0014636
COL1A1	qHsaCED0043248
FAM13C	qHsaCID0010924
FLNC	qHsaCID0012034
GSN	qHsaCID0021416
GSTM2	qHsaCED0038361
KLK2	qHsaCID0014394
SFRP4	qHsaCID0022180
SRD5A1	qHsaCID0012570
TPM2	qHsaCED0002140
TPX2	qHsaCID0016024
Reference genes	
ARF1	qHsaCED0002471
ATP5E	qHsaCID0038009
CLTC	qHsaCID0017813
GPS1	qHsaCED0038152
PGK1	qHsaCED0042912

Acknowledgment

The following cores for services provided: Analytical Biochemistry Core University of Hawai'i Cancer Center, Biostatistics Core University of Hawai'i Cancer Center, Molecular and Cellular Immunology Core University of Hawai'i, and Biobank and Translational Research Core Cedars-Sinai Medical Center.

Authors' Affiliations:
- Samuel Oschin Comprehensive Cancer Institute, Cedars-Sinai Medical Center, Los Angeles, CA (YH, JH,YS, KM CJR, HF)
- Cancer Prevention and Control Program, University of Hawai'i Cancer Center, Honolulu, HI (IP)

Correspondence to:
Charles J. Rosser MD, MBA; Cedars-Sinai Medical Center, Samuel Oschin Comprehensive, Cancer Institute, 8700 Beverly Boulevard, Los Angeles, CA 90048; Email: charles.rosser@cshs.org

References

1. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin.* 2020;70(1):7–30. doi: 10.3322/caac.21590.
2. Ohmann EL, Loeb S, Robinson D, Bill-Axelson A, Berglund A, Stattin P. Nationwide, population-based study of prostate cancer stage migration between and within clinical risk categories. *Scand J Urol.* 2014;48(5):426–435. doi: 10.3109/21681805.2014.892150. Epub 2014 Mar 11.
3. Loeb S, Bjurlin MA, Nicholson J, et al. Overdiagnosis and overtreatment of prostate cancer. *Eur Urol.* 2014;65(6):1046–1055. doi: 10.1016/j.eururo.2013.12.062.Epub 2014 Jan 9.
4. McClatchey W. From Polynesian healers to health food stores: changing perspectives of Morinda citrifolia (Rubiaceae). *Integr Cancer Ther.* 2002;1(2):110–120; discussion 120. doi: 10.1177/153473540200100200 2.
5. Akihisa T, Matsumoto K, Tokuda H, et al. Anti-inflammatory and potential cancer chemopreventive constituents of the fruits of Morinda citrifolia (Noni). *J Nat Prod.* 2007;70(5):754–757. doi: 10.1021/np068065o. Epub 2007 May 5.
6. Liu G, Bode A, Ma WY, Sang S, Ho CT, Dong Z. Two novel glycosides from the fruits of Morinda citrifolia (noni) inhibit AP-1 transactivation and cell transformation in the mouse epidermal JB6 cell line. *Cancer Res.* 2001;61(15):5749–5756.

7. Hiwasa T, Arase Y, Chen Z, et al. Stimulation of ultraviolet-induced apoptosis of human fibroblast UVr-1 cells by tyrosine kinase inhibitors. *FEBS Lett.* 1999;444(2-3):173–176. doi: 10.1016/s0014-5793(99)00057-5.
8. Liu XL, Zhang L, Fu XL, Chen K, Qian BC. Effect of scopoletin on PC3 cell proliferation and apoptosis. *Acta Pharmacol Sin.* 2001;22(10):929–933.
9. Carroll PR, Parsons JK, Andriole G, et al. NCCN guidelines insights: prostate cancer early detection, Version 2.2016. *J Natl Compr Canc Netw.* 2016;14(5):509–519. doi: 10.6004/jnccn.2016.0060.
10. Issell BF, Gotay CC, Pagano I, Franke AA. Using quality of life measures in a Phase I clinical trial of noni in patients with advanced cancer to select a Phase II dose. *J Diet Suppl.* 2009;6(4):347–359. doi: 10.3109/19390210903280272.
11. Issell BF, Franke A, Fielding RM. Pharmacokinetic study of Noni fruit extract. *J Diet Suppl.* 2008;5(4):373–382. doi: 10.1080/19390210802519671.
12. Knezevic D, Goddard AD, Natraj N, et al. Analytical validation of the Oncotype DX prostate cancer assay - a clinical RT-PCR assay optimized for prostate needle biopsies. *BMC Genomics.* 2013;14:690. doi: 10.1186/1471-2164-14-690.
13. Akfirat C, Zhang X, Ventura A, et al. Tumour cell survival mechanisms in lethal metastatic prostate cancer differ between bone and soft tissue metastases. *J Pathol.* 2013;230(3):291–297. doi: 10.1002/path.4180.
14. Guenther WC. Desk calculation of probabilities for the distribution of the sample correlation coefficient. *The American Statistician.* 1977;31(1):45–48.
15. Fleiss J, Levin B, Paik M. *Statistical Methods for Rates and Proportions.* 3rd ed: John Wiley & Sons; 2003.
16. Rosser CJ. Prostate cancer--to screen, or not to screen, is that the question? *BMC Urol.* 2008;8:20. doi: 10.1186/1471-2490-8-20.
17. Anai S, Nakamura K, Chang MN, Pendleton J, Yacoub S, Rosser CJ. The feasibility of expectant management with inner-city men with newly diagnosed localized prostate cancer. *J Health Care Poor Underserved.* 2008;19(1):164–170. doi: 10.1353/hpu.2008.0024.
18. D'Amico AV, Whittington R, Malkowicz SB, et al. Biochemical outcome after radical prostatectomy, external beam radiation therapy, or interstitial radiation therapy for clinically localized prostate cancer. *JAMA.* 1998;280(11):969–974.
19. Freedland SJ, Terris MK, Csathy GS, et al. Preoperative model for predicting prostate specific antigen recurrence after radical prostatectomy using percent of biopsy tissue with cancer, biopsy Gleason grade and serum prostate specific antigen. *J Urol.* 2004;171(6 Pt 1):2215–2220. doi: 10.1097/01.ju.0000124463.13319.0a.
20. Kattan MW, Eastham JA, Stapleton AM, Wheeler TM, Scardino PT. A preoperative nomogram for disease recurrence following radical prostatectomy for prostate cancer. *J Natl Cancer Inst.* 1998;90(10):766–771. doi: 10.1093/jnci/90.10.766.
21. Fang AM, Glaser ZA, Rais-Bahrami S. Increasing the use of active surveillance for prostate cancer in younger men. *Cancer.* 2019;125: 3292–3295. doi: 10.1002/cncr.32333.
22. Pienta KJ, Esper PS. Risk factors for prostate cancer. *Ann Intern Med.* 1993;118(10):793–803. doi: 10.7326/0003-4819-118-10-199305150-00007.
23. Haenszel W, Kurihara M. Studies of Japanese migrants. I. Mortality from cancer and other diseases among Japanese in the United States. *J Natl Cancer Inst.* 1968;40(1):43–68.
24. Shimizu H, Ross RK, Bernstein L, Yatani R, Henderson BE, Mack TM. Cancers of the prostate and breast among Japanese and white immigrants in Los Angeles County. *Br J Cancer.* 1991;63(6):963–966. doi: 10.1038/bjc.1991.210.
25. Parsons JK, Zahrieh D, Mohler JL, et al. Effect of a behavioral intervention to increase vegetable consumption on cancer progression among men with early-stage prostate cancer: The meal randomized clinical trial. *JAMA.* 2020;323(2):140–148. doi: 10.1001/jama.2019.20207.
26. Klein EA, Cooperberg MR, Magi-Galluzzi C, et al. A 17-gene assay to predict prostate cancer aggressiveness in the context of Gleason grade heterogeneity, tumor multifocality, and biopsy undersampling. *Eur Urol.* 2014;66(3):550–560. doi: 10.1016/j.eururo.2014.05.004. Epub 2014 May 16.
27. Oderda M, Cozzi G, Daniele L, et al. Cell-cycle progression-score might improve the current risk assessment in newly diagnosed prostate cancer patients. *Urology.* 2017;102:73–78. doi: 10.1016/j.urology.2016.11.038. Epub 2016 Nov 25.
28. Pendleton JM, Tan WW, Anai S, et al. Phase II trial of isoflavone in prostate-specific antigen recurrent prostate cancer after previous local therapy. *BMC Cancer.* 2008;8:132. doi: 10.1186/1471-2407-8-132.

Psychometric Evidence of the Attitudes Toward Food Scale for Native Hawaiians

Olivia K. Uchima PhD; George M. Harrison PhD; Phoebe W. Hwang DrPH; Ilima Ho-Lastimosa MSW; and Jane J. Chung-Do DrPH

Abstract

Many efforts are being made to promote healthy eating habits and nutrition among Native Hawaiian communities by cultivating positive attitudes toward healthy foods. However, there are limited quantitative scales that have been psychometrically validated with Native Hawaiian communities. This paper examines evidence on the reliability and validity of the Attitudes Toward Food (ATF) scale used with 68 Native Hawaiian adults from Waimānalo who are participating in a backyard aquaponics intervention called Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics (MALAMA). Exploratory factor analysis (EFA) and internal consistency reliability analysis were conducted to examine the underlying constructs of the ATF scale. Cognitive interviews with 3 MALAMA participants were also conducted to analyze how participants understood, processed, and responded to the scale. Findings from the cognitive interviews provided response-process evidence of validity and acceptability. Findings from the EFA revealed 2 factors. Factor 1 contained items that discussed confidence in preparing and using healthy foods. Factor 2 contained items that involved the consumption of healthy foods. The reliability analysis suggested that the 2 factors of the ATF scale are internally consistent (Cronbach's alpha = 0.79 and 0.71, respectively). Taken together, the evidence provides provisional support for the validity and reliability of the instrument for measuring attitudes among Native Hawaiians from Waimānalo. The ATF scale may be useful for similar health and nutritional programs for Native Hawaiians in Hawai'i. Future studies with larger samples and diverse sources of validity evidence may provide additional support of the scale's validity.

Keywords

nutrition, aquaponics, Hawai'i, rural community, validity

Abbreviations and Acronyms

ATF = Attitudes Toward Food scale
CFA = confirmatory factor analysis
EFA = exploratory factor analysis
FAB = Food Attitudes and Behavior scale
KMO = Kaiser–Meyer–Olkin measure of sampling adequacy
MALAMA = Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics

Introduction

Native Hawaiians developed a deep understanding of how to manage and maintain Hawai'i's natural resources to feed and perpetuate a healthy and robust population. The values of pono (righteousness) and lōkahi (balance and harmony) ensured the physical, mental, and spiritual parts of the person were in balance.[1-3] Western intrusion and the illegal overthrow of the Hawaiian Kingdom in 1893 resulted in drastic changes to the lifestyles, cultural practices, and traditional food systems of Native Hawaiians.[2-4] Specifically, traditional food staples, which are high in protein and complex carbohydrates and low in fat, were replaced with a highly processed Western diet high in saturated fat, sodium, and sugar.[5]

Presently, Native Hawaiian life expectancy is one of the shortest among the major ethnic groups in Hawai'i, with a 10-year gap compared to Japanese and Chinese residents.[6,7] Native Hawaiians experience social and health disparities, including chronic diseases related to nutrition and obesity.[8] Native Hawaiians suffer from high rates of cardiovascular morbidity and mortality and face social determinants and structural barriers that prohibit them from achieving optimal health, such as having the lowest levels of educational attainment, lowest mean income, highest poverty rates, and the highest prevalence of current, everyday smokers compared to White, Japanese, and Chinese adults in Hawai'i.[8] Native Hawaiians also experience greater difficulty accessing westernized health care services due to socioeconomic disparities, lack of cultural relevance, and institutionalized discrimination.[9]

Efforts have been made to restore Native Hawaiian cultural practices to improve the inequities surrounding health, self-governance, education, and research.[10] Many programs and research studies that integrate the values and practices of traditional food production, such as mālama *'āina* (taking care of the land), have been shown to yield promising results in promoting health outcomes with indigenous peoples.[11-14] Waimānalo is a rural community with approximately one-third of the residents identifying as Native Hawaiian. Residents of Waimānalo not only experience a lack of personal health services and high rates of economic, cultural, and linguistic barriers to receiving health care, but more than 30% of households are food insecure (ie, limited access to nutritious food) as a result of socioeconomic and other factors.[15] However, there is strong community cohesion and retention of Native Hawaiian values within this community. Mini Ahupua'a for Lifestyle and Mea'ai through Aquaponics (MALAMA) seeks to address these challenges and leverage these strengths by using a backyard aquaponics intervention that integrates Native Hawaiian cultural practices and values. The MALAMA researchers collected clinical health indicators (eg, blood pressure, hemoglobin A1C, cholesterol, and body mass index) and administered a health survey that included the Attitudes Toward Food (ATF) scale to assess the long-term health impact of the intervention.

The Theory of Planned Behavior and the Attitude-Social Influence-Self-Efficacy model have been utilized to study cognitive indicators of eating behaviors.[16,17] Both theories highlight the intention to consume fruits and vegetables as the most important indicator of fruit and vegetable intake.[11,12] Attitudes and self-efficacy are additional indicators that predict intention to eat fruits and vegetables.[16,17] Attitudes are an individual's expectations and evaluations about a health behavior, whereas self-efficacy is the individual's confidence in performing a behavior or the perception that the behavior is within the person's control.[14,16,18] Research has shown positive attitudes toward fruits and vegetables (ie, people's beliefs that these foods taste good and are beneficial for health, and their confidence in preparing meals with them) are associated with higher fruit and vegetable consumption.[19]

Survey instruments for measuring attitudes and self-efficacy with fruit and vegetable intake among adults in the United States exist.[19] However, many have not been tested with Native Hawaiians who may have unique values and lived experiences that shape eating behaviors. For example, healthy eating behaviors among Native Hawaiians are maintained through indigenous values rooted in their relationships with others and their connection to the ʻāina (land).[11] However, validated instruments for measuring attitudes and self-efficacy toward food among Native Hawaiians are nonexistent. The purpose of this study was to examine the validity and reliability of the ATF scale with a Native Hawaiian community.

Validity is most appropriately evaluated by examining evidence supporting or refuting the intended types of interpretations to be drawn from an instrument.[20] There are 4 types of evidence: (1) evidence based on the content, (2) relations with other variables, (3) subjects' response processes, and (4) internal structure.[20-22] These roughly align with the so-called validity types (content, criterion-referenced, and construct validities).[21,23-25] Validation tends to be an ongoing process carried out across studies.[21,26] This study examined evidence based on (1) the response processes ("face validity") and (2) internal structure, whether the correlations among the items reflect the hypothesized dimensional structure. In classical terminology, these 2 evidence types underpin construct validity. Cognitive interviews were conducted to examine response-process validity evidence. Quantitative survey-response data were analyzed to examine evidence based on the internal structure using factor analysis and internal consistency reliability.

Methods

Participants

Participants were recruited through Native Hawaiian organizations and social groups in Waimānalo and given a gift of cultural significance valued at $10. All participants resided in Waimānalo. The inclusion criteria included (1) be a member of a family that is of Native Hawaiian ancestry, (2) being aged 18 years or older, (3) living in a home with the space to install and maintain the aquaponics system, and (4) attending 9 workshops to learn how to build and maintain an aquaponics system in their backyards. The first cohort of 10 families was a part of a separate pilot study. Twenty more families were recruited for this study and were randomly assigned to cohort 2 or cohort 3. This study was approved by the University of Hawai'i Institutional Review Board (2019-00092).

Cognitive interviews were conducted with 3 volunteers who were MALAMA participants. They were of varying literacy and educational levels to assess their understanding of the ATF scale. There were 2 males and 1 female with a median age of 50 years. The ATF survey dataset was based on follow-up data for cohort 1, baseline and follow-up data for cohort 2, and baseline data for cohort 3. There were 68 participants aged 21 to 82 years.

Cognitive Interviewing

Cognitive interviewing is a method to inform scale revisions and provide evidence of validity.[27-29] This method can detect discrepancies between how participants think through survey questions and how the developer(s) had intended them to think through and respond to the questions.[27-29] Evidence that the participants understand the questions and respond in a way that represents their status on the construct adds support to the scale's validity argument.

Each participant was interviewed one at a time. Field notes were recorded during and after the interviews. The interviews were conducted in Fall 2019 at a community event and lasted approximately 20 minutes. The interviewer used retrospective verbal probes to address comprehension, thought processes, and response processes. The probes were (1) In this question, what does the word "confident" mean to you?, (2) In this question, what does "healthy foods" mean to you?, (3) In this question, what does the word "enjoy" mean to you?, (4) How did you decide your answer to this question?, (5) How easy or hard was it to choose an answer?, (6) Are there any confusing things about this scale?, and (7) What questions do you have about this scale?

Factor Analysis

A polychoric correlation matrix was performed to determine whether the items anticipated for the types of attitudes toward food were related to each other. The polychoric correlation matrix includes estimates of each item's correlation with all other items and is more appropriate than raw data in factor analysis and reliability studies with Likert-type ordinal data.[30] The ATF scale was adapted from the Food Attitudes and Behaviors (FAB) Survey, which evaluated several factors related to fruit and vegetable intake among adults (eg, self-efficacy, social support, perceived barriers and benefits of eating fruits

and vegetables, etc).[31] The present scale modified the attitudes and beliefs section of the FAB Survey by asking questions about self-efficacy and food preferences that are consumed among Native Hawaiians. The ATF scale consisted of 8 items on a 5-point Likert-type scale, in which 1 equals "strongly disagree" and 5 equals "strongly agree." The 8 items included (1) I feel confident in my ability to prepare a healthy meal, (2) I feel confident in my ability to make laʻau (medicine) with fruits and vegetables, (3) I feel confident in my ability to use fruits and vegetables in my family's meals, (4) Eating healthy food is important to me, (5) Eating healthy food is important to my family, (6) I enjoy eating fruit, (7) I enjoy eating vegetables, and (8) I enjoy eating fish.

Statistical Analysis

For cognitive interviews, the participant responses were summarized on a question-by-question basis. Interviews were combined to identify major themes and were shared with the MALAMA research team. For the psychometric analysis, the survey data were entered into REDCap (a secured, electronic database) and then exported to R version 3.6.1.[32] Because this was an exploratory study to investigate the relationships among the questions with a new instrument, EFA was more appropriate than confirmatory factor analysis (CFA). CFA would be more appropriate if the purpose were to test whether the observed data fit a hypothesized model or there was a strong theory to guide the specification of the factor model.[33] A pairwise case analysis for the EFA was employed on the polychoric correlation matrix, represented as ρ, using the psych package.[34] This package used information from the other variables in the matrix when a case was missing any responses. EFA models were estimated to allow the factors to correlate with each other (using promax rotation). The number of factors was determined by examining scree plots and parallel analysis. Factors with eigenvalues greater than 1 were considered meaningful, as eigenvalues correspond with a proportion of total variance that is explained by the factor. For judging whether an item is meaningfully explained by a factor, an arbitrary criterion of at least a 0.40 factor loading, which is common, was established *a priori*.[33] Factor loadings are standardized regression coefficients of how strongly the factor explains an item's variance. The internal consistency using Cronbach's alpha was computed from the polychoric matrices for the final constructs. The Cronbach's alpha and coefficient omega ≥ 0.70 was set as a criterion for satisfactory reliability.[35]

Results

Sociodemographic Characteristics

The sociodemographic characteristics of the participants are shown in Table 1. The sample was primarily Native Hawaiian (87%) and female (67%). Although participants needed to be from a Native Hawaiian family, non-Hawaiian family members were included to be aligned with the family-oriented nature of the intervention. The median age was 50 years. The majority of participants had completed high school (39%) or had some college experience (34%).

Table 1. Sociodemographic Characteristics of Participants (N = 68)

	n (%)
Sex	
Female	44 (67)
Male	22 (33)
Education	
High school/GED	25 (39)
Some college/vocational/technical/AA	22 (34)
College degree (BA/BS)	9 (14)
Graduate degree (masters, PhD, MD, JD)	9 (14)
Ethnicity[a]	
Native Hawaiian	59 (87)
Chinese	28 (41)
Japanese	8 (12)
Filipino	9 (13)
Korean	3 (4)
Portuguese	21 (31)
White	32 (47)
Samoan	3 (4)
Native American	1 (2)
Latino	2 (3)
Other	13 (19)
Age, years (mean [SD]; range)	50.29 (15.31); 21–82
Number living in household (mean [SD]; range)	4.8 (2.3); 1–10

Abbreviations: GED, General Equivalency Diploma; AA, Associate of Arts; BA, Bachelor of Arts; BS, Bachelor of Science; PhD, Doctor of Philosophy; MD, Medical Degree; JD, Juris Doctor; SD, standard deviation.

[a] Participants were allowed to report more than 1 ethnicity.

Cognitive Interviews

All 3 participants reported it was easy to comprehend the items and choose a response. The participants' responses to the probes suggested they could accurately and consistently describe what confidence, healthy foods, and enjoyment meant to them. They reported confidence as being able, capable, or sure of yourself. For example, one participant stated, "My mother was a lāʻau practitioner, so I am very confident in my ability to make lāʻau." The participants shared healthy foods, including vegetables, fruits, and foods that are low in sugar and high in protein. They also stated that enjoying food means eating foods that taste good and wanting to eat the meal that was prepared. For example, one participant stated, "Enjoy means flavorful, ʻono (good). If not, I will not eat it." No patterns emerged to suggest unexpected thought processes. This evidence supported

the claim that the ATF scale was an acceptable and appropriate mechanism for measuring a participant's attitudes toward food. In other words, the cognitive interviews provided provisional evidence for validity based on the response processes and the content, which are two categories valued in validation practice.[20]

Exploratory Factor Analysis

Table 2 shows the inter-item polychoric correlation matrix estimated to represent the relationships among the items in the scale. Item 2 was negatively correlated with Item 6. There was also a high correlation between Items 1 and 3 ($\rho = 0.80$) and Items 4 and 5 ($\rho = 0.70$).

Table 2. Polychoric Correlation Matrix of the Items in the Attitudes Toward Food Scale

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8
Item 1	1.00	0.57	0.80	0.52	0.36	0.13	0.44	0.34
Item 2		1.00	0.60	0.27	0.06	-0.25	0.25	0.27
Item 3			1.00	0.62	0.45	0.29	0.59	0.35
Item 4				1.00	0.70	0.34	0.57	0.33
Item 5					1.00	0.24	0.46	0.30
Item 6						1.00	0.51	0.41
Item 7							1.00	0.49
Item 8								1.00

Polychoric correlation matrix (ρ) greater than 0.6 is considered elevated correlation.

The Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and the Bartlett Test of Sphericity identify whether factor analysis is appropriate. If these tests are not met, the correlations among variables are too weak for EFA. The results of both tests supported the factorability; the KMO was 0.69, and the sphericity test was statistically significant ($\chi^2 = 288.7$, $df = 28$, $P<.001$).[37]

Table 3. Proportion of Variance Explained by Each Potential Factor

Potential Factor	Eigenvalue[a]	Percentage of Variance	Cumulative Variance
1	**3.9**	**48.7**	**48.7**
2	**1.5**	**19.1**	**67.8**
3	0.9	11.5	79.4
4	0.6	7.6	87.0
5	0.4	5.2	92.1
6	0.3	3.6	95.7
7	0.2	2.8	98.5
8	0.1	1.5	100.0

[a] Eigenvalues are estimated from the exploratory factor analysis model. Each eigenvalue corresponds with a potential factor, with more salient factors having higher values and explaining more of the total variance in the polychoric correlation matrix. This information aids in determining the number of factors to retain; more than two-thirds of the variance is explained by 2 factors.

Inspection of the parallel analysis and proportion of variance indicated the presence of 2 factors. Table 3 shows there were 2 factors with eigenvalues greater than 1. These 2 factors could explain about 67.8% of the variance. The scree plot was deemed relatively inconclusive as the plot was gradual.

The factor loadings with promax rotation that met the 0.40 criterion are presented in Table 4. Each factor loading was named based on the items grouped in the factor. Factor 1 contained items that addressed the participants' confidence in their ability to prepare and use healthy foods (Items 1, 2, and 3). Factor 2 contained items that involved the participants eating/enjoying healthy foods (Items 4, 5, 6, 7, and 8). There was 1 complex-loading item suggesting all items except Item 6 loaded onto 1 of the 2 factors.

The items' communalities ranged from 0.29 to 0.83 and are interpreted as the proportion of variance in the item explained by the combination of factors (See Table 4). Six communalities exceeded 0.50, suggesting a good association between one another. Items 5 and 8 had the lowest communalities where 60% and 71% of the variance are unique to Item 5 and Item 8, respectively, and not shared with either factor. The correlation between the 2 factors was 0.46, indicating a moderate positive relationship between Factor 1 and Factor 2.

Table 4. Factor Loadings and Communalities[a,b]

Item	Question	Factor 1: Confidence	Factor 2: Eating/Enjoying Healthy Foods	Communalities
1	I feel confident in my ability to prepare a healthy meal.	**0.696**	0.221	0.67
2	I feel confident in my ability to make la'au (medicine) with fruits and vegetables.	**0.953**	-0.285	0.74
3	I feel confident in my ability to use fruits and vegetables in my family's meals.	**0.657**	0.398	0.83
4	Eating healthy food is important to me.	0.217	**0.654**	0.61
5	Eating healthy food is important to my family.	No value	**0.601**	0.40
6	I enjoy eating fruits.	-0.409	**0.818**	0.53
7	I enjoy eating vegetables.	0.104	**0.732**	0.62
8	I enjoy eating fish.	0.106	**0.480**	0.29

[a] Factor loadings are interpretable as correlations with a factor. For example, a 0.40 loading indicates 16% of the variable's variance is explained by the factor. This 0.40 criterion was set beforehand to aid interpretation of which items meaningfully load on which factor. Promax rotation was used, which allows the factors to correlate.
[b] An item's communality is the proportion of the item's variance explained by the 2 factors.

Reliability

There was good internal consistency reliability for the set of all 8 items in the ATF scale (Cronbach's alpha = 0.84). Based on the EFA, each factor's reliability was estimated. The reliability of Factor 1 was high enough, whereas Factor 2 was acceptable (Cronbach's alpha = 0.79 and 0.71, respectively). The reliability of both factors was good using coefficient omega at 0.83 and 0.81, respectively.

Discussion

This study examined the psychometric properties of the ATF scale adapted from the FAB Survey specifically for the Native Hawaiian population. Based on the team's knowledge, there has been no literature examining the validity and psychometric properties of a scale for Native Hawaiians.

Findings from this study suggest that the ATF scale was a multidimensional measure with 2 factors present (1) attitudes of the participants' confidence in their ability to prepare and use healthy foods, and (2) attitudes towards consumption/enjoyment of healthy foods by participants and their families. These 2 factors explained 67.8% of the variance and revealed a clear pattern of attitudes toward food that were related to each other, with no evidence of any unrelated construct unduly contributing to participants' responses. There was 1 cross-loading with Item 6, indicating its possible removal. However, the communality was more than 0.50, and its removal may alter the meaning of the scale, thereby weakening the validity from a face and content validity perspective. Variables with communalities < 0.20 are typically removed since the outcome is to explain the variance through common factors.[37,38] All the items were greater than 0.20, suggesting they should be retained.

The ATF scale had good internal consistency reliability using all 8 items as a single score. With the scores obtained from Factor 1 and Factor 2, there were fewer items in each subscale, thus decreasing the Cronbach alpha values. Nonetheless, the reliability estimates met the criterion for acceptability. The moderate correlation between these 2 factors would be expected in the social sciences and that they involve similar topics about healthy foods but are not identical constructs.[38]

Through cognitive interviews, this study provided response-process support for the validity and acceptability of the ATF scale. There were rational decision-making processes in choosing responses and good comprehension of the questions. Participants also stated that there was no confusion with the phrasing of instructions or the scale itself. There were no suggestions that could be used to make changes to the scale.

There were some potential limitations. First, this study was based on a relatively small and select population of Native Hawaiians from a specific community. Given the small sample size, multi-group differences were not analyzed. Thus, findings from this study might not be generalizable to Native Hawaiians who reside in communities other than Waimānalo participating in similar health promotion programs. Therefore, more studies should be conducted with other Native Hawaiian communities to further assess the reliability and validity of this scale. A comprehensive validity study includes evidence based on the content, response processes, internal structure, relations with other variables, and consequences.[27,36,38] This study examined 2 of these sources of evidence, suggesting the findings on validity are supportive but are provisional.

Future studies should expand on this study to determine whether the rewording or removal of Item 6 eliminates any cross-loadings. There needs to be careful consideration by the research team whether the remaining set of items still adequately represents the construct if Item 6 is removed. Therefore, feedback from content experts in the area of Native Hawaiian nutrition is imperative to test the validity of the constructs. Future studies examining this instrument's functioning with a larger sample size or with a different geographic region within the Native Hawaiian population will provide further evidence to support the provisional findings in this study. Future studies can also follow up with CFA to determine the best model fit based on the two-factor structure found in this study. Test-retest reliability should be estimated for this instrument to examine changes in attitudes over time.[33] Furthermore, future studies can address validity evidence based on content, relations with other variables, and consequences.

This study has established provisional evidence of the reliability and validity of the ATF scale to measure attitudes and behaviors related to healthy eating with a specific sample of Native Hawaiian community members. The findings provide support for future use of the ATF scale with other health and nutritional programs in Waimānalo and possibly other Native Hawaiian communities in Hawai‘i.

Conflict of Interest

None of the authors identify any conflict of interest.

Authors' Affiliations:
- Office of Public Health Studies, University of Hawai'i at Mānoa, Honolulu, HI (OKU, PWH, IH, JJC)
- College of Education, University of Hawai'i at Mānoa, Honolulu, HI (GMH)

Correspondence to:
Olivia Uchima PhD; Office of Public Health Studies, University of Hawai'i at Mānoa, 1960 East-West Road, Honolulu, HI 96822; E-mail: ouchima@hawaii.edu

References

1. Rezentes W. *Ka lama kukui Hawaiian Psychology: An Introduction*. Honolulu: A'ali'i Books; 1996.
2. Kame'eleihiwa L. *Native Land and Foreign Desires: Pohea La E Pono Ai? How Shall We Live in Harmony?* Honolulu, HI: Bishop Museum Press; 1992.
3. Mau M. *Health and Health Care of Native Hawaiian and Other Pacific Islander Older Adults*. Stanford, CA: eCampus Geriatrics; 2010.
4. Kaholokula JK, Okamoto SK, Yee BW. Special issue introduction: advancing Native Hawaiian and other Pacific Islander health. *Asian Am J Psychol*. 2019;10(3):197–205. doi: 10.1037/aap0000167
5. Kanaiaupuni S. The breakdown of the kapu system and its effect on Native Hawaiian health and diet. In: Else, I, ed. *Hūlili: Multidisciplinary Research on Hawaiian Well-being*. Volume 1. Honolulu; Kamehameha Schools; 2004: 241–255. Available from: http://ulukau.org/elib/collect/hulili04/index/assoc/D0.dir/doc261.pdf. Accessed April 17, 2020.
6. Wu Y, Braun K, Onaka AT, Horiuchi BY, Tottori CJ, Wilkens L. Life expectancies in Hawai'i: a multi-ethnic analysis of 2010 life tables. *Hawaii J Med Public Health*. 2017; 76(1):9–14.
7. Wu Y, Uchima O, Browne C, Braun K. Healthy life expectancy in 2010 for Native Hawaiian, White, Filipino, Japanese, and Chinese Americans living in Hawai'i. *Asia Pac J Public Health*. 2019;31(7):659–670. doi: 10.1177/1010539519875614
8. Look M, Trask-Batti M, Agres R, Mau M, Kaholokula J. Assessment and priorities for health & well-being in Native Hawaiians & Other Pacific peoples. Honolulu: Center for Native and Pacific Health Disparities Research. 2013. Available from: https://www2.jabsom.hawaii.edu/native/docs/community/DNHH_Assessment&Priorities_Report_2013.pdfAccessed October 20, 2019.
9. Ka'opua LS, Braun KL, Browne CV, Mokuau N, Park CB. Why are Native Hawaiians underrepresented in Hawai'i's older adult population? Exploring social and behavioral factors of longevity. *J Aging Res*. 2011; 2011(701232):1–8. doi: 10.4061/2011/701232
10. Goodyear-Kaopua N, Hussey I, Wright EK. *A Nation Rising: Hawaiian Movements for Life, Land, and Sovereignty.* Durham: Duke University Press; 2014.
11. Beebe JK, Amshoff Y, Ho-Lastimosa I, et al. Reconnecting rural Native Hawaiian families to food through aquaponics. *Genealogy*. 2020;4(1):1–9. doi: 10.3390/genealogy4010009
12. Kaholokula JK, Mau MM, Efird FT, et al. A family and community focused lifestyle program prevents weight regain in Pacific Islanders: a pilot randomized controlled trial. *Health Educ Behav*. 2012;39(4):386–395. doi: 10.1177/1090198110394174
13. Mokuau N. Culturally based solutions to preserve the health of Native Hawaiians. *J Ethn Cult Divers Soc Work*. 2011;20(2):98 –113. doi: 10.1080/15313204.2011.570119
14. Ho-Lastimosa I, Chung-Do JJ, Hwang PW, et al. Integrating Native Hawaiian tradition with the modern technology of aquaponics. *Glob Health Promot*. 2019;26(3_suppl):87–92. doi: 10.1177/1757975919831241
15. Baker Kromer K, Derrickson JP, Derrickson SAK, et al. *Hunger and Food Insecurity in Hawai'i: Baseline Estimates 1999-2000, Hawai'i Health Survey (HHS).* Honolulu, HI, Hawai'i State Department of Health, Office of Health Status Monitoring; 2001. Available from: https://health.hawaii.gov/hhs/files/2013/04/specfood.pdf. Accessed April 17, 2020.
16. Brug J, de Vet E, de Nooijer J, Verplanken B. Predicting fruit consumption: cognitions, intention, and habits. *J Nutr Educ Behav*. 2006;38(2):73–81. doi: 10.1016/j.jneb.2055.11.027
17. Brug J, Lechner L, De HV. Psychosocial determinants of fruit and vegetable consumption. *Appetit*e. 1995;25(3):285–296. doi: 10.1006/appe.1995.0062
18. Shaikh AR, Yaroch AL, Nebeling L, Yeh MC, Resnicow K. Psychosocial predictors of fruit and vegetable consumption in adults: a review of the literature. *Am J Prev Med*. 2008;34(6):535–543. doi:10.1016/j.amepre.2007.12.028
19. Erinosho TO, Pinard CA, Nebeling LC, et al. Development and implementation of the National Cancer Institute's Food Attitudes and Behaviors Survey to assess correlates of fruit and vegetable intake in adults. *PLoS One*. 2015;10(2):e0115017. doi: 10.1371/journal.pone.0115017
20. American Educational Research Association (AERA), American Psychological Association (APA), National Council on Measurement in Education (NCEA). *Standards for Educational and Psychological Testing.* Washington, DC: American Educational Research Association; 2014.
21. Royal K. Four tenets of modern validity theory for medical education assessment and evaluation. *AMEP*. 2017;8:567–570. doi: 10.2147/amep.s139492
22. Tavakol M, Dennick R. The foundations of measurement and assessment in medical education. *Med Teach*. 2017;39(10):1010–1015. doi: 10.1080/0142159x.2017.1359521
23. Anastasi A. Evolving concepts of test validation. *Annu Rev Psychol*. 1986;37(1):1–16. doi: 10.1146/annurev.ps.37.020186.000245
24. Messick S. Validity. In: Linn RL, ed. *Educational Measurement*. 3rd ed. New York, NY: Macmillan Publishers Ltd; 1989:13–103.
25. Royal K. "Face validity" is not a legitimate type of validity evidence! *Am J Surg*. 2016; 212(5):1026–1027. doi: 10.3138/jvme.0416-091
26. Kane M. Validity studies commentary. *Educational Assessment*. 2020;25:83–89. doi: 10.1080/10627197.2019.1702465
27. Harrison GM. Validity arguments with survey scales [Accepted chapter]. In: Luhanga, U. and Harbaugh, AG, eds. *Basic Elements of Survey Research in Education: Addressing the Problems Your Advisor Never Told You About.* Charlotte, NC: Information Age Publishing; 2020.
28. Peterson CH, Peterson NA, Powell KG. Cognitive interviewing for item development: validity evidence based on content and response processes. *Meas Eval Couns Dev*. 2017;50(4):217–223. doi: 10.1080/07481756.2017.1339564
29. Willis GB. *Cognitive Interviewing: A Tool for Improving Questionnaire Design*. Thousand Oaks, CA: Sage Publications; 2004.
30. Gadermann AM, Guhn M, Zumbo BD. Estimating ordinal reliability for Likert-type and ordinal item response data: a conceptual, empirical, and practical guide. *Pract Assess Res Eval*. 2012;17(3):1–13. doi: 10.7275/n560-j767
31. National Cancer Institute. Food Attitudes and Behaviors (FAB). Available from: https://cancercontrol.cancer.gov/brp/hbrb/fab/. Accessed November 1, 2019.
32. R Core Team. *R: A Language and Environment for Statistical Computing* [Computer software] (Version 3.6.1). *R* Foundation for Statistical Computing, Vienna, Austria. Available from: http://www.R-project.org/. Accessed October 20, 2019.
33. Bandalos DL. *Measurement Theory and Applications for the Social Sciences*. New York, NY: Guilford Publications; 2018.
34. Revelle W. *Psych: Procedures for Personality and Psychological Research*. Available from: https://cran.r-project.org/web/packages/psych/index.html. Accessed October 20, 2019.
35. DeVellis RF. *Scale Development: Theory and Applications*. 3rd ed. Sage Publications, Inc.; 2012.
36. Child D. *The Essentials of Factor Analysis.* (3rd ed.). New York, NY: Continuum International Publishing Group; 2006.
37. Yong AG, Pearce S. A beginner's guide to factor analysis: focusing on exploratory factor analysis. *Tutor Quant Methods Psychol*. 2013;9(2):79–94. doi: 10.20982/tqmp.09.2.p079
38. Kane MT. Validating the interpretations and uses of test scores. *J Educ Meas*. 2013;50:1–73. doi:10.111jedm.12000

Anti-Asian Climate During COVID-19: Through the Lens of an Asian Social Worker

Sophia Kim PhD, MSW

Social Work in Action is a solicited column from the social work community in Hawai'i. It is edited by HJHSW Contributing Editor Sophia Kim PhD, of the Thompson School of Social Work & Public Health at the University of Hawai'i at Mānoa.

Introduction

Since the start of the COVID-19 pandemic in March 2020, there have been growing concerns and fear experienced among Asian American (AA) communities in the United States (US). This was in response to the growing overt anti-Asian sentiments which included bias, microaggressions, and hate incidents and crimes. Across the US, anti-Asian hate acts are reportedly on the rise. Between March 19, 2020 and March 31, 2021, approximately 6603 hate incidents were reported with close to 70% identifying as females.[1] It is also concerning that these acts are blatantly occurring in public streets and parks (37.8%) and in businesses (32.2%).[2] Following the emergence of COVID-19, researchers using mixed methods analyzed more than 3.4 million tweets from November 2019-June 2020 and revealed a marked increase (68.4%) in anti-Asian sentiment and a decline in positive Asian sentiment when compared to other racial/ethnic groups.[3] Together, these findings demonstrate the harmful climate surrounding the Asian identity in the US.

Disaggregated data showed that the top 3 types of discrimination were: verbal harassment (65.2%), deliberate avoidance of Asian and Pacific Islanders (18.1%), and physical assault (12.6%).[2] The Asian ethnic group breakdown showed that the hate incident reports came from Chinese individuals (43.7%), followed by Koreans (16.6%), Filipinx (8.8%), and Vietnamese (8.3%)[2]. Mainstream news media are paying more attention to Asian experiences and have publicized the anti-Asian experiences permeating across major US cities.[4-5] Unfortunately, the link between COVID-19 and hate sentiments against AA highlights the reality of the long enduring racial stereotypes and scapegoating on AA in American society.[6-8] It should be clear that contrary to the model minority stereotype that is pervasively attached to the AA identity, significant social determinants of health experienced by many are xenophobia and racism. What may be most different in this current anti-Asian hate climate is that it is more visible to the general public's eye due to the attention paid by mainstream media and advocates' use of social media platforms.

Impacts of Anti-Asian Climate

Mental Health

Currently, there is a growing number of studies investigating the psychosocial impacts of hate crimes, microaggressions, and discrimination on AA's mental health.[8-10] A report by Stop Asian American Pacific Islander (AAPI) Hate showed that AA who have experienced racism are more stressed by anti-Asian hate than the pandemic COVID-19 itself.[11] Several studies also investigated the impacts of social determinants of health on mental health. One study looked at levels of discrimination and health outcomes among Asians currently living in the US. It found that the full models predicting anxiety symptoms and depression symptoms were statistically significant, $F(5, 400) = 41.08$, $P < .001$, adjusted $R^2 = .33$ and $F(5, 398) = 53.17$, $P < .001$, adjusted $R^2 = .40$, respectively.[10] Another study found that perceived discrimination was related to concurrent anxiety symptoms ($B = 0.21$, $P = .009$) among Chinese American college students.[9] It has even been suggested that increases in COVID-19 related discrimination may be more strongly associated with PTSD symptoms (e.g., disturbed memories, thoughts, and avoidance) ($B = 1.33$, $P < .05$) than anxiety symptoms ($B = 0.39$, $P < .05$).[6] These research foci are especially important as it's been reported that AA in the US underutilize formal mental health services such as licensed clinical social workers, psychologists, psychiatrists, and other helping professionals.[12]

Mobilization of Social Movements

Amidst the pandemic COVID-19, a strength that must be recognized is the solidarity and strengthening of a collective voice within AA groups and between AA and other racial/ethnic groups. It has been stated that "social movement protests remain, more than ever, people's choice for mass resistance when abuses in power pose threats to 'ordinary' peoples' day-to-day access to material needs and resources as well as their social, political, and cultural rights".[13] In response to the anti-Asian hate climate, AA stakeholders have mobilized to offer various types of support

for one another and their communities. One such movement, #StopAAPIHate, was spearheaded by a nonprofit organization, Stop Asian American Pacific Islander (AAPI) Hate. Stop AAPI Hate is a coalition between Asian Pacific Policy and Planning Council (A3PCON), Chinese for Affirmative Action (CAA), and San Francisco State University. This coalition, under the leadership of Manjusha Kulkarni, executive director of A3PCON, Cynthia Choi, co-executive director of CAA, and Russel Jeung, professor and chair of the Asian American studies department at San Francisco State University, was formed to document and maintain records of racially motivated hate, violence, harassment, discrimination, shunning, and child bullying incidents[14]. This particular emphasis on data collection and management is critical given the need for disaggregated health data when developing tailored interventions for A/AA groups.

Social Workers in Action

Social work is an academic discipline and practice-based profession. The heartbeat of the social work profession is our commitment to social and health justice. Given these core characteristics, what can social workers do amidst the anti-Asian climate during the pandemic COVID-19? To start, we can begin with ourselves. We must maintain our own self-awareness and explore barriers that can impact our personal or professional lives. This requires social workers to practice what we preach with our clients: (1) *compassion* – granting ourselves permission to take pauses and to be present with ourselves, and (2) *reflection* – on the impacts of the current context and aiming to learn and grow from it. For social workers, taking pauses for critical self-reflection can contribute significantly to our self-care. Self-care is necessary and vital for all helping professionals.[15] Furthermore, this practice can support our professional development and practice with clients. AA in the helping profession, such as social work, are not immune to social challenges like the current anti-Asian hate. The growing body of literature focusing on social determinants of health like racism, help-seeking patterns, and mental health outcomes among AA is an important start. However, fewer studies have examined variables among AA subgroups like social workers and other helping professionals.[15] There are opportunities to better support our helping professionals as they may be navigating through their own trauma and other mental health challenges in an anti-Asian hate climate.

Secondly, we must build our knowledge base on the long-standing history and oppressive experiences of the disaggregated AA groups in the US. The National Association of Social Workers (NASW) is the largest membership organization for professional social workers. One of our ethical responsibilities outlined in our profession's code of ethics is to maintain cultural competence, which includes recognizing the inherent strengths within all cultures and engaging in self-reflection to nurture cultural humility.[16] The Asian population in the US is not monolithic. It is comprised of more than 50 ethnicities and more than 100 distinct languages[17]. Each ethnic group also has their distinct experiences with colonization and imperialism which have had detrimental impacts on their sense of self. Intersectionality and how various dimensions of the person come together to create our cultural identity must be understood and embraced especially because the essence of social work depends on meaningful relationships with clients. Understanding the unique lived realities of AA in the US is long overdue. Focused attention in this arena can help debunk the pervasive model minority stereotype and highlight important variables to target in research, policy development/reform, and practice.

Author's Affiliation:
Thompson School of Social Work and Public Health, University of Hawai'i at Mānoa, Honolulu, HI

References

1. Jeung R, Yellow Horse AJ, Popovic T, Lim R. Stop AAPI Hate National Report. https://secure-servercdn.net/104.238.69.231/a1w.90d.myftpupload.com/wp-content/uploads/2021/03/210312-Stop-AAPI-Hate-National-Report-.pdf. Published 2021. Accessed July 15, 2021.
2. Jeung R, Yellow Horse AJ, Cayanan C. Stop AAPI Hate National Report. https://stopaapihate.org/wp-content/uploads/2021/05/Stop-AAPI-Hate-Report-National-210506.pdf. Published 2021. Accessed July 15, 2021.
3. Nguyen, TT, Criss S, Dwivedi P, Huang D, Keralis J, Hsu E, Phan L, Nguyen LH, Yardi I, Glymour MM, Allen AM, Chae DH, Gee GC, Nguyen QC. Exploring U.S. shifts in anti-Asian sentiment with the emergence of COVID-19. *International Journal of Environmental Research and Public Health.* 2020;17(19):1-13.
4. Krishnakumar P. Why hate crime data can't capture the true scope of anti Asian violence. CNN. https://www.cnn.com/2021/03/18/us/hate-crime-reporting-anti asian-violence/index.html. Published March 18, 2021. Accessed July 30, 2021.
5. McAboy K. Asian American communities being targeted by hate crime, unprovoked attacks during pandemic. Fox 11. https://www.foxla.com/news/asian-american-communities-being-targeted-by-hate-crime-violent-attacks-during-pandemic. Published February 11, 2021. Accessed July 30, 2021.
6. Hahm HC, Ha Y, Scott JC, Wongchai V, Chen JA, Liu CH. Perceived COVID-19-related anti-Asian discrimination predicts post-traumatic stress disorder symptoms among Asian and Asian American young adults. *Psychiatry Research*. 2021;114084-. doi: https://doi.org/10.1016/j.psychres.2021.114084
7. Le TK, Cha L, Han HR, Tseng W. Anti-Asian xenophobia and Asian American COVID-19 disparities. *American Journal of Public Health (1971).* 2021;110(9):1371-1373. https://doi.org/10.2105/AJPH.2020.305846
8. Tessler H, Choi M, Kao G. The anxiety of being Asian American: Hate crimes and negative biases during the COVID-19 pandemic. *American Journal of Criminal Justice.* 2020;45:636-646. doi: https://doi.org/10.1007/s12103-020-09541-5
9. Haft SL, Zhou Q. An outbreak of xenophobia: Perceived discrimination and anxiety in Chinese American college students before and during the COVID-19 pandemic. *International Journal of Psychology*. 2021;56(4):522-531. https://doi.org/10.1002/ijop.12740
10. Lee S, Waters SF. Asians and Asian Americans' experiences of racial discrimination during the COVID-19 pandemic: Impacts on health outcomes and the buffering role of social support. *Stigma and Health.* 2020;6(1):70-78. http://dx.doi.org/10.1037/sah0000275
11. Saw A, Yellowhorse AJ, Jeung R. Stop AAPI Hate Mental Health Report. https://stopaapihate.org/wp-content/uploads/2021/05/Stop-AAPI-Hate-Mental-Health-Report-210527.pdf. Published n.d. Accessed July 31, 2021.
12. Lee S, Juon H, Martinez G, Hsu CE, Robinson ES, Bawa J, et al. Model minority at risk: Expressed needs of mental health by Asian American young adults. *Journal of Community Health.* 2009;34(2):144–52. https://doi.org/10.1007/s10900-008-9137-1.
13. Noble C. Social protest movements and social work practice. *International Encyclopedia of the Social & Behavioral Sciences.* 2015;22: 518-524.
14. Stop AAPI Hate. About. Stop AAPI Hate. https://stopaapihate.org/about/. Accessed July 15, 2021.
15. Acker GM. Self-care practices among social workers: Do they predict job satisfaction and turnover intention? *Social Work in Mental Health*. 2018;16(6): 713-727.
16. Siebert DC, Siebert CF. Help seeking among helping professionals: A role identity perspective. *American Journal of Orthopsychiatry*. 2007;77(1): 49-55.
17. National Association of Social Workers (NASW). Read the code of ethics. https://www.socialworkers.org/About/Ethics/Code-of-Ethics/Code-of-Ethics-English Published n.d. Accessed August 1, 2021.
18. U.S. Department of Health and Human Services. The feasibility of using electronic health data for research on small populations. Population #1: Asian-American subpopulations. https://aspe.hhs.gov/reports/feasibility-using-electronic-health-data-research-small-populations-0 Published August 31, 2013. Accessed July 31, 2021.

Is it time for a change?

MIEC was founded in turbulent times, by physicians who imagined a better way to do business. An insurance company that provided its physician owners the best possible coverage, at the lowest sustainable price, and didn't turn profits over to outside shareholders. Over the last 44 years we have put more than $442 million back into the pockets of our policyholders. To learn more about the benefits of being an MIEC policyholder, or to apply, visit **miec.com** or call **800.227.4527**.

Get a quote today.

Insurance by physicians, for physicians.™

miec

miec.com | 800.227.4527