Pili Pono Practice: A Qualitative Study on Reimagining Native Hawaiian Food Sovereignty through MALAMA Backyard Aquaponics

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Pahonu Coleman , *Ke Kula Nui O Waimanalo*
Samantha Keaulana , *University of Hawaii at Manoa*
J Kahaulahilahi Vegas , *University of Hawaii at Manoa*

See next page for additional authors

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Abstract

Living in one of the most remote island chains in the world, Native Hawaiians developed sophisticated food cultivation systems that sustained a thriving and robust population for centuries. These systems were disrupted by colonization, which has contributed to the health disparities that Native Hawaiians face today. MALAMA, a culturally-grounded backyard aquaponics program, was developed to promote food sovereignty among Native Hawaiians. This study utilized participant interview and focus group data to identify how participating in the MALAMA program impacts the wellbeing. The findings demonstrate that MALAMA enhanced the participants' pilina (relationship, connection) to traditional foods, land, cultural identity, family, and community, which contributed to the quick adoption of the program into Native Hawaiian communities. To address food insecurity, it is imperative to seek Indigenous-developed, community-based, and culturally-grounded programs and solutions like the MALAMA program.

Keywords

food sovereignty; food security; Native Hawaiian; Indigenous; community health; family; nutrition; sustainability; aquaponics; culture/ethnicity

Cover Page Footnote

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Authors

Pahonu Coleman, Samantha Keaulana, J Kahaulahilahi Vegas, Phoebe W. Hwang, LeShay Keliiholokai, Jane J. Chung-Do, Ikaika Rogerson, and Ilima Ho-Lastimosa

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Pahonu Coleman, Ke Kula Nui O Waimānalo
Samantha Keaulana, PhD, University of Hawai‘i at Mānoa
J. Kahaulahilahi Vegas, MPH, University of Hawai‘i at Mānoa
Phoebe W. Hwang, DrPH, University of Hawai‘i at Mānoa
LeShay Keliiholokai, MA, Ke Kula Nui O Waimānalo
Ikaika Rogerson, BA, Ke Kula Nui O Waimānalo
Jane J. Chung-Do, DrPH, University of Hawai‘i at Mānoa
Ilima Ho-Lastimosa, MSW, MoA, University of Hawai‘i at Mānoa, Ke Kula Nui O Waimānalo, God’s Country Waimānalo
Corresponding Author: Samantha Keaulana, skscott@hawaii.edu

ABSTRACT

Living in one of the most remote island chains in the world, Native Hawaiians developed sophisticated food cultivation systems that sustained a thriving and robust population for centuries. These systems were disrupted by colonization, which has contributed to the health disparities that Native Hawaiians face today. MALAMA, a culturally grounded backyard aquaponics program, was developed to promote food sovereignty among Native Hawaiians. This study utilized participant interview and focus group data to identify how participating in the MALAMA program impacts the wellbeing. The findings demonstrate that MALAMA enhanced the participants’ pilina (relationship, connection) to traditional foods, land, cultural identity, family, and community, which contributed to the quick adoption of the program into Native Hawaiian communities. To address food insecurity, it is imperative to seek Indigenous-developed, community-based, and culturally grounded programs and solutions like the MALAMA program.

Keywords: food sovereignty; food security; Native Hawaiian; Indigenous; community health; family; nutrition; sustainability; aquaponics; culture/ethnicity

INTRODUCTION

As a result of structural inequities originating from colonialism, Native Hawaiians, or Kānaka Maoli, today experience pervasive health inequities that have led to high levels of chronic diseases and food insecurity. Kānaka Maoli, were the first people to arrive and settle on the Hawaiian Islands. Their arrival is estimated to be as early as 100 AD (Papa Ola Lōkahi, 2020). In one of most geographically isolated land masses in the world, Native Hawaiians developed a reciprocal, familial, and spiritual relationship with their ʻāina (land) that sustained them for centuries. They were proficient in the patterns of natural conditions from mauka (mountainside) to makai (seaside). Before contact with Western forces, all Native Hawaiians bore a kuleana (responsibility) in ensuring everything on the ʻāina was cultivated sustainably. To do so, they meticulously built sophisticated food systems that were in alignment with the natural surroundings and ensured their food security. Their food systems and practices were designed to prevent depleting natural resources and promoted regeneration that could continue to feed the people. Each island was divided into sections of land called ahupuaʻa, running from mountain to sea, and they were designed to provide all resources needed for land and people to thrive. Within these land divisions included food production systems, including loko iʻa, or fishponds used to grow and cultivate fish, and loʻi, irrigated terraces for planting kalo (taro), a traditional staple of the Hawaiian diet and a significant spiritual plant (Ho-Lastimosa et al., 2020). These food production systems and sustainable practices nourished entire communities throughout the seasons. Contemporary Native Hawaiians and their ancestors believe that the health of the ʻāina is critical to the health of the people (Keli'iholokai et al., 2020). Therefore, mālama ʻāina (land stewardship, to care for land) was tied into every part of Native Hawaiians livelihood (Kameaʻeleihiwa, 1992).

With an influx of Western and foreign settlers in the early 1800s, Native Hawaiians faced forced assimilation and eventual illegal occupation of their sovereign nation (Arvin, 2019). Traditional values, practices, laws, and food systems were made inferior to the new way of life enforced by settlers. For example, Native Hawaiians believed in land tenureship, where they cared for land as their older sibling and, in return, land provided an abundance of nutrients and sustenance for Native Hawaiians living (Keliiholokai et al., 2020). This relationship and reverence for the ʻāina is reinforced in an ʻōlelo noeʻau (Hawaiian proverb) that states, "he aliʻi ka ʻāina, he kauwā ke kanaka" or "the land is chief, man is servant" (Pukui & Varez, 1983). Contrary to Native Hawaiians belief, settlers believed that land was to be owned and employed for capital gain. To illustrate, American businessmen saw Hawaiʻi as an ideal climate to grow sugar and began to utilize the land for profit, building mass sugar plantations for extraction and export (Tengan, 2004). In conjunction, sugar planters diverted natural flowing waters to grow and process sugarcane, leaving detrimental impacts on traditional food systems like loko iʻa and loʻi (Cantor, Kay, & Knudson, 2020; Gingerich & Wolff, 2005, Oki et al., 2010). Such ventures were made possible with land privatization, a foreign concept to Native Hawaiians (MacKenzie & Sproat, 2017; Van Dyke, 2017). Eventually, land privatization shifted from Native Hawaiians living sustainably through their sophisticated food production systems to outside foreigners controlling their land and access to their traditional foods. The Native Hawaiian diet, which is full of fiber, vitamins, and lean protein (Shintani & Hughes, 1994), was replaced by a diet filled with sugar, carbohydrates, and sodium. This was further exacerbated with the militarization of the Hawaiian Islands, which brought many highly processed, canned, and imported foods to the islands. Disrupted food production systems left a once robust people in turmoil without access to traditional

food systems and diets, introduced them to food insecurity which has contributed to contemporary Native Hawaiian health disparities.

Currently, Native Hawaiians face systemic and societal challenges which inhibits their optimal health and well-being. In particular, many Native Hawaiians face limited access to healthy food grocers and when available, the expensive cost of healthy foods is unattainable for families due to the high costs of living (Karger, 2020). In addition, traditional Hawaiian food systems are minimal and Hawai‘i has a high percentage of imported foods, importing over 90% of the food consumed as local farms and food industries continue to dwindle (Loke & Leung, 2013). Mass agriculture plantations, such as sugar and pineapples, have been replaced by the extractive tourism and real estate industries as well as the continued presence of the military. Native Hawaiians continue to have very little access to their traditional foods and traditional subsistence living (Brace et al., 2020), which has resulted in disproportionate risks of food insecurity and chronic diseases. For example, Native Hawaiians and Pacific Islanders (NHPI) die at higher rates of coronary heart disease (207.1/100,000 NHPI compared to 65.5/100,000 overall state of Hawai‘i), congestive heart failure (28.6/100,000 NHPI compared to 10.0/100,00 overall state of Hawai‘i), cancer (372.3/100,000 compared to 121.9/100,000 overall state of Hawai‘i), and diabetes (77.2/100,000 NHPI compared to 17.3 overall state of Hawai‘i) than the overall State of Hawai‘i (Hawaii Health Matters, 2021). In addition, Native Hawaiians have a higher prevalence of obesity (40%) in Hawai‘i when compared to the overall state of Hawai‘i (24.5%), Chinese (19.2%), Filipino (20%), and Japanese (18.1%). Native Hawaiians also face socioeconomic challenges with a total of 14.8% of Native Hawaiians and Pacific Islanders living in poverty compared to 9% of non-Hispanic whites (Office of Minority Health, 2021) and tend to live in areas with high levels of poverty with limited healthy food options and high concentrations of fast food (Lee et al., 2012; Mau et al., 2008). Compared to the State as a whole, Native Hawaiians are having a harder time paying for essentials, such as housing, utility bills, medicine, childcare, and food. In fact, 34% of Native Hawaiians stated they are having problems purchasing food (State of Hawaii, 2017). As the cost of living and food continues to rise in Hawai‘i, it is pertinent to look toward solutions that are culturally grounded to help Native Hawaiians become more self-sustainable and self-sufficient as their ancestors once were.

Today, Hawai‘i boasts a plethora of resources and experts to improve Native Hawaiian health. Indigenous scholars have suggested that culture and cultural identity have the ability to serve as buffers of historical trauma which have caused systemic and societal challenges to health (Walters & Simoni, 2002; Sotero, 2009). In addition, the growing literature is demonstrating the importance of cultural values and perspectives in healing Indigenous peoples (Keli'iholokai et al., 2020). The current study adds to the body of literature by describing one intervention that utilized a cultural understanding of health and balance. In particular, it privileged the understanding of the interconnected relationships between spirituality, ‘āina, and kānaka (people) as being significant to health among Native Hawaiian people. In essence, in order to address Native Hawaiian health, it is urgent that we embrace and promote food sovereignty through an Indigenous lens.

God’s Country Waimānalo and the community of Waimānalo

Native Hawaiian communities have been instrumental in retaining and promoting cultural practices, including the community of Waimānalo. Waimānalo is a rural community located on the eastern side of the island of O‘ahu. It is home to approximately 7,000 residents with one-third being Native Hawaiian. It is recognized as a medically underserved population and more than 30% of the households are food insecure (Hawai‘i Department of Health, 2001). Despite these

challenges, many strengths reside in this close-knit community. Waimānalo is known for its natural resources, a history of community advocacy and organizing, and a large number of Native Hawaiian grassroots organizations. One of these organizations is God's Country Waimanalo (GCW), which was founded by a Waimānalo resident and community leader.

The mission of God's Country Waimānalo is Hoʻoulu a me Hoʻōla Lāhui, which means to propagate & perpetuate the race. The organization is rooted in cultural preservation and community partnerships and connects traditional Hawaiian cultural practices to modern day concepts of health and wellness (Ho-Lastimosa et al., 2014). GCW strives to incorporate four key Native Hawaiian values of kuleana (responsibility), mālama (to care for, to protect), ʻike pono (intellect), and haʻahaʻa (humility, humbleness). These traditional values help shape culturally grounded programs to preserve culture, strengthen community partnerships, and promote health and wellness. Their educational pedagogy embraces the belief that Hawaiian knowledge is best acquired through experiential learning from one generation to the next (Meyer, 2001). Thus, all projects have emphasized experiential and multigenerational learning. Similar to other indigenous communities in North America (Richmond et al., 2021), the families and residents of Waimānalo believed that revitalizing cultural practices around food is key to resolving the community's food insecurity. Thus, GCW puts efforts into programming focused on growing food, especially traditional foods, and restoring indigenous food practices.

GCW's early efforts helped plant the seeds for a grassroots community-based non-profit organization, Ke Kula Nui O Waimānalo (KKNOW), which was established in 2017 by individuals from the Waimānalo ahupuaʻa. KKNOW is built upon the early efforts of GCW and the organization's vision is Kūkulu Kaiāulu, which means building community. Their mission is to provide a community of practice through collaboration of Kānaka to promote a strong and healthy ahupuaʻa. They aim to support the Waimānalo community to become self-sustainable in every way, from the mountain to the sea, with the belief that the ʻāina and kai (ocean) can provide for the community as it did years ago. Figure 1 illustrates the majority of the programs currently offered by KKNOW.

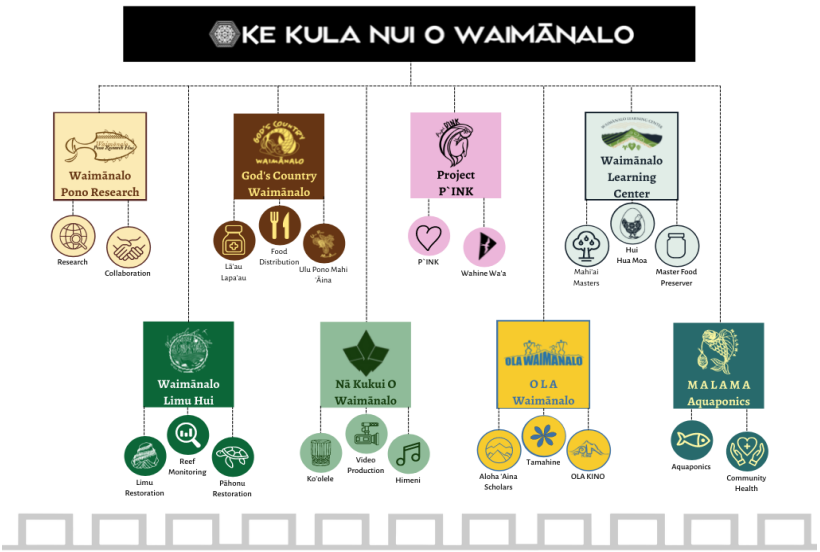

Figure 1. Ke Kula Nui O Waimānalo Programs

History of aquaponics in Waimānalo

As awareness around food and food sovereignty grew in Waimānalo, GCW and agricultural researchers at the University of Hawai‘i Windward Community College partnered together in 2009 to develop a backyard model of an aquaponics system. Aquaponics optimizes water and nutrient use efficiency by effectively combining hydroponics (soilless horticulture) and aquaculture (raising fish in tanks) that uses a fraction of the water and nutrients traditional terrestrial systems do (Tokunaga et al., 2015). Aquaponics systems can be easily constructed on a small scale to provide families and communities a consistent source of staple Native Hawaiian foods in a system that models traditional natural resource management like the ahupua‘a (see Image 1) (Hambrey et al., 2013). GCW obtained funding to bring this technology to the Waimānalo community to promote food sovereignty. Supplies and equipment needed to build aquaponics systems were purchased and groups of families from Waimānalo were invited to attend a series of hands-on workshops to learn how to build and maintain the systems together. Topics of the workshop included assessing water quality, troubleshooting the aquaponics system, and ‘ai pono (healthy eating). ‘Ai pono workshops were hands-on and were delivered through cooking and lā‘au lapa‘au (traditional herbal medicine) demonstrations that taught families how to use the plants and herbs grown in the systems to make healthy meals and traditional remedies. Through grants obtained, participating families were given all the supplies needed, free of charge, to build their aquaponics system. The workshops included a “build day” where the families constructed the systems for their backyards together.

Image 1. MALAMA Aquaponics System

Since the first series of workshops in 2009, over 100 aquaponics systems have been built and placed into the backyards of Waimānalo families. As workshops were implemented over the

years, GCW partnered with the University of Hawai‘i researchers and students to collect program evaluation data. Many families reported that building an aquaponics system and being a part of the community workshops initiated their interest and increased their self-efficacy in food sovereignty (Ho-Lastimosa et al., 2017). The evidence strongly suggests that not only can it be used to increase intake of fresh vegetables, fruits, and fish but it has wholistic impacts on overall health, including social connectedness that is essential to Native Hawaiian worldview of health and wellness (Beebe et al., 2020; McGregor et al., 2003).

Formation of the MALAMA Study

These preliminary findings suggested that this backyard aquaponics program spearheaded by GCW has the potential to be an effective public health intervention in Native Hawaiian communities. Therefore, the founder of GCW and a team of public health researchers decided to apply for a pilot research grant in 2018 to further systematically explore the health impacts of the backyard aquaponics efforts. The study was named MALAMA, which stands for Mini Ahupua‘a for Lifestyle And Mea‘ai [food] through Aquaponics. The aim of the study was to test the feasibility of the aquaponics program as a public health intervention with 10 Native Hawaiian families who participated in 8 standardized workshops over 3 months (Ho-Lastimosa et al., 2019). Building on the past GCW workshops, the MALAMA workshops integrated Native Hawaiian cultural practices, such as lā‘au lapa‘au (Native Hawaiian traditional healing through plants and spirituality) (Abbott, 1992) and ‘ai pono (nourishing foods). Throughout their participation, they learned to grow, cultivate, and harvest herbs, vegetables, and fish to make traditional and herbal medicine as well as healthy meals. The workshops emphasize co-learning and relationship-strengthening through peer mentorship, which has been found to be a promising approach with indigenous populations (Mau et al., 2010; Richmond et al., 2007). Peer mentors called Lima Kōkua who already had aquaponics systems from previous GCW workshops, were enlisted to provide tips, lessons learned, and support for the family participants. Participants learned to build and maintain backyard aquaponics systems as a family and attend the workshop as a cohort of families. All participants were involved in a demonstration build-day where they built a demo system together. This was followed by a Build Weekend where families spent the weekend together, building 10 backyard aquaponics systems and visited each other’s homes to help one another install their systems in their backyards.

To explore the health impacts of MALAMA, a mixed-methods design was used. Clinical and survey data were collected in addition to qualitative data. The current study reports on the qualitative findings and sought to explore the research question: how does participating in the MALAMA program impact the well-being of Native Hawaiians? Therefore, the purpose of this paper is to report on the findings from the qualitative data to understand how a culturally grounded food sovereignty program, like the MALAMA program, can wholistically impact Native Hawaiian families’ sense of wellness.

METHODS

Participants

To recruit participants into the MALAMA Study, a flier was developed and distributed to various Native Hawaiian organizations and groups to invite them to a recruitment meeting. The goal was to recruit a total of ten families that fit the inclusion criteria. A recruitment meeting with interested community members was held in the evening in Waimānalo and dinner was served. Criteria for inclusion as a research participant was being a part of a Native Hawaiian family, ages

18 and older, living in a home with sufficient outdoor space to keep the aquaponics system, and committed to maintaining their system for at least three months. Costs of building and installing the aquaponics systems were entirely covered by the grant. Those who were not part of a Native Hawaiian family, younger than 18 years old, did not want to install an aquaponics system in their backyard, and could not commit to the eight workshops were excluded. To be mindful of Native Hawaiian collectivistic values, children under the age of 18 were invited to participate with adult family members in the workshops but were not considered research participants. In addition, previous research has found that support from family and friends have an additive effect to self-management education on improved health (Lee et al., 2017). Participants signed a written informed consent form at the beginning of the study, which were also verbally explained to them.

The current study included MALAMA Study participants that were 18 years or older (n=21) from ten different Native Hawaiian families and four Lima Kōkua (n=4). All 21 participants participated in the focus group and 6 of those participants also participated in key informant interviews. The participants came from an average household size of 6 people. The mean age was 45 years old with the youngest research participant being 18 years old and the oldest being 68 years old. A total of five people (24%) had a high school diploma or GED, eight people (38%) had some college or vocational training, seven people (33%) had a college degree, and one person (5%) had a graduate degree. Participants in this study come from larger households than the average household in Waimānalo, but have higher educational attainment (U.S. Census Bureau, 2022). The four Lima Kokua served as peer leaders throughout the program. Three of the Lima Kokua were male, and one was female. Overall, the current study included 25 participants total (n=25).

Procedures

A focus group with all the participants was conducted at the end of the last workshop in May 2018. All 10 families were present at the focus group. The focus group was about an hour long and was audio-recorded. To understand the long-term outcomes of the backyard aquaponics systems, we conducted one-on-one in-depth interviews with eight families and four Lima Kōkua three months after the program completion (between August-November 2018. This gave the participants some time to reflect on the program and make use of their systems. The interviews lasted an average of 30 minutes and were audio-recorded. To reduce social desirability bias, both the focus group and interviews were facilitated by public health students who were not a part of implementing the MALAMA program. This study was approved by the University of Hawai‘i Committee on Human Studies.

Measures

This qualitative study utilized a semi-structured focus group and key informant interview guide. Both guides focused on understanding the participants' experience and process in participating with the MALAMA program. Questions from the guide assessed their level of satisfaction and challenges (e.g., What did you like about the MALAMA-aquaponics program overall? Were there parts of the MALAMA-aquaponics program you did not like?) and impacts of their participation on their health (e.g., Did the MALAMA program impact the way you eat? Has the MALAMA aquaponics study encouraged or motivated you to be healthier?). Since the key informant interviews were conducted three months after program completion, the key informant interview guides included questions that assessed the longevity of the program. Appendices A and B illustrate the focus group and key informant interview guides respectively.

Analysis

The focus group and interviews were transcribed verbatim and were uploaded into NVivo version 20. In total, there were five coders from our research team. Initially, three coders reviewed the transcripts individually and used a grounded theory approach to find codes that emerged from the data. From this initial coding process, it was determined that a major theme emerging from the data was the concept of pilina, which loosely translates to connection, relationship, joining. From this preliminary finding, the Pili Pono Practice was developed by co-authors, Pahonu Coleman and Ilima Ho-Lastimosa, to describe the connection and relationships that are vital to Native Hawaiians health based on the collective work in the Waimānalo community and the data that has been collected over the years. Pili Pono Practice describes the doing, the lifestyle, and the practice of all programs of Ke Kula Nui O Waimānalo and encompasses the following dimensions: pili ʻāina (connection to land), pili kai (connection to ocean), pili ʻai (connection and access to food), pili ola (connection and access to physical, spiritual, mental, and emotional health), pili kānaka (connection to people), pili waiwai (connection and equitable access to wealth), pili ʻohana (connection to family), pili kaiāulu (connection to community), pili paʻa (confident and firm understanding), and pili hoa (connection to friends, companionship). These dimensions are not finite as Ke Kula Nui O Waimānalo believes that Pili Pono Practice is ever evolving and fluid.

It was decided by the initial three coders that Pili Pono Practice would be used as a coding framework. The remaining two coders were introduced to the coding framework and after initial review of the transcripts, they agreed that the framework was emerging from the data. From there, the transcripts were divided evenly among two groups of coders. Researchers worked in pairs to enhance reliability and coded each transcript in-depth using a priori coding approach with the Pili Pono Practice framework. Throughout the coding process, constant comparisons were made, and the researchers revisited the coding framework to make adjustments as needed. The final framework was determined by consensus and only seven of the ten dimensions of Pili Pono Practice were found in the coding process. Each transcript was then recoded with the seven dimensions and the most salient themes became the seven dimensions of Pili Pono Practice. These dimensions were determined to be salient if two or more coders coded a quote from the data with the same dimension.

RESULTS

Three major themes were identified: 1) pili ʻāina, 2) pili kānaka, and 3) pili kaiāulu. The research team agreed that pili ʻāina included sub-themes of pili ʻai and pili ola and pili kānaka included sub themes of pili waiwai and pili ʻohana. While pili kaiāulu was the most coded theme, all themes are viewed as interconnected, possessing relationships with each other. Each theme is described in greater detail below with quotes from participants. Participant gender and age status (makua or adult for those aged 18-65 and kupuna or elder for 65 and older) were provided to describe the quoted participant.

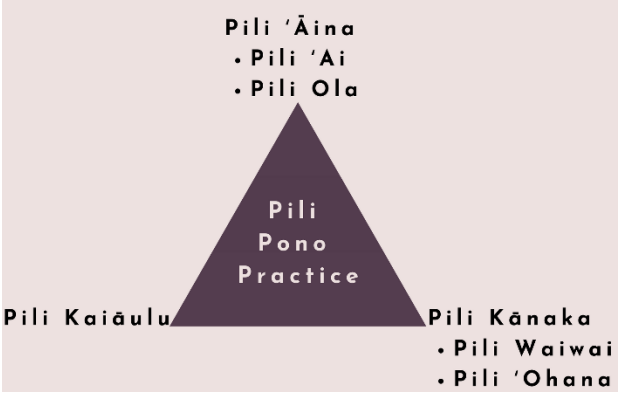

Figure 2. Pili Pono Practice of MALAMA

Theme 1: Pili ʻāina, ʻai, ola

The overall theme of pili ʻāina, ʻai, ola centers on the interconnected nature of ʻāina, ʻai (food), and ola (health). The land is a central part of Native Hawaiians well-being as it provides food, medicine, and sustenance to the people. In addition, Native Hawaiians have a spiritual connection to the land and food as Hāloa (kalo or taro) is seen as the older brother of Native Hawaiians. These deep multi-layered connections were held and practiced by Hawaiian ancestors and emerged in the stories told in the focus group and interviews. Being a part of the MALAMA Program allowed families to practice mālama ʻāina, where they took care of the plants and fish, and in turn, their connection to food and health were restored. Because of the limited access to land, Hawaiians have not been able to practice and be a part of the ahupuaʻa system to gather food as their ancestors did. However, the aquaponics system allowed families to have a "mini ahupuaʻa" in their own backyard and engage in their ancestral practices of food sovereignty, sustainability, and stewardship as illustrated by one of the participants:

> *"For me, it aligns up with self-sustenance from the mountain to the sea. Cause in the mountain you would get all your lāʻau, all your greeneries, your fresh water, and the ocean you get your fish. But I have it all right here. So everything is growing right in front of me. And it's a different process but it is so sustenance."* Female, Kupuna

The participants also spoke about how being a part of MALAMA also restored their relationship with food. They expressed pride in growing their own food and excitement to try new vegetables, herbs, and fruits, especially traditional plants. Being able to grow a variety of plants in a short amount of time was pleasantly surprising and motivating to them. They also reported sharing their excess produce with their families, which is an important aspect of Native Hawaiian well-being as expressed by one of the participants:

> *"You know the gratification you get, you know for me, I can't eat all that but it's always nice when I can come out and pick something fresh, the basil, Chinese parsley, other herbs I never used, lemon grass, and I have enough that I can give and share and that makes me feel good. That makes my wife and my family feel good that they can come. And when they come and visit, they can leave and always leave with something. And that's something I always wanted to be able to do."* Male, Makua

In addition to motivating them to eat healthier, the participants also shared how participating in MALAMA enhanced multiple aspects of their overall sense of wellness, including connecting with their family members and promoting their mental health. They also spoke about

using the plants and herbs to make lāʻau (medicine) and expressed contentment from being able to practice the ancestral practice of lāʻau lapaʻau. Many also spoke about the therapeutic aspect of gardening as well as how they like the sound of the constant flowing of water.

> *"I use it as like a therapy because every day I come home from work, I just kinda hang out right there and watch the fish. That's how I know my dog drink water outta there (laughter). But yeah, I use it like therapy. Just kinda hang out. Even my dogs they go over there fall asleep."* Male, Kupuna

Theme 2: Pili kānaka, ʻohana, waiwai

The overall theme of pili kānaka demonstrates the close relationships participants were able to strengthen with their sense of identity (pili kānaka), their families (pili ʻohana), and their systems (which became a part of their families), which reignited their cultural values and practices. This provided the ability for participants to self-determine and take ownership of their health and generate financial wealth (pili waiwai). The MALAMA program encouraged participants to make deeper connections and relationships with other participants in their community. Through these connections, they felt closer to their Hawaiian culture and appreciated the use of pule (prayer), Hawaiian values, ahupuaʻa living, and other Hawaiian practices in the program curriculum. Each session began with an opening circle called the ʻAloha Circle' and participants reported that the circle deepened their connections with each other and gave everyone an opportunity to share. As one participant shared,

> *"I think that it gets so… the spirituality of it. The "prayer", that Hawaiian value. That's where the connection is in this project and what makes it even more special. In terms of Waimānalo, Waimānalo has the largest group of Native Hawaiians. I'm Native Hawaiian myself, and so I think that it just brings extra comfort in knowing that "others just like you" are a part of this project."* Female, Kupuna

Through the program, participants reported growing deeper connections with their family members. Building and maintaining the aquaponics systems served as a shared household activity and chore. The aquaponic system was a family project that all family members could nurture together and gave each family member a kuleana (responsibility). For example, the younger children often fed the fish, the parents often maintained the system, and the grandparents often harvested the plants. The collaborative effort required to maintain the system brought family members closer together. In addition, older adults expressed that having a system allowed them to spend more time with their grandchildren.

> *"Well, my grandson is responsible for feeding the fish. We have an inside fish tank and an outside tank so one grandson feeds with the inside tank and one with the outside tank. And they help me maintain it… Actually, in the beginning our system went down because we had some rocks stuck in it. So, we had to take it all apart and put it back together, so it was a family affair."* Key Informant Interviewee, Female, Kupuna

The backyard aquaponics systems also allowed participants to eat healthy and save money. They identified that eating healthy, especially shopping organic, was expensive when shopping at grocery stores. The aquaponics systems relieved some financial burden on families as they were able to grow their own fish and produce. In addition, the participants spoke about self-determining their nutrition by growing their own foods in their aquaponic systems. Unlike the foods purchased from grocery stores, participants recognized that they were in control of the items grown in their backyard systems as they dictated what the fish ate, which controlled what the plants ate, and

eventually what they were consuming. In essence, they began to control their food intake, while saving money.

> *"We are able to produce our own protein (fish), vegetables, and lāʻau lapaʻau. In the end, it saves us money, it allows us to eat healthier, we know exactly what is going in our bodies."* Focus Group Participant, Female, Makua

Participants also indicated that their participation in MALAMA helped them with their self-determination in terms of their financial income. Some participants utilized their produce and other plants from their aquaponics systems for financial profit by selling produce or manufacturing lāʻau (herbal medicine) to sell in local shops and markets. They also expressed working with other families in the Waimānalo community to help each other gain a profit from produce growing in their systems. While the concept of capital gain was foreign to their ancestors, the participants see the opportunity to sell their produce as a means to support their families and each other, especially in Hawaiʻi where the cost of living is one of the highest in the US.

> *"We got like 7 or 8 families and we set up 4 tables, 1 tank system in each backyard… we were growing primarily lettuce… and we were growing it from seed, to seedling, to full grown plant in two months and we were going to send it to the market."* Key Informant Interviewee, Male, Makua

Theme 3: Pili Kaiāulu

Pili kaiāulu was the third and final theme, which demonstrated how the MALAMA program reinforced relationships within the Waimānalo community and grew a sense of community connectedness. Many participants expressed how day-to-day life activities hindered their involvement with the community. On Oʻahu, the capital of Honolulu is the geographical location for innumerable jobs. Therefore, many participants in the program expressed that they must travel outside of Waimānalo for work, and when factoring in travel time and other daily activities, the ability to interact and know the members of their community was miniscule. However, being in the MALAMA program created a space and time for them to engage and interact with community members. Going through the workshop together as a cohort allowed them to get to know their neighbors and strengthen their sense of being a part of the community. Many reported staying connected with one another even after the program ended, using communication methods such as Facebook, to work out challenges that arose with their systems. They also physically helped each other with their systems, shared healthy recipes, and began to rely on each other for support with non-aquaponics related tasks.

> *"We became bonded together and we work for different services. Like I work for Hawaii Job Corps, and we just had a huge flood come through when [we had] heavy storms. So, I called upon [another participant]. [The participant] is a fireman with the Waimānalo Station and he helped clear out 3 inches of mud… He also went next door to Hui Mālama and helped them clean out their area too."* Key Informant Interviewee, Female, Kupuna

For some participants, the program created a stronger bond and rekindled relationships with community members they grew up with and for others, they became great friends with previous strangers.

> *"... well, the best experience I got from it is new friends that I met. The community is so small. You see these people's faces in [the] store and don't know them. Through this program, you meet them and now we are friends."nn*Key Informant Interviewee, Male, Kupuna

The connection of community was also illustrated by participants who desired to help their fellow community members past the completion of the MALAMA program. After building pilina with participants in the program, many were motivated to tackle issues and challenges they faced together as a Waimānalo community. They resourced and networked with each other for aquaponics maintenance, shared recipes, helped with non-aquaponics challenges faced in the community, and began to think about other needs they could address together like diabetes and early death.

> *"It's the community coming together because we do have problems especially with diabetes and early death and things like that. So, something like THIS (aquaponic study) is a great thing to improve the health of the community."* Focus Group Participant, Female, Makua

In addition, participants reported satisfaction with the program being made for and by the community. Many expressed gratitude for co-author and executive director of GCW, Ilima Ho-Lastimosa, who was responsible for bringing aquaponics to the Waimānalo community. They described how Ilima, a trusted community member and leader, had a vision to bring her community together by offering a health program developed specifically for them.

> *"She's getting people from different parts of Waimānalo to come to her class that wouldn't normally meet each other and then they get to know each other and get to know what other people in the community are doing and so it's not like you have to go call somebody that lives in town or Kāneʻohe, they only live like 5 or 10 minutes down the road."* Key Informant Interviewee, Female, Makua

In addition to satisfaction with the program, the participants believed that the program could help other Native Hawaiians communities in perpetuity. Many participants knew people outside of the Waimānalo community who were interested in the MALAMA program and the benefits of owning an aquaponics system. They also mentioned that lessons learned, and relationships built within the program were significant for future generations to come. Lastly, they provided some room for improvement. For example, some described the length of the survey to collect self-reported data was lengthy, however, they understood the importance of collecting such data and the benefit of receiving a system and building community outweighed the lengthy survey.

> *"... it's good for the next generation because the next generation should know how to grow their own."* Focus Group Participant, Female, Kupuna

DISCUSSION

The purpose of this study was to explore the health impacts of the MALAMA program which aims to promote food sovereignty among Native Hawaiian families. Overall, participants expressed that MALAMA reinforced their pilina with ʻāina, ʻai, ola, kānaka, waiwai, ʻohana, and kaiāulu. The program restored participants' relationships with land, food, and wellness. In addition, they got to grow deeper connections within their families and build meaningful relationships with community members they previously seen in passing. Participants also reported maintaining their relationships established through MALAMA even after the program. Findings from this study emphasizes the success of the MALAMA program as a solution to increasing Native Hawaiians health and addressing food insecurity in Native Hawaiians communities. In addition, findings suggest that the program provides an opportunity for food and financial sustenance through the lens of food sovereignty.

The Food and Agricultural Organization of the United Nations defines food security as existing "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs for an active and healthy life" (Food and Agricultural Organization of the United Nations, 2009). Health disparities among Native Hawaiians suggests that there is inequitable access to safe and nutritious foods in Native Hawaiians communities. As stated in the introduction, Native Hawaiians were once self-sustainable and possessed sophisticated food systems to feed entire communities. In today's society, there are multiple challenges facing Native Hawaiians, which exacerbates food insecurity. For example, the settler State of Hawai'i is one of the most expensive states in the U.S. to live in (The State of Hawaii Databook, 2009). The high cost of living combined with an estimated 90% of imported foods and the prevalence of cheap, processed foods, likely leads to the chronic diseases disproportionately affected by Native Hawaiian people (Halweil, 2004; Office of Planning, 2020). Native Hawaiians are forced to shop in grocery stores or order from food establishments in their communities and many of those establishments offer cheap, processed foods, aiding in the chronic diseases disproportionately affected by Native Hawaiians people. While these challenges do not stand alone, they illustrate that current built environments are not conducive to the social, cultural, and economic needs of Native Hawaiians to reach food security. Therefore, establishing more grocery stores with safe and nutritious foods in Native Hawaiians communities cannot address food insecurity alone.

To truly promote wholistic health for indigenous people, we need to move beyond food security by promoting food sovereignty. Coté describes food sovereignty as "the right of all peoples to healthy and culturally appropriate food and the right to define their own food and agricultural systems" (Coté, 2016). By teaching community members how to grow their own food through connections with the land, their families, and communities, MALAMA offers a solution for Native Hawaiians to reimagine ahupua'a living in contemporary times, which is a crucial part of the transformative process of health and wellness. As stated, the aquaponics system simulates a mini ahupua'a, providing families nutritious resources to not survive, but thrive. Although studies have shown that the traditional Hawaiian diet can help Native Hawaiians lose weight and improve blood pressure, serum glucose, and serum lipid (Shintani et al., 1994), the high cost of traditional foods in grocery stores creates a barrier for Native Hawaiians in accessing their traditional diets and, therefore, they lack the opportunity of optimal health. MALAMA also provides Native Hawaiians the space to grow traditional and local foods once found in every ahupua'a that are now expensive and nonexistent in grocery stores. For example, program participants are actively growing kalo (taro), māmaki (a native Hawaiian plant used for tea that has healing properties), and 'olena (turmeric) (Ho-Lastimosa et al., 2021a; Ho-Lastimosa et al., 2021b; Fox et al., 2020). Culturally grounded programs that seek to promote food sovereignty, like the MALAMA program, provide an avenue to grow Native Hawaiian traditional foods and increase access to traditional diets. Such programs offer a decolonized solution to address the pervasive health disparities. Decolonization involves empowering Native Hawaiians and other Indigenous groups in self-determining their health, reconnecting to their culture, and redefining their relationships with food, land, community, and their families. Additionally, it involves Indigenous food sovereignty which directly tackles issues that prevent Indigenous peoples from practicing their culture (Robin, 2019), and thus, having access to traditional foods and a means to survive and thrive through nutrition.

Other Indigenous groups have developed food sovereignty programs, and, like the MALAMA program, they inspire Indigenous peoples to rebuild connections to land and reignite

the responsibility to care for land through growing food (Delormier, Horn-Miller, McComber, & Marquis, 2017; Gulrukh Kamal, Linklater, Thompson, Dipple, & Ithinto Mechisowin Committee, 2015; Miltenburg, Neufeld, & Anderson, 2022). Some of these programs have been developed for Indigenous groups who have had to relocate to urban areas or away from their ancestral homelands (Cidro, Adekunle, Peters, & Martens, 2015). While the MALAMA program was tested among Native Hawaiians in Hawai‘i, its technology and curriculum can be adapted for Native Hawaiians and other Indigenous peoples living in more urban areas in and outside of Hawai‘i. A growing number of Native Hawaiians have relocated to the continental U.S. as the cost of living has skyrocketed (Kelleher, 2023). Programs like MALAMA could offer them a connection to home, culture, family, and community that have positive implications for well-being.

However, the issue of food insecurity needs to be addressed at home in Hawai‘i. Having sustainable, accessible, and cheap sources of safe and nutritious foods is pertinent in Hawai‘i as its geographical location is isolated from the rest of the world. It is especially important during natural disasters and critical times like COVID-19. During the pandemic, Hawai‘i witnessed how finite imported resources were as the virus caused a panic for residents who flocked to grocery stores and emptied shelves, resulting in wait periods to purchase foods and resources normally available pre-pandemic. Moreover, in July and August 2020, a SMS Community Pulse Survey was conducted and found that one in five Hawai‘i residents reported that the food they bought did not last and they did not have money to get more (SMS Community Pulse, 2020). The MALAMA program offers a solution through self-sufficiency and self-determination where aquaponics systems can serve as a source to nourish their families during difficult and stressful times, especially in times of disaster or worldwide pandemics. Future studies should investigate programs like MALAMA in addressing the impacts of COVID-19.

This study also highlights the need to decolonize public health and health programming, especially for Indigenous communities. Programs that target one aspect of health are not sustainable in Indigenous communities as many believe in a wholistic approach to well-being. As seen in Pili Pono Practice and other Native Hawaiian health frameworks like Kūkulu Kumuhana and Pilinahā, health is relational to all aspects of life (Kūkulu Kumuhana, 2020; Odom et al., 2019). Native Hawaiian understanding of health goes beyond individual behaviors and includes salient and reciprocal connections to food, land, community, families, spirituality, etc. The findings from this study are in alignment with studies conducted with other Indigenous communities that have demonstrated successful decolonial approaches to tackle morbidity and inequitable social determinants of health (Delormier et al., 2009; de Souza et al., 202; Fast et al., 2020; Kaholokula et al., 2021; Lemke et al., 2018; Potvin et al., 2003; Stelkia et al., 2020). Therefore, it is critical that public health interventions that are designed for Indigenous communities consider Indigenous ideas of well-being. Failure to do so risks the ongoing trend of health disparities disproportionately impacting Indigenous communities. Furthermore, efforts to address health disparities should be made under the direction of Indigenous peoples who once independently sustained themselves because of their long-standing, familial, and reciprocal relationships with land and food. It is imperative to note that Indigenous communities are diverse and vast based on their ethnicity and geographical location. Therefore, practices and frameworks for one Indigenous community are not always generalizable. Decision-makers and public health professionals who are not from these communities should heed to the voices, expertise, and recommendations of the Indigenous people from the community at hand. The development of the Pili Pono Practice is evident of this recommendation as Ke Kula Nui O Waimānalo recognizes other stellar models of Native Hawaiian

health but developed their own dimensions of Pili Pono Practice to fit the needs of the Waimānalo community.

Pilina, with the various dimensions of Pili Pono Practice, is pertinent to the success of the MALAMA program and other programs of Ke Kula Nui O Waimānalo. Colonization and settlerism has attempted to destroy Native Hawaiian pilina to culture, land, values, and practice. However, with the emphasis on building pilina, the MALAMA program has reclaimed Hawaiian culture and connection with the Waimānalo community. The interconnectedness of the Pili Pono Practice dimensions stem from ʻike kūpuna (ancestral knowledge). Findings from this study add to the body of literature in demonstrating that reinstating the knowledge and teachings of the past with innovative ways of mālama ʻāina and other practices works for contemporary Native Hawaiians (Ho-Lastimosa et al., 2014; Kaholokula et al., 2018; Shintani et al., 1994). Therefore, largely funded public health programs that wish to close disparity gaps, like food insecurity and chronic diseases, must prioritize Native Hawaiian reclamation of culture and hold ʻike kūpuna with high regard.

Perhaps the most salient theme in this study was pili kaiāulu or connection to community. Participants spoke at length about how the MALAMA program reignited or strengthened their relationships with other community members. While pili kaiāulu is interconnected with other dimensions of Pili Pono Practice, it is important to note that culturally grounded programs established by and for Indigenous communities can increase participant retention and can have longer-lasting impacts (Nadalin et al., 2013). Furthermore, findings suggest that the pilina between participants, Lima Kōkua, and the program/research team that exists beyond the program has ignited a sense of desire to work together to address challenges participants face as a community. Such pilina is reflected in pre-Western contact Hawaiʻi, where everyone within an ahupuaʻa had a role and worked together to survive and thrive. Fortunately, the MALAMA program is just one example of programs in the Waimānalo community, and the broader Native Hawaiian community aimed at addressing health disparities and enhancing health equity using Indigenous methodologies. Many of the research team and program staff are board members of Ke Kula Nui O Waimānalo, which boasts a plethora of community-based and culturally grounded programs that wholistically address health for the Waimānalo community. Public health professionals and decision makers who determine where public health resources are spent should follow the leadership of Indigenous community leaders who are deeply committed to their communities, like Ke Kula Nui O Waimānalo.

Board member of Ke Kula Nui O Waimānalo, executive director of GCW, and co-author, ʻIlima Ho-Lastimosa, envisioned early on an aquaponics system in every backyard of every Hawaiian Homestead home to provide Native Hawaiians food security, direct connection to their culture, and potential economic gain. The Hawaiian Homes Commission Act of 1920 was intended to rehabilitate Native Hawaiians through a government-sponsored homesteading program and give them economic self-sufficiency through the provision of land (Hawaiian Homes Commission Act, 2020). However, the diversion of natural resources like water and the geographical placement of Hawaiian Homesteads prohibited their self-sufficiency by placing Native Hawaiians on land that lacked the resources their kūpuna (ancestors/elders) needed to survive and thrive. Native Hawaiians who were fortunate to receive Hawaiian Homestead leases were provided land and/or homes but lacked the infrastructure to self-sustain and support each other. Eventually, towns that possessed Hawaiian Homesteads were presented with structural challenges, resulting in the most daunting health, social, educational, and economic disparities in Hawaiʻi. Programs like

MALAMA may provide favorable conditions in health and address the Hawaiian Homes Commission Act's original intention, as it allows Native Hawaiians access to healthy and traditional foods, traditional ways of life, and an opportunity to make a profit from produce. Therefore, while Hawaiian Homestead lands are not conducive for traditional ahupua'a living, participants in the program have been able to regain such living practices and reclaim food sustenance through their aquaponics systems. In addition, Nānā i ke Kumu: Helu 'Ekolu was published in 2020 by authors who are esteemed cultural practitioners (Paglinawan et al., 2020). They tasked the present generation to have a healer in every home. By reviving and promoting the practice of lā'au lapa'au, MALAMA is one of the efforts that are helping the community move towards this goal.

Currently, the MALAMA program has been expanded to more families in Waimānalo and to other islands, including Maui and Hawai'i Island, specifically Hawaiian Homestead communities. Through partnerships with multiple Hawaiian Homestead communities on these islands, Native Hawaiians families who are homesteaders are learning methods of food sovereignty and growing their own food through backyard aquaponics. There are different homestead associations on every island and MALAMA is providing an opportunity for families from multiple associations together in every community. Lima Kōkua are also being trained as peer leaders to serve as community resources and champions to grow capacity within each community. So far, the following Hawaiian Homestead Associations are partnered with the MALAMA program: Waiohuli and Kēōkea on Maui, and Maku'u, Panaewa, Keaukaha, Kaumana, and Pi'ihonua on Hawai'i Island. Currently, within different homestead communities, there are multiple sub-divisions that are divided by private real estate, rivers, corporate stores, etc. Such division has been divisive for Native Hawaiians who lack connection to other Native Hawaiians in their own communities. The MALAMA program fosters connections within communities and across Hawai'i, forging a better connected Lāhui (nation).

However, it is important to note that backyard aquaponics alone cannot address all disparities. Structural changes must coincide with community-level food security and health programs. One solution is 'āina back, or for lands to be returned to Native Hawaiians. 'Āina back provides endless opportunities for Native Hawaiians to address their own food insecurity and reclaim food sovereignty by providing more acreage to cultivate food, share it, and sell to local markets. 'Āina back also has the ability to heal Native Hawaiians who have been in a state of chaos since foreigners arrived in Hawai'i. 'Āina for Native Hawaiians, like many other Indigenous peoples, is familial and central to all other dimensions of health, wellness, and wealth. Without 'āina, Pili Pono Practices cannot exist as contemporary Native Hawaiians and their ancestors look to land for meaning of their lives, relationships, and spirituality. With 'āina back, we will truly address the original intention of the Hawaiian Homes Commission Act by making all Native Hawaiians, regardless of blood quantum, economically self-sufficient and rebuild their connections to 'āina and each other.

Despite the important findings of this study, limitations must be acknowledged. Findings from this study may not be generalizable to other Native Hawaiians and or Indigenous communities as participants evaluated the MALAMA program specifically in Waimānalo. In addition, while community members were included in the entire research process, the findings may be limited to the interpretations of the research team and those involved in the research process. Also, negative impacts or dissatisfaction of the program were not identified by participants. The only attempt to collect this data was in the focus group, which could pose limitations through

confirmation bias. Future evaluations of the MALAMA program and other similar interventions should consider inquiring about dissatisfaction through key informant interviews. Lastly, to respect community protocols, data regarding socioeconomic background was not presented in the current paper. One variable, educational attainment, was reported and of participants in this study had higher educational attainment than the average in the Waimānalo community. However, this data alone cannot illustrate the food insecurity and economic status of participants, limiting our understanding of participant need for the MALAMA program.

CONCLUSION

Food insecurity among Native Hawaiians can be addressed through culturally grounded programs, like the MALAMA program, that go beyond providing food. The success of MALAMA in rebuilding Native Hawaiian relationships with land, strengthening their connections with family and community, and providing them an opportunity for economic, social, and physical wellness is a step toward Native Hawaiian food sovereignty that can be adapted in other Hawaiian communities in and outside of Hawai‘i.

REFERENCES

Abbott, I.A. (1992). La‘au Hawai‘i: Traditional Hawaiian uses of plants. Bishop Museum Press.

Arvin, M. R. (2019). *Possessing polynesians: The science of settler colonial whiteness in Hawai`i and Oceania*. Duke University Press.

Beebe, J. K., Amshoff, Y., Ho-Lastimosa, I., Moyeadi, G., Bradley, A.L. C., Kim, I., Casson, N., Protzman, R., Espiritu, D., Spencer, M.S., Chung-Do, J.J. (2020). Reconnecting Rural Native Hawaiian Families to food through aquaponics. *Genealogy, 4*(9). Doi:10.3390/geanealogy4010009.

Brace, A.M., Moore, T.W., Matthews, T.L. (2020). The Relationship Between Food Deserts, Farmers’ Markets, and Food Assistance Programs in Hawai‘i Census Tracts. *Hawaii Journal of Health and Social Welfare, 79*(2), 36-41.

Cantor, A., Kay, K., Knudson, C. (2020). Legal geographies and political ecologies of water allocation in Maui, Hawai‘i. *Geoforum*, 110, 168-179.

Coté C. (2016). “Indigenizing” Food Sovereignty. Revitalizing Indigenous Food Practices and Ecological Knowledges in Canada and the United States. *Humanities, 5*(3), 57. https://doi.org/10.3390/h5030057

Delormier, T., Frohlich, K.L., Potvin, L. (2009). Food and eating as a social practice -- understanding eating patterns as a social phenomena and implications for public health. *Sociology of Health & Illness, 31*(2), 215-228.

de Souza, R., Bilodeau, N., Gordon, K., Davis, A., Stearns, J., Cranmer-Byng, M., Gasparelli, K., Davis Hill, L., Anand, S. (2021). Entsisewata’karí:teke (You Will Be Healthy Again): Clinical Outcomes of Returning to a Traditional Haudenosaunee Diet. *International Journal of Indigenous Health, 16*(2). 10.32799/ijih.v16i2.33098

Delormier, T., Horn-Miller, K., McComber, A.M., Marquis, K. (2017). Reclaiming food security in the Mohawk community of Kahnawà:ke through Haudenosaunee responsibilities. *Maternal and Child Nutrition*, 13(Suppl 3), e12556.

Fast, E., Lefebvre, M., Reid, C., Deer, W., Swiftwolfe, D., Clark, M., Boldo, V., Mackie, J., Mackie, R. (2020). Restoring Our Roots: Land-Based Community by and for Indigenous

Youth. *International Journal of Indigenous Health, 16*(2). 10.32799/ijih.v16i2.33932.

Food and Agricultural Organization of the United Nations. (2009). The State of Food Insecurity in the World 2009: Economic Crises – Impacts and Lessons Learned. Retrieved from: https://www.fao.org/3/i0876e/i0876e00.htm

Fox, B.K., Radovich, T., Tsukayama, N., Silva, P., Chung-Do, J.J., Ho-Lastimosa, I., Hwang, P., Keli'iholokai, L., Rogerson, I., Deitschman, K., Ho, K. K. Maximizing Taro (Colocasia esculenta L.) Corm Production in Aquaponics through Manipulation of Water Quality Late in the Vegetative Growth Stage. Poster presentation at the American Society for Horticultural Science. Orlando, FL, August 2020.

Gingerich, S.B., Wolff, R.H. (2005). *Effects of surface-water diversions on habitat availability for native macrofauna, Northeast Maui, Hawaii*. US Department of the Interior, US Geological Survey.

Goebert, D.A., Hamagami, F., Hishinuma, E., Chung-Do, J.J., Sugimoto-Matsuda, J.J. (2019). Change pathways in indigenous and non-indigenous youth suicide. *Suicide and Life-Threatening Behavior, 49*(1), 193-209. DOI: 10.1111/sltb.12420.

Gulrukh Kamal, A., Linklater, R., Thompson, S., Dipple, J., Ithinto Mechisowin Committee. (2015) A Recipe for Change: Reclamation of Indigenous Food Sovereignty in *O-Pipon-Na-Piwin Cree* Nation for Decolonization, Resource Sharing, and Cultural Restoration. *Globalizations*, 12(4), 559-575, DOI: 10.1080/14747731.2015.1039761

Halweil, B. (2004). Eat here: Reclaiming homegrown pleasures in a global supermarket. W.W. Norton & Co.

Hambrey, J., Evans, S., Pantanella, E. (2013). The relevance of aquaponics to the New Zealand aid programme, particularly in the Pacific. Ministry of Foreign Affairs and Trade (New Zealand). https://www.mfat.govt.nz/assets/Uploads/The-relevance-of-aquaponics-to-the-New-Zealand-aid-programme-particularly-in-the-Pacific.pdf

Hawai'i Department of Health. (2001). Hunger and food insecurity in Hawai'i: Baseline Estimates Honolulu: Hawai'i Department of Health. Retrieved from: http://health.hawaii.gov/hhs/files/2013/04/specfood.pdf

Hawai'i Health Matters [database online]. (2021). *Custom Dashboard*. https://www.hawaiihealthmatters.org/indicators/index/indicatorsearch?module=indicators&controller=index&action=indicatorsearch&doSearch=1&i=2393_3135_1248_11371_2467_1307&l=14&primaryTopicOnly=&b%5B%5D=100&subgrouping=1&card=0&handpicked=1&resultsPerPage=150&showComparisons=1&showOnlySelectedComparisons=&showOnlySelectedComparisons=1&includeArchivedIndicators=&includeArchivedIndicators=1&grouping=1&ordering=1&sortcomp=0&sortcompIncludeMissing= . Accessed April 2023.

Hawaiian Homes Commission Act. Department of Hawaiian Homelands. Retrieved from: https://dhhl.hawaii.gov/hhc/laws-and-rules/. Accessed January 2020.

Ho-Lastimosa, I., Hwang, P.W., & Lastimosa, B. (2014). Insights in public health: Community strengthening through canoe culture: Ho'omana'o Mau as Method and Metaphor. *Hawai'i Journal of Medicine & Public Health, 73*(12), 397–399.

Ho-Lastimosa, I., Chung-Do, J., Amshoff, Y., Bradley, A., Beebe, K., Casson, N., Kim, I., Moayedi, G., Protzman, R., Radovich, T., Lastimosa, B., Ho, K., & Spencer, M. (2017). Promoting Native Hawaiian Wellness through the Use of Aquaponics. Poster presented at the American Public Health Association Conference, Atlanta, Georgia.

Ho-Lastimosa, H.I., Chung-Do, J.J., Hwang, P., Radovich, T., Rogerson, I., Ho, K…Spencer, M.S (2019). Integrating Native Hawaiian tradition with the modern technology of aquaponics. *Global Health Promotion, 26*(Supp 3), 87-92. doi: 10.1177/1757975919831241.

Ho-Lastimosa, I., Keli‘iholokai, L., Kassebeer, K., Kassebeer, H., Kamai, J. A., Rogerson, I., Jr, K. H., Ho, M., Ho, K., Deitschman, K., Ka‘a‘a, D., Radovich, T., & Chung-Do, J. (2020). Kōkua Kaiāulu: Keeping the Native Hawaiian Community in Waimānalo Fed. *Journal of Indigenous Social Development, 9*(3), 170–182.

Ho-Lastimosa, I., Fox, B.K., Radovich, T.J.K., Chung-Do, J.J., Keli‘iholokai, L., Rogerson, I., Deitschman, K., Ho Jr., K. K., Vegas, K., Hwang, P., Tsukayama, N., Silva, P. (2021a). Maximizing taro Colocasia esculenta L. corm production in aquaponics through manipulation of water quality late in the vegetative growth stage. Aquaculture America 2021 Conference, San Antonio, TX.

Ho-Lastimosa, I., Chung-Do, J.J., Keliiholokai, L., Deitschman, K., Hwang, P., Vegas, K., Rogerson, I. Ho, K., Makaneole, K., Coleman, P., Fox, B. K., Radovich, T. (2021b). Aquaponic Vegetable Production Supports Food Self-Sufficiency Efforts in Indigenous Hawaiian Communities. American Society for Horticultural Science, Denver, CO.

Kaholokula, J., Look, M., de Silva, M., Seto, T., Wills, T. (2018). Using a Native Hawaiian Cultural Practice to Prevent Cardiovascular Disease: The KāHOLO Project. Society for Prevention Research 2018 Annual Meeting 10.13140/RG.2.2.32224.79368.

Kaholokula, J., Look, M., Mabellos, T., Ahn, H.J., Choi, S.Y., Sinclair, K., Wills, T., Seto, T., de Silva, M. (2021). A Cultural Dance Program Improves Hypertension Control and Cardiovascular Disease Risk in Native Hawaiians: A Randomized Controlled Trial. *Annals of Behavioral Medicine, 55*(10), 1006-1018. 10.1093/abm/kaaa127

Kamea‘eleihiwa, L. (1992). Native Land and Foreign Desires: Pehea lā e pono ai? How shall we live in harmony? Bishop Museum Press.

Kanaeokana. The Kula Hawai‘i Network. Retrieved from: https://kanaeokana.net/aole/. Accessed January 2020.

Karger H. (2020). Problems in Paradise: Low Wages and the Well-Being of Hawaiians. *Families in Society, 101*(3), 340-352. doi:10.1177/1044389420911321

Kawai‘ae‘a K. et al. (2019). Keaomālamalama: Catalysts for Transformative Change in Hawaiian Education. In: McKinley E., Smith L. (eds) Handbook of Indigenous Education. Springer. https://doi-org.eres.library.manoa.hawaii.edu/10.1007/978-981-10-3899-0_35

Ke Kula Nui O Waimānalo. Waimānalo Limu Hui. Retrieved from: http://www.kekulanuiowaimanalo.org/programs/limu/. Accessed January 2020.

Keli'iholokai, L., Keaulana, S., Antonio, M., Rogerson, I., Deitschman, K., Kamai, J.A., Albinio, L., Wilson, K., Kepa, D., Makua, K.L., Vegas, J.K., Chung-Do, J.J., Ho, K., Jr, & Ho-Lastimosa, H.I. (2020). Reclaiming 'Āina Health in Waimānalo. *International Journal of Environmental Research and Public Health, 17*(14), 5066. https://doi.org/10.3390/ijerph17145066

Kelleher, J.S. (2023, Jan 23). *More Native Hawaiians flock to mainland cities and leave Hawai‘i, citing high costs*. Hawai‘i Public Radio. https://www.hawaiipublicradio.org/local-news/2023-01-23/more-native-hawaiians-flock-to-mainland-cities-and-leave-hawaii-citing-high-costs

Kūkulu Kumuhana. Creating Radical and New Knowledge to Improve Native Hawaiian Wellbeing. Retrieved from:

https://onipaa.org/media/W1siZiIsIjIwMTkvMDEvMDQvMTdfNDlfNDVfNTI2X0tfa3VsdV9LdW11aGFuYV8yMDE4X1llYXJfSW5fUmV2aWV3LnBkZiJdXQ/K%C5%ABkulu%20Kumuhana%202018-Year%20In%20Review.pdf?sha=13b0afd0. Accessed January 2020.

Lee, A.A., Piette, J.D., Heisler, M., Janevic, M.R., Langa, K.M., & Rosland, A.M. (2017). Family members' experiences supporting adults with chronic illness: A national survey. *Families, Systems, & Health, 35*(4), 463–473. https://doi.org/10.1037/fsh0000293

Lee, S., Oshiro, M., Hsu, L., Buchthal, O.V., & Sentell, T. (2012). Public Health Hotline: Neighborhoods and Health in Hawai'i: Considering Food Accessibility and Affordability. *Hawai'i Journal of Medicine and Public Health, 71*(8), 232–237.

Lemke, S., Delormier, T. (2018). Indigenous Peoples' food systems, nutrition, gender: Conceptual and methodological considerations. *Maternal & Child Nutrition, 13*(S3), E12499.

Loke, M.K., Leung, P. (2013). Hawai'i's Food Consumption and Supply Sources: Benchmark Estimates and Measurement Issues. *Journal of Agricultural Economics, 1*, 10. https://doi.org/10.1186/2193-7532-1-10

Look, M.A., Soong S., Kaholokula, J.K. (2020). Assessment and Priorities for Health and Well-Being in Native Hawaiians and Pacific Islanders. Honolulu, HI. Department of Native Hawaiian Health, John A. Burns School of Medicine, University of Hawai'i.

MacKenzie, M.K.,Sproat, D.K. (2017). A Collective Memory of Injustice: *Reclaiming Hawai'i's Crown Lands Trust in Response to Judge James S. Burns*, 39 U. Haw. L. Rev. 481, 502–06 .

Mau, M.K., Wong, K.N., Efird, J., West, M., Saito, E.P., & Maddock, J. (2008). Environmental factors of obesity in communities with native Hawaiians. *Hawaii Medical Journal, 67*(9), 233–236.

Mau, M.K., Kaholokula, J.K., West, M.R., Leake, A., Efird, J.T., Rose, C, Palakiko, D., Yoshimura, S., Kekauoha, P. B., Gomes, H. (2010). Translating Diabetes Prevention Into Native Hawaiian and Pacific Islander Communities: the PILI 'Ohana Pilot project. *Progress in Community Health Partnerships, 4*(1), 7-16.

Mcgregor, D.P., Morelli, P.T., Matsuoka, J.K., Rodenhurst, R., Kong, N., Spencer, M.S. (2003). An Ecological Model of Native Hawaiian Health. *Pacific Health Dialogue, 10*(2), 106-128.

Meyer, M.A. (2001). Our own liberation: Reflections on Hawaiian Epistemology. *The Contemporary Pacific, 13*(1), 124-148. 10.1353/cp.2001.0024

Miltenburg, E., Neufeld, H. T., & Anderson, K. (2022). Relationality, Responsibility and Reciprocity: Cultivating Indigenous Food Sovereignty within Urban Environments. *Nutrients, 14*(9), 1737. MDPI AG. Retrieved from http://dx.doi.org/10.3390/nu14091737

Nadalin, V., Maar, M., Ashbury, F., McLaughlin, J. (2013). Issues in the Recruitment and Retention of Aboriginal Health Research Participants in Canada. In Aboriginal Policy Research Series Volume IX.; White, J.P., Peters, J., Dinsdale, P., Beavon, D. Thompson Educational Publishing, Inc.

Odom, S.K., Jackson, P., Derauf, D., Inada, M.K., & Aoki, A.H. (2019). Pilinahā: An Indigenous Framework for Health. *Current Developments in Nutrition, 3*(Suppl 2), 32–38. https://doi.org/10.1093/cdn/nzz001

Office of Minority Health. (2021). Profile: Native Hawaiians/Pacific Islanders. Department of

Health and Human Services. Accessed January 2020. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=65

Office of Planning, Department of Business, Economic Development and Tourism, Hawai'i. Increased food security and food self-sufficiency strategy. Retrieved from: https://files.hawaii.gov/dbedt/op/spb/INCREASED_FOOD_SECURITY_AND_FOOD_SELF_SUFFICIENCY_STRATEGY.pdf. Accessed January 2020.

Oki, D.S., Wolff, R.H., Perreault, J.A. (2010). *Effects of surface-water diversion on streamflow, recharge, physical habitat, and temperature, Nā Wai 'Ehā, Maui, Hawai'i.* US Geol. Surv. Sci. Invest. Rep, 5011, 154.

Paepae o He'eia. Restoration. Retrieved from: https://paepaeoheeia.org/restoration/. Accessed January 2020.

Paglinawan, L.K., Kauahi, D., Kanuha, V.K., Paglinawan, R.L. (2020). Nānā I Ke Kumu: Helu 'Ekolu (Volume Three). Liliuokalani Trust.

Papa Ola Lōkahi. Hawaiian Health Timeline and Events. Retrieved from: http://papaolalokahi.org/images/pdf-files/hawaiian-health-time-line-and-events.pdf. Accessed January 2020.

Potvin, L., Cargo, M., McComber, A.M., Delormier, T., Macaulay, A.C. (2003). Implementing participatory intervention and research in communities: lessons from the Kahnawake Schools Diabetes Prevention Project in Canada. *Social Science & Medicine, 56*(6), 1295-1305. https://doi.org/10.1016/S0277-9536(02)00129-6.

Protect Kaho'olawe 'Ohana. Retrieved from: http://www.protectkahoolaweohana.org/mo699olelo-699256ina.html. Accessed January 2020.

Pukui, M.K., & Varez, D. (1983). 'Ōlelo No'eau: Hawaiian proverbs and poetical sayings. Bishop Museum Press.

Richmond, C.A., Ross, N.A., Egeland, G.M. (2007). Social Support and Thriving Health: A New Approach to Understanding the Health of Indigenous Canadians. *American Journal of Public Health, 97*(10),1827–33.

Richmond, R., Kerr, R.B., Neufeld, H., Steckley, M., Wilson, K., Dokis B. (2021). Supporting Food Security for Indigenous Families Through the Restoration of Indigenous Foodways. *The Canadian Geographer / Le Géographe canadien, 65*(1), 97-109.

Shintani, T., Beckham, S., O'Connor, H.K., Hughes, C., & Sato, A. (1994). The Waianae Diet Program: a culturally sensitive, community-based obesity and clinical intervention program for the Native Hawaiian population. *Hawaii Medical Journal*, *53*(5), 136–147.

SMS Community Pulse. (2020). One in Five Hawaii residents indicate that they do not have enough money for food. SMS Hawaii. Retrieved from: https://www.smshawaii.com/posts/2020/08/21/sms-community-pulse-one-in-five-hawaii-residents-indicate-that-they-do-not-have-enough-money-for-food

Sotero M.A. (2009). Conceptual Model of Historical Trauma: Implications for Public Health Practice and Research. *Journal of Health Disparities Research and Practice, 1*(1), 93-108.

State of Hawaii, Department of Business, Economic Development, and Tourism, Research and Economic Analysis Division. (2017). Native Hawaiians in Hawaii's Tourism Sector. https://files.hawaii.gov/dbedt/economic/reports/Native_Hawaiians_in_Tourism_Final_4-13-17.pdf

Stelkia, K., Beck, L., Manshadi, A., Fisk, A., Adams, E., Browne, A., Dixon, C., McEachern, D.,

Ritchie, W., McDonald, S., Henry, B., Marsden, N., Behn-Smith, D., Reading, J. (2020). Letsemot, "Togetherness": Exploring How Connection to Land, Water, and Territory Influences Health and Wellness with First Nations Knowledge Keepers and Youth in the Fraser Salish Region of British Columbia. *International Journal of Indigenous Health, 16*(2). 10.32799/ijih.v16i2.33206.

Tengan, T.P.K. (2004). Of colonization and Pono in Hawai'i. *Peace Review, 16*(2), 157-167. https://doi.org/10.1080/1040265042000237699

Van Dyke, J.M. (2008). *Who Owns the Crown Lands of Hawai'i?* University of Hawai'i Press.

Walters, K.L., & Simoni, J.M. (2002). Reconceptualizing native women's health: an "indigenist" stress-coping model. *American Journal of Public Health***,** *92*(4), 520–524. https://doi.org/10.2105/ajph.92.4.520

The State of Hawaii Data Book 2014. Retrieved from: https://files.hawaii.gov/dbedt/economic/databook/2014-individual/14/142214.pdf. Accessed January 2020.

Tokunaga, K., Tamaru, C., Ako, H., & Leung, P. (2015). Economics of commercial aquaponics in Hawai'i. *Journal of the World Aquaculture Society, 46*(1), 20-32. https://doi.org/10.1111/jwas.12173

Appendix A

Focus Group Guide Questions

Topic Area	Questions	Prompts
Satisfaction	1. What did you like about the MALAMA Aquaponics Program overall?	What about -ice breakers -the schedule of the program -the length of the program -any barriers?
	2. What would be an ideal schedule for you and your ‘ohana?	
	3. Were there parts of the MALAMA Aquaponics Program you did not like? If so, what?	
	4. How could the team improve some of these things?	
Data collection	5. In the beginning of the program and today, you got your blood pressure, hip-waist measurement, and weight taken. How did you feel about getting these measurements taken?	What did you like/not like about it? What about stepping on a scale? Did you feel uncomfortable at any time?
	6. You also took a survey in the beginning of the program and today. How did you feel about the survey?	Were there any questions that made you feel uncomfortable? How about the length?
	7. Have you seen any changes in your ‘ohana, in yourself, or anything in your life since you’ve been in the MALAMA-aquaponics program that you didn’t see in the survey?	
Culture	8. Do you think the MALAMA-aquaponics	

	program was rooted in Hawaiian values and practices?	
	9. What Hawaiian values did you practice in the MALAMA-aquaponics program?	
	10. What are ways the program could be more Hawaiian?	
	11. Did you learn something new about the Hawaiian culture?	
	12. Did you feel it was a safe place to share and practice Hawaiian culture?	
Future participation and suggestions	13. Would you participate again?	If MALAMA-aquaponics were to continue, how would you want to be involved since you've already participated in the program and have a system?
	14. Would you recommend your family and neighbors to participate?	
	15. What would you like to see the next time around?	

Appendix B

Key Informant Interview Guide Questions

Questions	Prompts
1. Can you tell me about your experience with the MALAMA Study?	• What did you enjoy? What did you like the most? • What could have been better? What did you like the least? • What did you learn from participating in this project? • Did it meet your expectations? • Would you participate again? • Would you want to be a Lima Kokua for future families?
2. Did you think the workshops aligned with the values of the Waimānalo community and Native Hawaiian culture? What parts of it would you change or do differently?	
3. What did you think about being a research participant?	• How was the survey? • The nurses (blood pressure, weight, height, hip measurements) • Focus group at the end?
4. How has having an aquaponics system benefitted you, your family, and the Waimānalo community?	• Is everyone in the family eating what you're growing? Do you feel like you and your family are eating healthier? • Do you spend less on groceries--fresh fruits and vegetables, and/or fish? • Do you feel healthier physically (i.e., more energy)? • Has maintaining the aquaponics system together as a family help develop a stronger bond/relationship with one another? Do you spend more time with each other? Do you feel closer as a family? • Do you feel like it impacted your identity as Hawaiian or help you understand Hawaiian cultural practices and values?

	• What other benefits do you see?
5. Has the MALAMA aquaponics study encouraged or motivated you to be healthier? If so, how?	• Have you started exercising or getting more physically active? • Stopped smoking or smoking less? • Have you looked online about being healthier? • Have you spoken to health practitioners? • Have you joined other wellness programs since the study?
6. Are you using your aquaponics system? Is it currently functioning?	• If so, how often do you use it for your meals? • If so, what have you grown and how much? How have you used what you've grown (making meals, lāʻau, give to others?) • If not, what caused you to stop?
7. Would you want to learn how to grow kalo in there? How much kalo do you and your family eat now, and would you want to have more?	
8. What are some resources or support that could help you continue using your system or help you start up again?	• Workshops? On what kinds of topics, (increasing crop yield, pest control, technical assistance, how to cook the fish and veggies, etc.)? • Do you prefer a community workshop or individual attention? How often should we meet? • Do you use social media (MALAMA group on Facebook)? • What do you feel is the best way to communicate? •
9. Are you satisfied with the amount of food you are growing?	• Are you growing too little, enough, or excess food for your family? • If you have an excess amount, what do you do with the extra food?
10. Do you have any recommendations or advice for a family interested in starting their own aquaponics system?	