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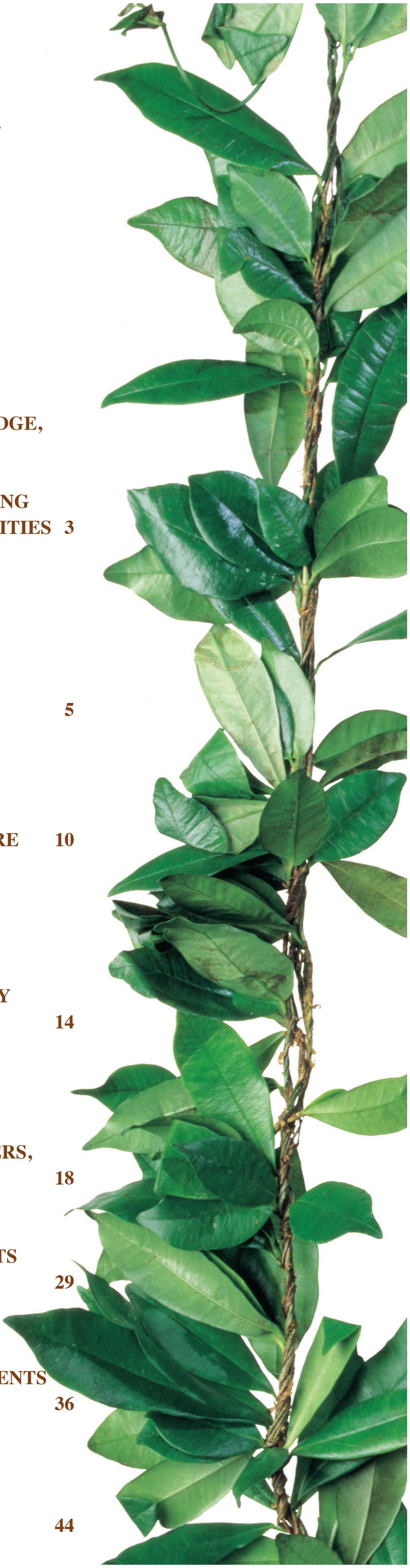
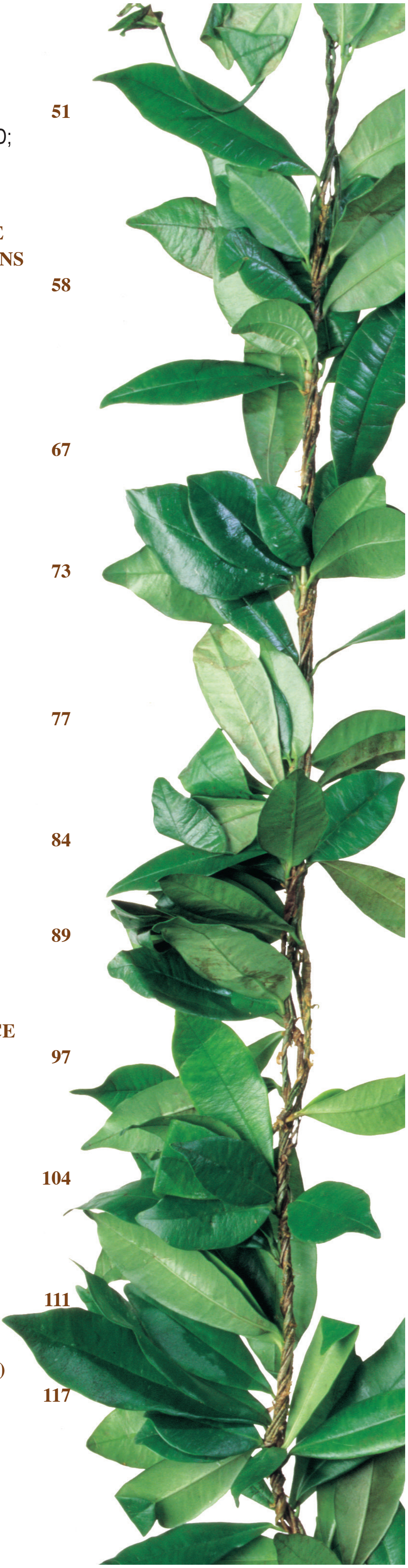


## SPECIAL ISSUE BY THE CENTER FOR PACIFIC INNOVATIONS, KNOWLEDGE, AND OPPORTUNITIES (PIKO)

## PART I

**PART II**



## Guest Editors' Message

# Resources and Methods for Examining Native Hawaiian, Pacific Islander, and Filipino Health Disparities

Eunjung Lim PhD; Kathryn L. Braun DrPH; Deborah Taira ScD

### Abbreviations

*BERD = biostatistics, epidemiology, and research design*
*NH = Native Hawaiian*
*PI = Pacific Islander*
*PIKO = Center for Pacific Innovations, Knowledge, and Opportunities*

Dear Readers,

Why does Hawai‘i need this supplemental issue titled, "Resources and Methods for Examining Native Hawaiian (NH), Pacific Islander (PI), and Filipino Health Disparities?" Chronic conditions including diabetes, heart disease, and obesity are more prevalent in NH, PI, and Filipino patients than other racial/ethnic groups.[1-7] Due to the higher prevalence of chronic diseases and other health problems, NHs have shorter life expectancies than the overall population.[8] When seeking medical care, NH, PI, and Filipino individuals often face linguistic and cultural difficulties that may result in poorer health outcomes and untreated medical issues.[9,10] NH, PI, and Filipino are also more likely to experience mental health problems, such as sadness and anxiety, than Whites and are less likely to seek mental health care.[11-13]

The goal of this supplement is to encourage broader use of research and intervention approaches that "work" for NH, PI, and Filipino individuals and other small populations by providing resources, tools, and information of relevance and importance to academic researchers and communities.

This issue is sponsored by the Center for Pacific Innovations, Knowledge, and Opportunities (PIKO), an infrastructure-building program funded by the National Institute of General Medical Sciences (U54GM138062). The goal of PIKO is to promote the development of culturally responsive and community-engaged clinical and translational research aimed at improving the health and wellbeing of NH, PI, Filipinos, and other medically underserved populations. PIKO supports early-stage investigators and other researchers through its 7 cores: (1) administrative; (2) biostatistics, epidemiology, and research design (BERD); (3) clinical research and regulatory support; (4) community engagement and outreach; (5) pilot projects program; (6) professional development; and (7) tracking and evaluation.

This supplement has been developed, compiled, and edited by the leadership of the BERD Core. The mission of the BERD core is to enhance methods, data collection, and data analysis to advance the science of health disparities and health equity research for NHs, PIs, Filipinos, and other medical underserved populations. This supplement aims to assemble articles from BERD core staff, other University of Hawai‘i faculty, and community members to contribute to this mission.

Race and ethnicity are social constructs in that they largely communicate variations in cultural, historical, and political differences between people, rather than inborn genetic distinctions.[14-16] In other words, we are more defined by "what surrounds us than what is inside of us."[17] Although cultural, historical, and political factors can influence individual and group health, they do not directly cause any particular health issue. However, they are often linked to social determinants of health (eg, stress, racism, income, education, and access to health care) and other factors that can contribute to health is-

sues but are frequently not included in datasets. By examining health data by race or ethnicity, specific inequities in health and in social determinants of health can be identified, and these data can be utilized to direct resources and interventions to the groups experiencing the greatest disparities.

Originally, the supplement was to include 8–10 manuscripts. However, the response to the call for papers from community-based and academic researchers was so strong that the editors received 18 high-quality manuscripts, resulting in a double issue. The first 9 manuscripts focus on issues of importance to communities and community-engaged researchers, including Indigenous research methods, community connectivity and collaboration, implicit bias, policy initiatives, cultural identification, and culturally adapted interventions to improve the health of NH, PI, and Filipinos.

The second 9 manuscripts address methodological challenges in health disparities research, for example: What racial/ethnic classifications ought to be applied when gathering and disclosing racial/ethnic information for NH, PI, and Filipinos? Which survey datasets are available with disaggregated data for these populations? Which interventions have been proven to be effective for these populations? And which survey tools have been validated for use in these populations? The supplement ends with a column regarding aspects of the data lifecycle that should be considered when conducting health disparities research.

Armed with the examples, tools, and resources provided in this special issue, we encourage you to conduct research to better the health of NH, PI, and Filipino people and communities. We appreciate everyone who co-authored an article or served as a reviewer for this special edition. If you have any questions or run into problems while conducting your research, PIKO and the BERD core are here and are ready to help.

With Aloha,

Eunjung, Kathryn, and Deb

## Conflicts of Interest

None of the authors identify a conflict of interest.

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# Indigenous Research Methodologies with *Kānaka ʻŌiwi* to Address Health Inequities: Two Case Studies

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## Abstract

*Kānaka ʻŌiwi (Native Hawaiians), the Indigenous Peoples of Hawaiʻi, have worldviews of health that emphasize the importance of being pono (ie, right and just) and maintaining balance with all our relations. Yet, the literature of health for Native Hawaiians often focuses on the disproportionate health disparities that affect the Native Hawaiian community. The purpose of this paper is to present 2 case studies that integrate Indigenous research methodologies with, for, and by Kānaka ʻŌiwi, moving beyond Community-Based Participatory Research (CBPR) approaches to respond to the health needs identified with, for, and by Native Hawaiian communities. The first case study, Mini Ahupuaʻa for Lifestyle and Meaʻai through Aquaponics (MALAMA), reports on the processes and outcomes for backyard aquaponics, which started with, for, and by the Waimānalo community and extended to include other Native Hawaiian communities. The second case study, Ke Ola O Ka ʻĀina, reports on the development and pilot findings of the ʻĀina Connectedness Scale, developed with, for, and by Native Hawaiian communities. Common themes resulting from the processes of these case examples include the importance of establishing relationships, protocols, and procedures for pono research, identifying community-based health priorities and solutions to address health disparities, and "walking in multiple worlds" to address the priorities of multiple stakeholders. Public health recommendations and implications, including lessons learned and academic policies that may counter Indigenous research methodologies, are further described.*

## Keywords

*Native Hawaiian, Health, Community-Based Participatory Research, Indigenous Methodologies, Culturally relevant approaches*

## Acronyms

*CBPR = Community-Based Participatory Research*
*IRL = Interdisciplinary Research Leader*
*MALAMA = Mini Ahupuaʻa for Lifestyle and Meaʻai through Aquaponics*
*RWJF = Robert Wood Johnson Foundation*

## Introduction

*Kānaka ʻŌiwi* (Native Hawaiian) worldviews of health emphasize the importance of being *pono* (righteous) and maintaining *lōkahi* (balance) to promote *mauli ola* (optimal health and wellbeing) for individuals, families, communities, *ʻĀina* (land, nature, environment, that which feeds), and the *lāhui* (nation) at large. In alignment with the Lōkahi Triangle, health encompasses *pono* relationships with *ʻāina, kānaka* (people), and *akua* (the spiritual realm), including *nā ʻaumakua* (family deities).[1-3] Similarly, the Kūkulu Kumuhana framework of wellbeing, developed by *Kānaka* ʻŌ*iwi* scholars and advocates throughout Hawaiʻi, proposes 6 dimensions of wellbeing to transform health systems by taking a holistic approach to health. These 6 dimensions work interconnectedly to promote wellbeing and include *ea* (self-determination), *ʻāina momona* (healthy and productive lands and people; being in balance with nature), *pilina* (mutually sustaining and quality relationships), *ʻōiwi* (cultural identity and native intelligence), *waiwai* (ancestral abundance and shared collective wealth), and *ke akua mana* (spirituality and sacredness of mana).[4] These worldviews of health align with many other Indigenous communities, whose epistemologies and ontologies center on balanced relationships as a core tenant of health and wellbeing.

From a biomedical perspective, however, contemporary Native Hawaiians continue to be reflected as experiencing significant health inequities, many of which stem from Indigenous determinants of health, including the legacy of colonization, historical trauma, and structures of oppression that continue today.[5-15] To demonstrate, Native Hawaiians continue to have the shortest life expectancy in their ancestral lands when compared to all other major ethnic groups of Hawaiʻi.[16-18] When examining specific biomedical health measures, Native Hawaiians experience disparate rates of almost every major category of medical disease, ranging from mental health concerns to chronic health conditions.[5-6,16-18]

Yet, the story of resilience and the reclamation of *mauli ola* from a Native Hawaiian worldview is critically important to embed within this narrative of health. While resilience has been described in the literature as an individual's ability to bounce back from adversities,[19] recent research expands on this definition to demonstrate the way the survivance of Native Hawaiians and Indigenous Peoples serves as resiliency after a long-standing history of colonization and cultural and historical trauma.[3,7-15,20-22] The term "survivance" calls attention to the ongoing resistance of Indigenous peoples who have not only "survived the genocidal ambitions of settler colonialism, but have continued to enliven their cultures in fluid, critical and generative ways."[37]

Strengths- and resilience-based approaches to studying health disparities are sensitive to and appropriate for Native Hawaiian individuals and communities. These approaches align with community-based participatory research (CBPR) principles, as well as Indigenous methodologies, which center community strengths and Indigenous ways of knowing and being. CBPR approaches acknowledge the strength of all partners who are engaged in the research process and ensure equitable research processes that (re)distribute power to community, thereby addressing power imbalances.[23] As a result, community priorities guide the research agenda and processes, while strengthening the health and wellbeing of community.

Similarly, Indigenous methodologies privilege Indigenous ways of knowing and research with, for, and by Indigenous Peoples.[24] For example, the 4 "R's", which highlight the importance of respect, relevance, reciprocity, and responsibility, resonate with many Indigenous values. Other frameworks from Pacific communities, such as Kaupapa Māori, highlight similar values.[25-27] CBPR research approaches and Indigenous methodologies may help to address determinants of health and promote spiritual healing from wounds that have resulted from oppression and historical trauma, especially in relation to research. In particular, identifying solutions with, for, and by communities may help to build community capacity, thereby addressing the determinants of health of Indigenous Peoples.

Case studies provide an opportunity to present an in-depth investigation of a natural phenomenon or complex topic in its natural setting.[28] This manuscript reports on the processes and outcomes of 2 research projects that serve as case studies and examples of research that is being conducted with, for, and by Native Hawaiian communities. These projects honor Native Hawaiian ways of knowing and being, and have successfully engaged participants and built community capacity. Common themes between the 2 case studies were synthesized to highlight how they address CBPR principles and Indigenous methodologies, and to provide lessons learned to inform other research projects, practice, and policies that ultimately aim to promote health equity in Native Hawaiian communities.

## Methods

Researchers and community partners involved in 2 ongoing research projects met to collectively review and discuss the processes and outcomes of these projects. Through iterative discussions, commonalities that align with CBPR principles and Indigenous methodologies were identified, and lessons learned were drawn from these common themes.

## Findings

### Case Study 01: MALAMA (Mini Ahupuaʻa for Lifestyle and Meaʻai through Aquaponics)

MALAMA is a culturally grounded, family-based backyard aquaponics intervention with Native Hawaiian families. The program started in Waimānalo as a grassroots and community initiative in 2009 by a Native Hawaiian community leader in response to the community identifying the need for more culturally-relevant strategies to reconnect Native Hawaiian families to traditional methods of food production. It started with a *hui* (group) of approximately 5-10 families and grew into an extramurally funded program undergoing rigorous testing through a long-time relationship between the community leader and public health students in Hawaiʻi. During the early years of the initiative, public health students engaged in this backyard aquaponics initiative as volunteers or through their classes and helped with collecting preliminary data about the program's impact through interviews and surveys. This helped the wider community get to know these students and build rapport and trust over time.

Almost a decade later (in 2018), an opportunity to apply for extramural funding for clinical research emerged. Following CBPR principles, a community-academic team was formed, composed of the Native Hawaiian community leader and some of the public health students who were now faculty members, as well as other community leaders from Waimānalo. All members of the research team were from Waimānalo and Native Hawaiian or had lonsgstanding relationships with the community. The team collectively applied for this funding opportunity to test the feasibility and cultural acceptability of engaging the Waimānalo community in research to test the intervention's impact on healthy eating, food security, and clinical measures. This pilot study was named MALAMA and yielded positive health outcomes and positive feedback from the participants. Recommendations from the participants informed the next iterations of intervention delivery and testing.

Through the MALAMA program, families learn to build and maintain backyard aquaponics systems, which fuses modern technology with traditional *ahupuaʻa* systems.[29] *Ahupuaʻa* systems were intricate land systems, comprised of resources that would generally extend from the mountain to the ocean and sea, allowing for a varied diet and sustainable resource management for each community.[30] Based on participant feedback, the program was expanded from a 3-month long to a 6-month long curriculum. A *hui* of 10 families engaged in 9 hands-on workshops over a 6-month time period to build aquaponic systems and learn how to grow their own fruits, vegetables, and fish.[29] These workshops have been tweaked and fine-tuned over time based on participant feedback as well as reflections from the community-academic team. To date, MALAMA has assisted more than 200 families in the Waimānalo community, 20 families in Maui, and 50 families in communities on Hawaiʻi Island to build and manage their own aquaponics system.

In each community, participants completed a comprehensive assessment to track health and health-related outcomes. Overall findings of the MALAMA program demonstrated increased knowledge and confidence to grow food, increased access to and consumption of fresh fruits, vegetables, and fish, and increased family and community connectedness.[31] Participants also demonstrated increased positive attitudes toward healthy eating, increased confidence in building/maintaining an aquaponics system, and decreases in food security and HbA1c levels for participants over the age of 52.[32]

The community-engaged processes led to high acceptance of the intervention and high retention rates in the research. Additionally, the protocols and workshops enhanced Native Hawaiian ways of knowing and cultural protocols that were deemed to be an essential part of the research process. All activities are family-based and engage *keiki* (children) to *kūpuna* (elders), which is aligned with Indigenous multigenerational ways of learning. The project also has helped developed community capacity to garner and administer its own funding. Over the years, the project has been funded by The Queen's Medical Center, the HMSA Foundation, the Robert Wood Johnson Foundation (RWJF), and the National Institute of Minority Health and Health Disparities through the OLA HAWAII center grant. To ensure community control of MALAMA, the community established a grassroots non-profit organization, Ke Kula Nui O Waimānalo, to manage funding for this and other projects that benefit Waimānalo.

### Case Study 02: Ke Ola O Ka ʻĀina

Ke Ola O Ka ʻĀina pursued a mixed methods approach to explore the role of *ʻĀina* connectedness in Native Hawaiian health and resilience, with the goal of creating a scale that could be used to measure *ʻĀina* connectedness in research. The project utilized CBPR approaches to ensure community knowledge, solutions, and priorities guided the research process. The core research team was composed of 2 Native Hawaiian academic researchers and 2 Native Hawaiian community leaders. The Native Hawaiian community leaders on this team provided feedback on the interview guide, facilitated the participant recruitment, and helped with data interpretation.

The research team also collaborated with Thought Partners, including *kūpuna* and cultural practitioners from Waimānalo on Oʻahu and Hoʻokena on Hawaiʻi Island, as well as communities in Maui, Molokaʻi, Lānaʻi, and Kauaʻi. Introductions to these communities were facilitated through existing relationships among community leaders who are a part of the Ke Ola O Ka ʻĀina research team. The academic researchers were invited to participate in community gatherings on these islands. This face-to-face time was essential to organically build rapport, as academic researchers were not there to just collect data. The researchers helped with setting up for the community events, including harvesting and preparing food, and also shared meals with community members. The act of harvesting, preparing, and eating meals together is a critical aspect of relationship-building in Indigenous cultures. Through this rapport-building process, qualitative interviews and focus groups were conducted with 40 Native Hawaiian adults engaged in Aloha ʻĀina land stewardship and restoration work throughout the Hawaiian Islands. Three major themes emerged from the interviews, which were: (1) *ʻĀina* is everything, and therefore, we as people are *ʻĀina*, (2) Connection to *ʻĀina* is important to health and stems from genealogy, respect, and deep responsibility to *ʻĀina*, and (3) Intergenerational health and resilience of communities is reflected through intergenerational knowledge about *ʻĀina*. In addition to findings from a scoping review of nature, land, and environmental connectedness, these qualitative findings informed the initial drafting of the ʻĀina Connectedness Scale, which was cognitively tested with 20 Native Hawaiian adults to assess validity, and later piloted with approximately 300 Native Hawaiian adults from the islands of Oʻahu, Maui, Molokaʻi, Lānaʻi, Hawaiʻi, and Kauaʻi.

The survey revealed that the vast majority of respondents felt connected to *ʻĀina*. Those who reported a connection to *ʻĀina* felt most connected physically, followed by spiritually, emotionally, and lastly, mentally. Many reported limited time, work demands, and COVID-19 restrictions as primary barriers that prevented participants from connecting with *ʻĀina*.

Following CBPR principles, findings were reported back to and validated with all the participants and Thought Partners. The research team has continued their relationship with the Thought Partners beyond this project by helping with writing testimonies to support community advocacy efforts. The Ke Ola O Ka ʻĀina Study was supported by pilot funding from National Institute of Minority Health and Health Disparities through the OLA HAWAII funding mechanism as well as the National Institute of General Medical Sciences through the PIKO Pilot Project funding.

### Lessons Learned from Case Study Analyses

Through the processes and implementation of these research projects, major themes were developed to summarize lessons learned. The lessons learned are based on feedback provided with and by community throughout the research process, and reflections provided by the research teams, which largely came from the development process. The lessons learned reflect CBPR principles as well as Indigenous methodologies, including the 4 R's (respect, relevance, reciprocity, responsibility) by highlighting the importance of relationships, community input, and Indigenous epistemologies.

One of the most salient lessons learned included the importance of taking time to build rapport and form meaningful and organic relationships to enhance community-based research approaches. Thus, these relationships continue to be sustained beyond the life of a grant. On the other hand, the time it takes to form meaningful relationships may not necessarily align with a specific deadline, and instead, the research process need to be fluid for more sustainable and meaningful changes. For example, respect and reciprocity was illustrated in the Ke Ola O Ka ʻĀina study by prioritizing face-to-face time and not solely focused on the research project. Going to where the community is at, helping at their community events, and preparing and sharing meals together demonstrates reciprocity and respect.

Second, to ensure success of these research projects, it is critical to engage community at every step of the process and view community as a vital part of the research team. The strengths, resources, and priorities of communities honor the worldviews and lived experiences of the various individuals and communities who participate in the research process. Taking this approach not only helps to foster cultural humility, but it also re-distributes power back to community to be in the driver's seat of the research process by identifying solutions to drive the research agenda. One way the case studies described above ensured CBPR approaches is through the vetting of the research process with entities such as the Waimānalo Pono Research Hui, who established protocols for engaging in *pono* research.[33-35] These protocols also acknowledge the role of community as part of the research team to guide the research agenda and ensure community voices are integrated at every step of the research process. This also demonstrates the importance of relevance and responsibility by ensuring the research that is being done in a community is vetted and approved by the community members.

Third, addressing health inequities among *Kānaka ʻŌiwi* requires a deeper understanding of the core social and cultural determinants of health, including the way in which colonization and structures of oppression continue to negatively impact the ability for *Kānaka ʻŌiwi* to thrive, especially in their own ancestral homelands. To rectify these determinants of health, Indigenous epistemologies must be centered with CBPR approaches to ensure health and wellbeing are (re)defined from a community perspective. Indigenous epistemologies require cultural humility as relationships and connections are intricately formed between stakeholders and *ʻĀina*, and across generations. While these epistemologies are critical for the research process, they often require "walking in multiple worlds" to address the priorities of multiple stakeholders which may sometimes counter the research processes in place at various institutions.

## Discussion

To effectively and sustainably address Native Hawaiian health disparities, research methodologies and ethics must align with Native Hawaiian ways of knowing and being. Because solutions to addressing these disparities are often within the community, power must be shifted back to the community to ensure research is community-driven and culturally-grounded in the lived experiences and values of the community. These 2 case studies demonstrate the important role of *ʻĀina* in Native Hawaiian wellbeing and strive to revitalize this vital connection between *Kānaka* and *ʻĀina* that was once lost due to the forces of colonization and oppression. These studies also highlight the power of communities to self-determine the research that takes place in their communities, with implications for future research, initiatives, practice, and policy.

While various lessons were learned throughout the research process, the most salient lessons learned through these case studies continue to reinforce the importance of centering relationships and community to move beyond addressing health disparities and create a culture of health and wellbeing while recognizing their survivance and resilience. Successful implementation of such research strategies also requires culturally responsive approaches to health, community-driven approaches, centering Indigenous ways of knowing and being, and acknowledging the role of deep-seated determinants of health that stem from ongoing cultural and historical trauma and systems of oppression. These lessons learned align with existing research for and by *Kānaka ʻŌiwi* communities and other Indigenous approaches to research.[25-27,36]

The greatest strength of this manuscript is the opportunity to provide deeper insights in case examples that address health inequities of Native Hawaiian communities and rectify determinants of health that contribute to these health inequities. Despite these strengths, limitations must be acknowledged. Similar to other case studies, findings and lessons learned may be limited to the processes, relationships, and experiences developed through these research projects. This limitation works in parallel with other research that emphasizes the notion that one size does not fit all, particularly in research settings. Nonetheless, the overall lessons learned provide insights and opportunities for future research, practice, and policy to redistribute power to communities who have been historically marginalized. The lessons learned also highlight the importance of engaging communities in the research process to identify health priorities, solutions, resources, and appropriate methodologies.

## Conclusion

The case studies and lessons learned provided in this manuscript change the narrative about health and wellbeing by taking a culturally grounded, community-prioritized, and Indigenous approach to wellness. Taking a wholistic approach to health shifts the focus from health disparities and moves in the direction of collective health and wellbeing, emphasizing the critical aspects of a person's relationship with oneself, one another, one's family, one's community, and the larger nation of Hawaiʻi as well as with *ʻĀina* and *Akua*. For instance, the focus on MALAMA aquaponics and ʻāina connectedness shifts the narrative away from health deficits and (re)conceptualizes health as being wholistic by focusing on connectedness with food and *ʻĀina* as medicine. These projects also highlight the importance of rethinking health, healing, and medicine to better align with Native Hawaiian worldviews and address health inequities that stem from colonization, cultural and historical trauma, and systems of oppression that contribute to the health inequities experienced by Native Hawaiians today.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Prioritizing Connection and Centering on Community: Take Your Shoes Off and Don't Put Your Feet on the Furniture

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## Abstract

*This column describes what it means to be "in" a community and how to create a leading role for community partners in shaping research. It highlights essential components for conducting clinical and translational research in the community, including: (1) invitation to share history and purpose; (2) community-initiated collaboration and engagement; (3) focus on social and cultural determinants of health; (4) community-driven measures and frameworks; (5) application of Indigenous methods and approaches; and (6) implementation of Indigenous and adaptable interventions. Partnering with a community entails building relationships and positioning research around community interests, using methodologies and interventions right for the community.*

## Keywords

*Community, relationships, knowledge sharing, Indigenous, Hawai'i*

## Acronyms

*CAB = Community Advisory Board*
*IDeA-CTR = Institutional Development Award Networks of Clinical and Translational Research*
*PIKO = Center for Pacific Innovations, Knowledge, and Opportunities*

In 2021, the Center for Pacific Innovation, Knowledge, and Opportunity (PIKO) was established through funding from the Institutional Development Award Networks of Clinical and Translational Research (IDeA-CTR) to encourage the creation and ease the implementation of clinical and translational research that is both culturally responsive and community-engaged to improve the health and well-being of Native Hawaiians, Pacific Islanders, Filipinos, and other underserved communities. The PIKO Community Advisory Board (CAB) ensures that communities can increase their research capacity to address health issues and concerns and are partners in all facets of clinical and translational research, from conceptualization to dissemination. This is possible because CAB members share the same worldview lenses and values as the communities they represent.

Research on underserved populations has demonstrated the influence of social, economic, and political factors in determining health outcomes.[1-4] Centering community has emerged as a critical strategy to reduce health disparities and build health equity.[5-8] This entails community activation and capacity-building to reduce health disparities and build health equity. By striving for power balance in developing, implementing, and disseminating research, communities have become more vested in participation in research and the sustainability of programs.

Community members understand the complex interplay between cultural, social, environmental, behavioral, and political settings influencing health and well-being experiences and outcomes. Community members should develop a narrative about who belongs to the health research community, how to improve care, and ways to create meaningful healthcare systems. They have lifetimes of history prioritizing relationships and sharing knowledge and experiences regarding health. Community organizations and programs are informed by and honor the peoples they serve.

While numerous articles have been published about ways to work with the community to produce culturally responsive and community-engaged research,[9-18] this paper highlights vital centering components based on the CAB's experiences. The members of the CAB, have decades of experience in culturally responsive community-engaged research and program development to improve health and well-being in Native Hawaiian, Pacific Islander groups, Filipinos, and other underserved groups in Hawai'i.

Conversations during the CAB meetings suggest that connection is much deeper than trust. It is built on working and learning in ways that honor ancestors, and protect, care for, and sustain communities for generations. The CAB has identified 6 essential components for conducting clinical and translational research in the community: (1) invitation to share history and purpose; (2) community-initiated collaboration and engagement; (3) focus on social and cultural determinants of health; (4) community-driven measures and frameworks; (5) application of Indigenous methods and approaches; and (6) implementation of Indigenous and adaptable interventions.

## Invitation to Share History and Purpose

Community includes family, place, support, and identity.[8] Native Hawaiians, other Pacific Islanders, and Filipinos are distinct social and cultural groups and subgroups with collective ancestral ties to the lands and shared experiences. Their identities, cultures, livelihoods, and physical and spiritual well-being are linked to their land and lives. Developing meaningful relationships with community partners takes time to learn about the history of the specific community.

The nurturing of relationships aligns with community values. As one CAB member described, "You can't come to me within 2 weeks, or even 2 months, of the proposal due date and expect me to vet the project with my community and provide a letter of support for the project."

When a community offers to meet with a researcher, it is an invitation to the researcher to listen and learn—a way to show respect and honor the community. It is like being invited into someone's home for the first time. "You take your shoes off before entering, and you don't put your feet on the furniture," explained another CAB member. Being open to nurturing that relationship and understanding where that community comes from helps to move ideas forward. For a new researcher, entry into the community has nothing to do with research. Researchers start with building a relationship with community members and must show up to support the community. Researchers can be embedded in community organizations and support their efforts. Community-based researchers have much to offer as engaged partners who simultaneously carry out collaborative research.

## Community-initiated Collaboration and Engagement

Community collaborators are the bridge and master navigators of cultures and community, providing valuable perspectives on values and life in Hawai'i. They also use their name to open doors only available to community members. Before sharing any research ideas, the researcher should know whether they share the same values as the community and if there is alignment. There needs to be a commitment, understanding, or alignment between the research and the community organization's values. "After 20 years of working with a community, I can see now why the first answer I received to working together on a research project was 'no thank you.' I didn't understand the context in which their work was being done," stated a PIKO CAB member.

It can be challenging to help researchers see some of the community's social justice or controversies. If researchers live, work, and/or play in a community, the researcher will have something to give back regarding health or services. The research will be grounded in the community and address community concerns and interests in a way that is appropriate for the community. Serving the community provides an opportunity to look through a community lens to see what is needed and what would be beneficial from that research. The community is protected and safe, the community benefits, and there may be new communities that will embrace research. It is about ensuring those who come after any study also have a place.

## Social and Cultural Determinants of Health

Social determinants are societal, political, and economic forces that influence the distribution of resources and opportunities that impact the health and well-being of people.[20] Social and cultural determinants of health contribute to illness and community inequities, but they also promote resilience, and support the well-being of individuals, families, and communities. Researchers looking to work within a community must know their specific communities' social and cultural determinants. They need to understand bias and receive training such as the Community 101 Course for Researchers.[19]

Hawai'i is rich with a history of multiculturalism, with unique social and cultural determinants that have created close-knit communities. Common and significant health needs must be addressed based on community input.[21] Nevertheless, remember that social and cultural determinants will vary in priority by community and may include other important factors based upon each communities' needs.[21,22] Hawaii's long and challenging political history that discouraged Indigenous cultural norms of language and beliefs lends to current cultural determinants. Communities are often centered on Indigenous definitions of health and preservation of cultural traditions, practices, and places. By acknowledging and understanding social and cultural determinants, research relevant to these determinants can be conducted to benefit community health.

## Community-driven Measures and Frameworks

Applying Indigenous frameworks and developing community-driven measures requires understanding the Indigenous worldview. Commonalities among Native Hawaiians, Pacific Islander groups, and Filipinos include a wholistic view of well-being encompassing the individual, family, community, and place. This shared view emerged over generation upon generation of experiences and existence. It typically includes interconnected relationships to land, spirituality, family, and community. As shared by community members, "*'āina* (land) is the land, the ocean, the sea, all the elements, plants, people, and their interconnection."[23] Among existing frameworks,[21,24-26] Kōkua Kalihi Valley uses the *Pilinahā* framework[14,25] to shape and establish relationships aligned with their values, including connection to self, others, and land. Given these frameworks, it is unsurprising that a recent review article on the Indigenous context of research found that the most commonly utilized cultural-based measures sought to assess cultural identity, social connectedness, and spirituality.[26]

Other measures are needed to capture the essence of interventions and their impact using such frameworks and the core elements of well-being. "From a community perspective, we have experts. I want to create jobs and learning opportunities so that we can apply Hawaiian prevention and traditional practices. Our organization knows how to collect meaningful data, and we know how to use data to justify our programming and evaluation. It is from this space that we can connect people to academic or research opportunities," shared a CAB member. Some research may need to be put on hold until measures can be developed because the study might not capture the impact of the intervention, and findings could be misleading or detrimental.

## Application of Indigenous Methods and Approaches

Native Hawaiian, Pacific Islander groups, and Filipinos' worldviews can voice place-based ways of knowing and learning through stories, ancestral wisdom, and metaphors. As quoted in Oliveira and Wright, Indigenous methods and approaches are "research by and for Indigenous Peoples, using techniques and methods drawing from the traditions and knowledges of those people."[27] Often thought of as "talk-story" approaches, Indigenous approaches are much deeper and more varied to include, but are not limited to, stories, narratives, histories, images, and symbols woven to create understanding through a process often referred to as a journey.[27,28]

The research design should reflect community needs, protocols, and acceptable approaches. Protocols will vary from community to community. Protocols outline who can receive the knowledge, how long data collection will take, and how learning will be shared. There are some things a researcher should not do, and there are ways a researcher should behave. A CAB member conveyed, "As gatekeepers, we have to be really aware of impact, because when *kūpuna* (elders) get involved, and they have a challenge or an issue, they let us know." Access to community is a gift of high value for advancing meaningful research and respecting that and lifting that is valued by communities. Moreover, research can empower communities if it reflects an understanding of community strengths and challenges—wherever they are—and brings that lens forward.

## Implementation of Indigenous and Adaptable Interventions

Culturally responsive interventions are aligned with cultural values, perspectives, and lifestyles[29] and lay on a spectrum from culturally adapted to culturally grounded programs.[30] Culturally-adapted interventions seek to modify programs shown to be effective in other groups for local application. Culturally-grounded interventions look beyond Western preventive measures and treatment to embrace different forms of healing, whether traditional, integrated, or developed by a community group from the ground up to design other forms of healing reflecting community interest. A CAB member described, "One of the things that came up for us was the notion of looking beyond Western preventive measures, Western treatment, and embracing other forms of healing, whether that's traditional or complementary, and including that as part of the research proposals…We acknowledge that both exist and that it's OK to do both in a collaborative fashion. We are willing to work with another community with cultural practitioners that wants to do something similar…As researchers, think about how each community is different, and each has its traditional healers." The integrity of the intervention, environment safety, and relationships are critical factors for practitioners' willingness to participate.

## Conclusion

The CAB recognizes that Native Hawaiian, Pacific Islander, and Filipino community members value relationships and knowledge-sharing among community members and with others that engage them. This column explored 6 essential components for conducting clinical and translational research in the community: (1) invitation to share history and purpose; (2) community-initiated collaboration and engagement; (3) focus on social and cultural determinants of health; (4) community-driven measures and frameworks; (5) application of Indigenous methods and approaches; and (6) implementation of Indigenous and adaptable interventions. By developing strategies that involve both the community and researchers, there are clear opportunities to establish, maintain and enhance relationships between both, thus improving outcomes and long-term success.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Using *Talanoa*, a Pan Pacific Indigenous Approach, To Identify Solutions to Public Health Issues

Chantelle E. Matagi BA; J. Keʻalohilani Worthington MPH; Donna-Marie Palakiko PhD, APRN

## Abstract

*The COVID-19 pandemic was a public health emergency that required various public health policies and programs at the state and federal level to be established to protect the health and safety of the nation. These mainstream policies and programs proved to be inadequate in addressing the specific needs of Native Hawaiian and Pacific Islander (NHPI) communities as evidenced by the high case counts and low vaccination rates in these communities. In an effort to better understand and address the high case counts and low vaccination rates, a partnership was developed between the Hawaiʻi State Department of Health (HDOH), medical providers, and a network of NHPI-serving organizations. After the failure of Western approaches for data gathering, leaders of the partnership used an Indigenous qualitative interview method called Talanoa situated within a cultural safety framework to learn reasons for low vaccine uptake and identify NHPI-specific solutions. Findings suggest that the use of Talanoa and its ingrained cultural safety framework allowed us to gather richer data, identified solutions grounded in community, and assisted with building sustainable trusting partnerships.*

## Keywords

*Cultural Safety, Equity, Indigenous/Native, Language, Native Hawaiian, Public Health, Pacific Islander, Research*

## Abbreviations

*HDOH = Hawaiʻi State Department of Health*
*NHPI = Native Hawaiian and Pacific Islander*
*NHPI 3R = Native Hawaiian and Pacific Islander Response Recovery Resilience Team*
*Team 6B = Native Hawaiian & Pacific Islander COVID-19 Case Investigation and Monitoring Team*

## Introduction

The COVID-19 pandemic was an unprecedented public health emergency affecting individuals worldwide. At the state and federal levels, public health policies and programs were established to protect the health and safety of all. These policies included testing, safety precautions, mitigation strategies, and vaccinations. In Hawaiʻi, these policies did not account for the rurality and accessibility issues faced by Native Hawaiian and Pacific Islander (NHPI) communities who reported high case counts and low vaccination rates.[1] Despite this significant disparity, the initial allocation of resources for testing and vaccination, in-language clinical assistance, and wrap around social services were not proportional to the ethnic distribution of cases and did not effectively address the needs of NHPI communities.[1]

To address this public health emergency in Hawaiʻi, a partnership was established between the Hawaiʻi State Department of Health (HDOH) Native Hawaiian and Pacific Islander COVID-19 Case Investigation and Monitoring Team (Team 6B) and the Native Hawaiian and Pacific Islander Response Recovery Resilience Team (NHPI 3R).[2] Team 6B was established within the HDOH's Disease Investigation Branch to address the needs of NHPI and Filipino communities in response to the pandemic, including providing in-language proactive educational community outreach that incorporated different cultures and values found throughout the Pacific.

The NHPI 3R included over 60 NHPI community-based organizations, faith-based institutions, social service providers, and community advocates and leaders with a common goal of elevating the needs of their communities and providing a safe, open forum to discuss and identify gaps in COVID-19 response and recovery.

The purpose of this paper is to introduce *Talanoa*, a traditional Pasifika data gathering approach that incorporates a high level of cultural safety, and the results that emerged from using this protocol.

## Methods

The project was performed in 2 stages. In the first stage, Western-style interviews were conducted to learn about barriers to vaccination among NHPI communities and ways to overcome them. When this approach did not yield rich data, the second stage involved the use of an Indigenous methodology known as *Talanoa*. *Talanoa* elevates the western style of focus groups and interviews to incorporate cultural protocol, creating a space where community participants are seen as equitable partners, lead the conversation, and offer community insight.

The *Talanoa* method is grounded in cultural safety, which "acknowledges the barriers to clinical effectiveness arising from the inherent power imbalance between provider and patient."[3] The label of cultural safety may be new to some, but the practice has been implemented by Indigenous service providers for decades.[3] In contradiction to cultural competency, cultural safety moves the focus away from becoming "competent" at another culture and toward creating spaces that make individuals from different cultures feel safe.[3] In these safe spaces, individual and community needs can be better understood and met. For providers, this means not focusing on learning the cultural customs of a group, but rather learning to create a space that allows this individual of a different community to feel safe. This task requires constant self-reflection of the provider's own biases. Thus, cultural safety is a cyclical process, rather than a goal to be met.

The process of conducting a *Talanoa* differs from the Western interview approach in critical ways. The premise of the *Talanoa* is to speak freely without restriction.[4] The process centers on respect of all participants and allows for an equitable collaboration between all speakers.[5] To create a culturally safe space for participants to talk about topics such as the COVID-19 response, a *Talanoa* begins with introductions (formal or informal) of who and where each participant comes from and provides an equitable space to begin building the relationship. After introductions, the talk story unfolds. Participants are encouraged to share freely from the heart. *Talanoa* will naturally end when no further discussion or ideas are presented. Compared to western interview approaches, *Talanoa* is not rigid and is not time bound.

Members of Team 6B and the NHPI 3R conducted 43 interviews in all—28 Western style and 15 *Talanoa* style—across Hawai‘i with community advocates and leaders, clinical providers, and representatives of government entities, community-based organizations, faith-based institutions, and social service agencies. Participants discussed their COVID-19 vaccine experience and the barriers they encountered while working with their communities. Five stakeholders participated in both the Western style interview and the *Talanoa* style.

The Western and *Talanoa* approaches were compared using 3 measures, including: (1) length (minutes) of interviews; (2) richness of data collected (length of transcripts), including context collected on participants' communities, as well as upstream factors affecting vaccination hesitancy; and (3) degree of willingness to partner to improve health.

## Findings

The use of *Talanoa* appeared superior based on the 3 measures. Specifically, the *Talanoa* sessions were 1 to 3 hours long compared to the Western style interviews that were all approximately 30 minutes in length. Lengthening the interview was assisted by opening the space with introductions, learning who participants were and where they came from and providing an authentic space to begin building the relationship.

Second, the *Talanoa* approach yielded richer data, in part because more time was spent in conversation. In these longer conversations, the participants shared broader and deeper stories that provided context for their communities' response to COVID-19 and barriers to vaccination. For example, 1 participant who had participated in both the western and *Talanoa* style interviews initially had a 30-minute Western interview that briefly covered their overall experience with their organization and the continuing challenges of encouraging people to get vaccinated. However, their *Talanoa* was almost 2 hours long, and the discussion provided a much bigger picture of the implications of pandemic on the participant's community. The individual noted:

> "The strategies that we're sharing with you are not the strategies for addressing the COVID situation now, but also a strategy for addressing health equity. I think the 2 go hand in hand…COVID has taught us a lot, but I think it mirrors strategies for addressing health equity."

Participants also discussed other upstream factors affecting NHPI health and the impact of COVID-19 on their community, such as government mistrust, with a *Talanoa* participant stating:

> "After years … of distrust of the government and just this history of Native Hawaiians, none of us should be surprised with this response, and to begin to unravel that and correct it just so that we can respond to COVID is completely unrealistic."

This again indicated that response to COVID-19 needed to be considered within the larger context of health equity. These bigger conversations should have started before the pandemic, and now they need to continue post-pandemic.

*Talanoa* participants exhibited a high degree of comfort with the flow of the conversation, shared the challenges and success of their pandemic experiences, and revealed their personal journeys that brought them to serve their communities. Participants also shared their motivations in continuing to work to vaccinate more people in their communities and to get them more involved in their health.

> "I think I'm trying to understand for this generation…what is the movement of this generation of 18-39? Where do they see our *lāhui* (Native Hawaiian community) going in the next 10 years, in the next 20 years? I don't know where that is and that's kinda where I'm stuck. The rational side of me is making that argument. The health care professional in me is saying there will not be a *lāhui* if we don't get a handle on this."

Another participant shared how their purpose continues to guide their work:

> "I think what really guided me was not only the significant disparities and the feeling that I could help address some of these issues, particularly in terms of the Native Hawaiian health status, but also saying that there [are] strengths in this community and in this population that could help address this. How do we use the past, how do we learn from the past to move forward in the future…?"

The *Talanoa* provided safe spaces to share personal stories and thoughts such as the ones above, indicating an increase in the genuineness and trust in these spaces among the participants and authors.

Third, those who participated in the *Talanoa* also showed a greater willingness to partner to improve health, in part because the approach was strengths-based and there was a promise to share findings with the community and to consider context and indigenous views within the partnership. One participant said:

> "Just based on what I've spoken to you about what the community needs are and strategies and such, I would like to see the outcomes translated to something that is tangible to the community."

Another participant expressed their gratitude for the opportunity to do this work and the new collaborative perspective it gave them on working in community.

> "I come away from this experience learning so much about so many different communities from the different walks of life. Understanding what makes them the way they are and appreciating that…helping them or working with them to figure out how we can overcome those hurdles."

All the interviews commented on collaboration with the community as an essential component of their successful strategies. Some participants had additional thoughts on how to appropriately do community work and how to sustain this movement of collaboration. A participant commented,

> "So when you say, 'Indigenous ways,' I mean it shouldn't be just a flavor of the month, it shouldn't be a trending thing. It should be the norm because the people here are Indigenous and the people we are serving are Indigenous, you know, so it should be the Indigenous ways in the end."

Enthused by the Talanoa method, another participant discussed the need to leverage the strengths-based approach to empower communities in the work ahead.

> "There needs to be more empowerment from a political infrastructure perspective of communities … We should strengthen the community infrastructure so that they feel empowered and … things come as close to the community as possible, and things go up from the community as much as possible."

## Discussion

This paper shared ways that the *Talanoa* collected a higher quality and richer data from participants. The *Talanoa* included cultural protocol and cultural context in the way it conducted its conversations with each of its participants. These conversations went beyond a talk story session, a common approach in Hawai'i to qualitative interviewing, by incorporating cultural safety. The focus was on creating a safe and genuine space where participants felt comfortable and open to sharing their authentic experiences from the pandemic.

Implementing Indigenous methodologies, such as *Talanoa*, empowers Indigenous peoples to tell their own narrative. Participants were receptive to the *Talanoa* format and commented on the comfortable space that this Indigenous method created. Incorporating Indigenous methodologies creates relational accountability between the researcher and the participant. These robust conversations were key in creating collaborative partnerships and open dialogues that identified ongoing challenges as well as community-oriented solutions that were sustainable beyond the pandemic.

Methodologies used to address a community's needs must be representative of that community's epistemologies, axiologies, and dynamics. Research must be conducted in partnership with the community and in a way that is respectful. The use of *Talanoa*, for example, ensures that participants can freely share their story in a safe space with no time constraints or limitations. The rich information is then analyzed for common themes and strategies, then presented back to the participants for comment and clarification.[4] This process allows the community to fully engage in the research and guide the work being done. By utilizing this collaborative practice, the research elevates the participant's narrative and establishes trusting relationships that foster reciprocity and reconciliation.

Promoting Indigenous methodologies also increases data sovereignty and data governance of Indigenous data by Indigenous people. Data sovereignty and data governance are important issues for Indigenous people who have long had their data misappropriated and used only to tell a "sad story" of disparity.[6] Indigenous methodologies stress the importance of returning data to the community and engaging the community in the analysis and dissemination process so that data are not used in a harmful or exploitive way.

The strength of this study was its approach to measuring the benefits of an Indigenous interviewing method in comparison to a Western interviewing approach. It was easy to measure and compare the lengths of the interviews. The measures related to context and partnership were more subjective, and these themes emerged from a discussion of the transcripts and the feelings behind the interviews and *Talanoa*. In the future, researchers may want to use more objective measures to compare Western and Indigenous methodologies.

## Conclusion

A comparison of Wesetern interviews and the Indigenous methodology *Talanoa* showed significant differences in the quality and quantity of information obtained from the participants. The rich discussions that came from the *Talanoa* increased feelings of safety, created trust, put COVID-19-related responses within a larger context, and facilitated partnerships focused on solutions.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Systematic Review for Survey Instruments to Measure Cultural Identification of Native Hawaiians, Pacific Islanders, and Filipinos

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## Abstract

*Numerous studies have used survey instruments to measure the degree of cultural identity/identification for a racial group to examine how they identify with their heritage or cultural group. However, only a few systematic reviews have summarized the survey instruments for Native Hawaiians, Pacific Islanders, and Filipinos. This systematic review aimed to summarize reliable and validated survey instruments that assessed the cultural identity/identification of Native Hawaiians, Pacific Islanders, and Filipinos in 3 steps: (1) identifying studies that meet the inclusion and exclusion criteria; (2) evaluating the psychometric properties of the instrument with reported validity and reliability test results; and (3) summarizing the selected studies. A search was conducted in PubMed, PsycINFO, Web of Science, and Health and Psychosocial Instruments databases for published articles related to the cultural identification for the 3 racial groups. Sixteen unique articles met the inclusion/exclusion criteria: 7 for Filipinos, 3 for Native Hawaiians, 1 for Pacific Islanders, 2 for Asian Americans, and 3 for non-specific Indigenous people. Three reviewers assessed the psychometric properties of the 16 articles using the pre-determined criteria and summarized the survey instruments and study outcomes. All the selected articles discussed their survey instrument's validity. This review can serve as a resource for researchers who want to apply a culturally tailored survey instrument for Native Hawaiians, Pacific Islanders, and Filipinos in their research studies.*

## Keywords

*psychometric properties, reliability and validity, cultural identity, cultural identification, Hawaiian, Pacific Islander, Filipino*

## Abbreviations

*AAMAS = Asian American Multidimensional Acculturation Scale*
*ASASFA = A Short Acculturation Scale for Filipino-Americans*
*ARSMA = Acculturation Rating Scale for Mexican Americans*
*CFA = confirmatory factor analysis*
*CFI = comparative fit index*
*EFA = exploratory factor analysis*
*ESFA = Enculturation Scale for Filipino Americans*
*ESFA-S = Enculturation Scale for Filipino Americans-Short*
*MEIM = Multigroup Ethnic Identity Measure*
*PCA = principal component factor analysis*
*PAF = principal axis factor analysis*
*RMSEA = root mean square error approximation*
*SASH = Short Acculturation Scale for Hispanics*
*SL-ASIA = Suinn-Lew Asian Self-Identity Acculturation Scale*
*SRMR = standardized root mean square residual*
*TLI = Tucker-Lewis index*

## Introduction

Cultural identity/identification has been described as an attachment to a heritage or cultural group or a sense of belonging.[1] It has also been described in the context of values, such as guiding principles, meaningful symbols, and lifestyles that individuals share with others.[2] Since culture is a dynamic factor influencing an individual's values and beliefs, developing an effective instrument to measure the degree of cultural identity/identification is challenging.

Past studies developed survey instruments to measure the degree of cultural identity/identification of various racial/ethnic groups. Marin et al developed the Short Acculturation Scale for Hispanics (SASH) consisting of 12 items (questions).[3] Cuellar et al developed a more targeted instrument, the Acculturation Rating Scale for Mexican Americans (ARSMA).[4] The revised version of this scale, ARSMA-II, assessed the acculturation levels of Mexican Americans using fewer items. The study reported the scale's psychometric properties, such as construct validity, criterion validity, and internal consistency.[5] Numerous studies reported the association between health conditions and self-identification with culture measured by an instrument, including the aforementioned instruments.[6-11]

Native Hawaiians, Pacific Islanders, and Filipinos have often been the focus of health-related studies in Hawai'i due to their level of health disparities. Since they have unique cultures and colonization histories, past studies have developed survey instruments to assess self-identification levels with their racial cultures. However, some studies do not report the instrument's psychometric properties. Researchers may want to review the instrument's psychometric properties before using it in a study, given that validity greatly affects the ability of the survey to truly measure issues of importance. A few systematic reviews have summarized the availability of survey instruments applicable to Pacific people.[12,13] However, to the authors' knowledge, no study reviewed the instruments specifically for the 3 racial groups. The purpose of this study was to summarize existing survey instruments that measure the degree of cultural identity/identification for Native Hawaiians, Pacific Islanders, and Filipinos. The review included information on the psychometric properties of the instruments to provide resources for validated and reliable survey instruments for health-related studies.

## Methods

### Selection Process

The current study was performed according to the PRISMA 2020 guidelines for reporting systematic reviews.[11] The authors developed inclusion/exclusion criteria to identify validated and reliable cultural identity/identification instruments for Native Hawaiians, Pacific Islanders, and Filipinos. The inclusion criteria were peer-reviewed articles that reported the psychometric properties of a survey instrument that measures the cultural identity/identification of Native Hawaiians, Pacific Islanders, or Filipinos. The exclusion criteria were: (1) instruments developed for specific racial/ethnic groups other than the 3 race groups; (2) studies that did not report validity test results; and (3) studies tested only with a sample of non-US residents. The authors developed a search strategy with consultation from librarians at the Health Sciences Library, University of Hawai'i at Mānoa. The search strategy included terms related to survey instrument focus areas, psychometric properties, and target racial groups. The database search did not limit the publication years and study participants' age.

The literature search was conducte" between March 2022 and February 2023. Four databases were extensively searched: PubMed, PsycINFO, Web of Science, and Health and Psychosocial Instruments. Full descriptions of the search terms are available from the corresponding author by request. All authors determined the eligibility of each article. Differences of opinion were resolved by discussion.

### Article Selection

The search yielded 72 records. After excluding 16 duplicated articles, the authors screened the titles and abstracts and selected articles using the inclusion/exclusion criteria. All remaining articles were retrieved, and each full text was reviewed. Ten articles were retrieved for further review from the bibliographies of the reviewed articles. Each author reviewed the purpose of the instruments and the psychometric properties described in 39 articles (29 from databases and 10 from bibliographies). As a result, 16 articles remained. **Figure 1** shows the flow diagram[14] describing the article selection of the current study.

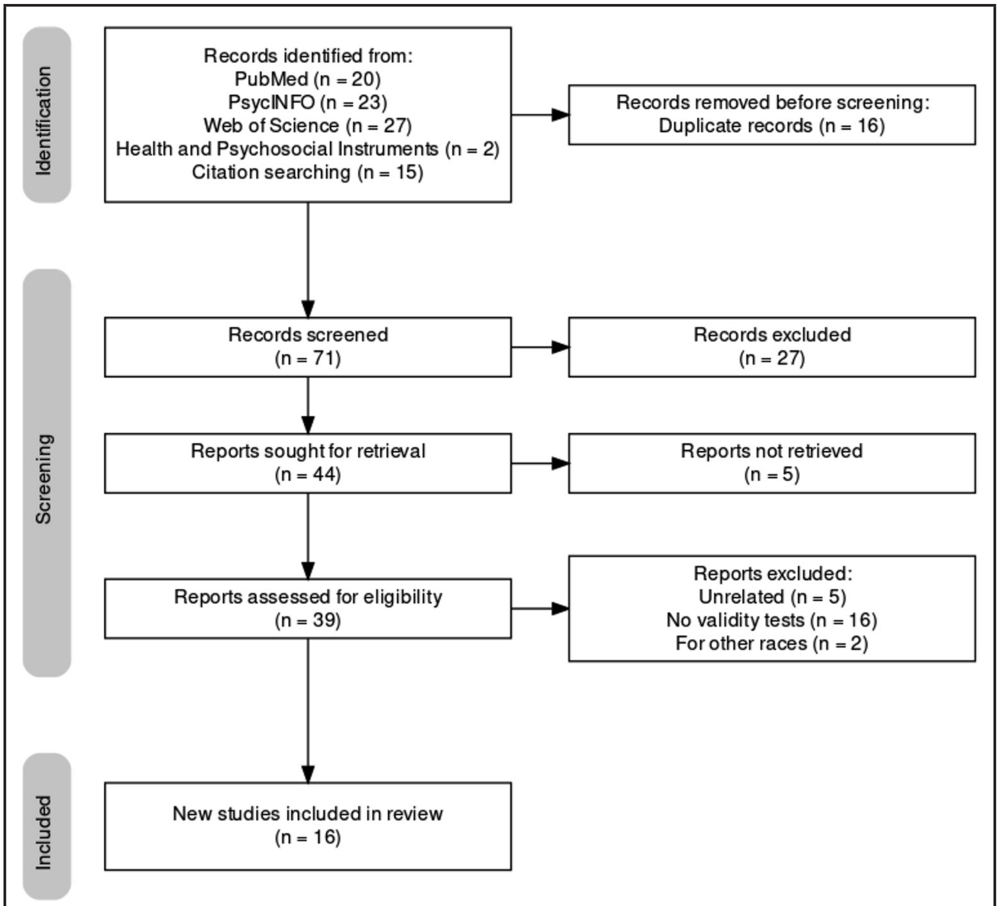

Figure 1. PRISMA 2020 Flow Diagram for a Systematic Review of Survey Instruments to Measure Cultural Identity/Identification for Native Hawaiians, Pacific Islanders, and Filipinos

Studies were selected with the inclusion criteria (peer-reviewed articles reporting the psychometric properties of a survey instrument that measures the cultural identity/identification of Native Hawaiians, Pacific Islanders, or Filipinos) and exclusion criteria (instruments developed for specific racial/ethnic groups other than the 3 race groups; studies that did not report validity test results; studies tested only with a sample of non-US residents). Screened studies were further reviewed except for 5 articles whose full texts were not available.

### Review of the Selected Articles

The authors reviewed the names of survey instruments, demographic characteristics of study samples, scoring systems and interpretations of high scores, and the number of factors and items (questions) of the final forms of survey instruments. Next, the articles were reviewed for psychometric properties: types of validity tests (ie, construct validity, concurrent validity, divergent validity), types of reliability tests (ie, internal consistency, stability), results of the validity and reliability tests, and other outcomes (eg, regression analyses using a score as a dependent variable).

If the study conducted a confirmatory factor analysis (CFA) for the construct validity, the authors used the following criteria to determine whether their sample data supported the validity of the survey instrument: (1) root mean square error approximation (RMSEA) was less than 0.08, (2) comparative fit index (CFI)/ Tucker-Lewis index (TLI) was greater than 0.95, or (3) standardized root mean square residual (SRMR) was less than 0.08.[15] If the study reported Cronbach's alpha values, which assess the internal consistency of the survey items, the authors considered a value greater than 0.60 acceptable.[16]

## Results

### Study Descriptions

**Table 1** summarizes 16 articles that met the inclusion/exclusion criteria. Most studies examined the validity of a survey instrument for Native Hawaiians, Pacific Islanders, or Filipinos. Some studies evaluated a scale using an ethnically diverse sample. These were included if the items were applicable to the Pacific Indigenous people.

Seven articles reported on survey instruments specifically for Filipinos.[17-21] Two of them were from dela Cruz et al.[17,18] Both described the development of a Filipino-American version of SASH, A Short Acculturation Scale for Filipino-Americans (ASASFA). They evaluated the scale using scores from Filipino immigrants in the first study and second-generation Filipinos in the latter study. Guerrero et al[19] used the Filipino Cultural Scale to examine the relationship between Filipino students' cultural identification levels and their delinquent behaviors. This instrument was modeled after the Hawaiian Cultural Scale – Adolescent Version.[22] Del Prado and Church developed the Enculturation Scale for Filipino Americans (ESFA).[20] Unlike an acculturation scale, an enculturation scale measures the degree of an individual's retention of his/her original culture. The authors expected that first-generation Filipinos would average higher than second-generation Filipinos, who average higher than non-Filipinos. They also anticipated that participants identifying as Filipino would average higher than those identifying as Filipino American. Cotas-Girard et al tested a short version of the Enculturation Scale for Filipino Americans (ESFA-S).[21] They reduced the items from 73 to 30 and tested the scale with first- and second-generation Filipinos. Choi et al developed the Familism Scale, which measures the degree of cultural identification in terms of familism. They described it as family-centered over individualist values, a cultural trait of Filipinos and Koreans,[23,24] and examined the psychometric properties using scores from Filipino and Korean youth and their parents living in the Midwest US.

Three studies reported the psychometric properties of an instrument for Native Hawaiians. Rezentez[25] and Strezltzer et al[26] described the Nā Mea Hawaiʻi scale, which measures the degree of acculturation of Native Hawaiian culture. The instrument measures acculturation levels in terms of Native Hawaiian language, cultural practice, and values, developed with Native Hawaiian representatives selected by the study. Hishinuma et al developed the Hawaiian Culture Scale—Adolescent Version.[22] It measures the degree of Native Hawaiian cultural identification with various aspects, such as activities/social events, folklore/legend, and causes-locations/access. For example, a question of the Causes-Access subscale is "Access rights to the ocean – to gather traditional shells, fish, and seaweed." A participant answers using a 3-point Likert scale (unfamiliar/don't know, you know how to, or you believe in or support). Baumhofer et al used the Pacific Cultural Affinity to measure the degree of cultural affinity/social identity of Samoans and Tongans living in California.[27] The study examined the interaction effect between cultural affinity levels and key demographic factors on island food consumption and reported the psychometric properties of the instrument.

The current review found 2 studies reported the development of an instrument for Asian Americans. Since the questions could be used for Filipinos who identify as Asian Americans, these studies were also included. Suinn et al developed the Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA), modeled based on ARSMA.[28] This scale measures the behavioral aspects of acculturation for Asian Americans. Chung et al developed the Asian American Multidimensional Acculturation Scale (AAMAS).[29] The instrument was adapted from SL-ASIA and developed into 3 subscales: each rates items according to a different reference group (their cultural origin, other Asian Americans, and European Americans).

Three studies developed a scale for diverse race groups. Each examined the instrument's psychometric properties using an ethnically diverse sample. The items of the survey instruments can be used for various racial groups, including Native Hawaiians, Pacific Islanders, and Filipinos. Thus, these articles were also included in the final results. Phinney developed the Multigroup Ethnic Identity Measure (MEIM) to measure behaviors and attitudes toward ethnic identity and tested it with data from diverse racial groups.[30] Yamada et al described the psychometric properties of the Ethnocultural Identity Behavioral Index.[31] The instrument focuses more on behavioral aspects than the MEIM, and can be used with individuals from any ethnocultural group. The study tested the instrument using a sample group including Hawaiians and Filipino residents in Hawai‘i. Malcarne et al developed the Scale of Ethnic Experience to measure multiple ethnic-related cognitive constructs across ethnic groups.[32] Unlike the other instruments reported here, the scale focuses on cognitive aspects of acculturation, such as perceived discrimination, mainstream comfort, and social affiliation.

All studies used a relatively large sample US residents of both sexes (range of participants: 116 to 2272). Some studies used more than 1 sample group to develop their instrument. Most studies recruited adults, while a few recruited youth or students. The number of factors/subscales of the instrument ranged up to 8. The number of items in the finalized form ranged from 11 to 73. Detailed descriptions of the survey instruments are presented in **Table 1**.

### Psychometric Properties of the Survey Instruments

**Table 2** presents the psychometric properties of the survey instruments of the 16 articles. All the studies reported results of validity tests. In most studies, construct validity was examined by factor analysis, which determines or confirms the number of factors or subscales in the instrument. The factor analysis type used varied across the studies. Exploratory factor analysis (EFA), principal axis factoring (PAF), or principal component factor analysis (PCA) was used by 9 studies to explore the instrument structure.[17-20,27-31] Six studies used CFA to confirm the factor loading or improve the instrument structure.[20,21,23,24,29,32] Two studies used EFA or PAF on a test or long version and CFA on a final or short version and reported both results.[20,29] The reported CFA results suggested that their finalized instrument's structure reached a satisfactory level (RMSEA <0.08, CFI/TLI >0.95, or SRMR <0.08). The construct validity of the Familism scale was also examined by factorial invariance,[23,24] which examines whether the pattern of factor loadings on a latent variable remains identical from sample to sample.[33] The study reported configural invariance, indicating that subscales were composed of the same items for most subscales between the Filipino and Korean sample groups.

Most studies examined criterion and/or discriminant validity. A criterion validity test examines whether the score was highly associated with another related information from the survey participants. For example, Del Prado and Church found a correlation between the EFSA scores and Filipino immigrants' age of US entry (r=0.36, *P*<.01) and a higher mean score from Filipino immigrants compared to second-generation Filipinos (*P*<.01).[20] Confirming a discrepancy between 2 types of people expected to differ could be interpreted as discriminant validity. Hishnuma et al found that Native Hawaiian students scored higher on all Hawaiian ethnic identity items of the Hawaiian Culture Scale – Adolescent version compared to non-Native Hawaiian students (*P*<.001).[22]

Divergent validity indicates that the instrument is not too highly correlated with a similar instrument with a different trait. Cotas-Giard et al[21] compared Filipino participants' scores on ESFA-S with the Rosenberg Self-Esteem Scale[34] and the Kaufman Domains of Creativity Scale.[35] The correlations with these 2 scales were low, as expected by the authors of the study (r = −0.037; r = 0.009). ESFA-S was also tested for convergent reliability, which examines how closely the instrument is related to an instrument that theoretically should be related. The test results showed that ESFA-S was inversely correlated with the Acculturation Scale for Filipino Americans (r = −0.62), which measures the degree of enculturation using reversing scale system.

Most studies reported internal consistency, the reliability test indicating how well the scale measures as intended. The majority of the studies used Cronbach's alpha values on total or subscale items to assess internal consistency, and their reported values reached an acceptable level ($\alpha = .60$). Three studies[21,29,32] reported the instrument stability by test-retest test: correlations between scores obtained twice over a period from their sample group. These instruments' stability was supported by a correlation coefficient close to 1.

## Table 1. Summary of Survey Instruments for Native Hawaiians, Pacific Islanders, and Filipinos to Measure Their Cultural Identity/Identification

| Instrument | Reference | Description of the Study | Study Sample (Size; Age; Gender/Sex[a]; Ethnicity/ Generation); Location | Instrument Scoring; Interpretation of Higher Scores | Additional Information[b] |
|---|---|---|---|---|---|
| A Short Acculturation Scale for Filipino- Americans (ASASFA) | dela Cruz et al (1998)[17] | Examined psychometric properties of a Filipino American version of the Short Acculturation for Hispanics,3 using first-generation Filipino-Americans. | n=165; 18+ y, mean=58 y; 62% female; 100% Filipino American; California | 5-point scale; Higher acculturation levels toward the American culture. | 12 items; 3 factors: Use and Preference for a Specific Language (5), Use and Preference for Media Language (3), Ethnic Social Relations (4); Tagalog |
| A Short Acculturation Scale for Filipino- Americans (ASASFA) | dela Cruz et al (2018)[18] | Examined psychometric properties of the updated version ASASFA, using second-generation Filipino Americans. | n=116; 18-65 y, mean=30 y; 67% female; 100% US-born Filipino American; California | 5-point scale; Higher acculturation levels toward the American culture. | 11 items; 2 factors: Language Use and Preference (7), Preference for Ethnic Social Relations (4) |
| Filipino Cultural Scale (FCS) | Guerrero et al (2010)[19] | Examined correlations between delinquent behaviors and potential mediating variables, including the FCS score. | n=150; 9–12th grade students; 62% female; 51% full Filipino, 49% mixed race Filipino; Hawaiʻi | A total score is the mean of the 7 factors. Subscales are based on item z-scores; Higher enculturation level of Filipino culture. | 33 items; 7 factors: Social Orientation (12), Family–Community Orientation (4), Ethnic Affiliation (3), Ethnic Knowledge (5), Filipino Media (3), Cultural Activities (3), Gender Roles (3) |
| Enculturation Scale for Filipino Americans (ESFA) | Del Prado & Church (2010)[20] | Examined psychometric properties of a measure of enculturation of Filipino Americans using 2 sample groups. | [Sample 1] n=281; 18–81 y, Filipino mean=40 y, non-Filipino, mean=34 y; 61% female; 77% Filipino Americans, 24% non-Filipino Americans<br>[Sample 2] n=269; 18–82 y, mean=38 y; 59% female; 100% Filipino Americans; Multiple locations across the US | 6-point Likert scale; Higher adherence to Filipino values and behavior/culture. | 73 items (long form), 30 items (short form); 3 dimensions (long form/short form): Connection with Homeland (29/10), Interpersonal Norms (29/10), Conservatism (15/10) |
| Enculturation Scale for Filipino Americans-Short (ESFA-S) | Cotas-Girard et al (2022)[21] | Examined psychometric properties of a short version of the ESFA, using 2 sample groups. | [Sample 1] n=267; 18–72 y, mean=27 y; 57% female; 40% Filipino American, 17% Filipino, 18% Mixed Filipino<br>[Sample 2] n=368; 18–79 y, mean=37 y; 64% female; 46% Filipino American, 42% Filipino, 7% Mixed Filipino; Multiple locations across the US | 6-item Likert-style response scale; Higher enculturation level of Filipino culture. | 30 items; 3 factors: Connection With Homeland (10), Interpersonal Norms (10), Conservatism (Traditional and Religious Ideas) (10) |
| Familism Scales | Choi et al (2018)[23] | Examined the psychometric properties of multiple survey items and scales to assess familism among Asian Americans. | n=338; mean=47 y; mostly females; 44% Filipino (90% foreign-born), 56% Korean (100% foreign-born); Midwest US | 5-point Likert scale; Higher emphasis on tradition, respect, caring, centrality, harmony/ sacrifice, and parental expectation. | 28 items for the scale of Filipino; 7 subscales: Traditional Manners and Etiquette (4), Respect for Adults (4), Caring for Aging Parents (3), Centrality of the Family Values (4), Centrality of the Family Behaviors (4), Harmony and Sacrifice (5), Parental Expectation of Family Obligation (4); Korean, Tagalog |
| Familism Scales | Choi et al (2021)[24] | Examined the psychometric properties of an updated version of the Familism Scale, using data from Filipino Americans and Korean Americans. | n=680 (343 youth, 337 parents); youth 12–17 y, mean=15 y, parent mean=47 y; 49% female in Filipino youth, 52% female in Korean youth, mostly females in parents; 45% Filipino, 55% Korean; Midwest US | Same as above. | 27 items; 5 subscales for Filipino Americans: Traditional Manners and Etiquette (5), Respect for Adults (4), Caring for Aging Parents and Harmony and Sacrifice (10), Centrality of the Family (4), Parental Expectation of Family Obligation (4); Korean, Tagalog |

Table 1. Summary of Survey Instruments for Native Hawaiians, Pacific Islanders, and Filipinos to Measure Their Cultural Identity/Identification (Continued)

| Instrument | Reference | Description of the Study | Study Sample (Size; Age; Gender/Sex[a]; Ethnicity/ Generation); Location | Instrument Scoring; Interpretation of Higher Scores | Additional Information[b] |
|---|---|---|---|---|---|
| Nā Mea Hawaiʻi Scale | Rezentez (1993)[25] | Developed an acculturation scale for Native Hawaiians through item development and survey administration. | n=150; 18–86 y; 50% female; 33% Hawaiian, 33% Caucasian, 33% Japanese; Hawaiʻi | "Yes/No/Don't know" or "Fill in the blank": 1 point for each item if the response is the same as the reference; Higher Hawaiian acculturation level. | 21 items about language, cultural practice, and values. |
| Nā Mea Hawaiʻi Scale | Streltzer et al (1996)[26] | Examined the validity of Nā Mea Hawaiʻi Scale and associations with psychosocial characteristics. | n=264; 12–84 y, mean=45 y; 67% female; 65% Hawaiian, 35% part Hawaiian; Hawaiʻi | Same as above. | Same as above. |
| Hawaiian Culture Scale—Adolescent Version | Hishinuma et al (2000)[22] | Examined the psychometric proprieties of a measure of the degree to which adolescents know of, believe in, value, and practice elements of traditional Hawaiian culture. | n=2272; 14–17 y; 54% female; 66% Hawaiian, 34% Non-Hawaiian; Hawaiʻi | 5 or 3-point Likert scale; Higher Hawaiian cultural identification level. | 50 items; 7 factors: Native Hawaiian Culture & Ethnicity (11), Customs & Beliefs (11), Lifestyles (8), Activities/Social Events (10), Folklore/Legend (5), Causes-Locations (3), Causes-Access (2) |
| Pacific Cultural Affinity | Baumhofer et al (2021)[27] | Examined the psychometric properties of a measure of the cultural affinity of Pacific Islanders and the effect of cultural affinity on island food consumption. | n=240; ≥18 y, mean=40 y; 50% female; 100% Samoan or Tongan; California | 4-point Likert scale (reverse-coded for analysis); Lower Pacific Island cultural affinity level. | 11 items; 2 factors: Cultural Affinity Activity (7), Cultural Affinity Media (3) |
| Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA) | Suinn et al (1992)[28] | Examined the psychometric properties of the scale. | n=284; mean=24 y; female % not reported; 100% Asian Americans, 73% 1st generation; Colorado | 5-point Likert scale; Higher acculturation (or higher Western Identity) level. | 21 items; 5 factors: Language (4), Identity (4), Friendship (4), Behaviors (5), Generation/Geographic Background (3), Attitudes (1) |
| Asian American Multidimensional Acculturation Scale (AAMAS) | Gim Chung et al (2004)[29] | Developed 3 versions of Asian American Multidimensional Acculturation Scale (AAMAS): culture origin (AAMAS-CO), Asian American (AAMAS-AA), and European American (AAMAS-EA). Examined the psychometric properties of the developed scale. | [Study1] n=342; 17–31 y, mean=21 y; 65% female; 28% Chinese, 27% Korean, 14% Japanese, 12% Filipino, 11% Vietnamese, 57% 1st generation<br>[Study 2] n=138; 18–35 y, mean=21 y; 70% female; 30% Chinese, 23% Korean, 12% Mixed Asian, 9% Filipino, 34% 1st generation<br>[Study 3] n=44; 21–32 y, mean=27 y; 43% female; 100% Korean, 50% 1st generation; West Coast US | 6-point Likert scale; Higher acculturation level. | 15 items; 3 subscales: Cultural Behavior (10), Cultural Identity (3), Cultural Knowledge (2) |
| Multigroup Ethnic Identity Measure (MEIM) | Phinney (1992)[30] | Examined the psychometric properties of a measure of ethnic identity based on elements of ethnic identity that are common across groups and the relationship of ethnic identity to demographic characteristics of self-esteem. | [Sample 1] n=417; 14–19 y, mean=17 y; 65% female; 32% Asian American, 31% Black, 21% Hispanic, 10% Mixed<br>[Sample 2] n=136; 18–34 y mean=20 y; 65% female; 26% Asian American, 8% Black, 43% Hispanic, 6% Mixed, 17% White; location not specified | 4-point Likert scale, scores are calculated by reversing negative items, summing all items, and obtaining the mean; Higher ethnic identity level. | 14 items; Affirmation and Belonging (5), Ethnic Identity Achievement (7), Ethnic Behaviors (2) |

Table 1. Summary of Survey Instruments for Native Hawaiians, Pacific Islanders, and Filipinos to Measure Their Cultural Identity/Identification (Continued)

| Instrument | Reference | Description of the Study | Study Sample (Size; Age; Gender/Sex[a]; Ethnicity/ Generation); Location | Instrument Scoring; Interpretation of Higher Scores | Additional Information[b] |
|---|---|---|---|---|---|
| Ethnocultural Identity Behavioral Index (EIBI) | Yamada et al (1998)[31] | Examined the psychometric properties of the scale of ethnocultural behavior with potential utility. | n=352; 17–47 y, mean=22 y; 63% female; 14% Chinese, 11% Filipino, 34% Japanese, 12% Part Hawaiian; Hawai'i | 7-point Likert scale, select 1 ethnocultural group and rate the identification level; Higher ethnocultural identity level. | 19 items; 3 factors: Cultural Activities, Social Interaction, Language Opportunities |
| Scale of Ethnic Experience | Malcarne et al (2006)[32] | Examined the psychometric properties of a multidimensional measure of ethnic-related cognitive constructs that can be used across American ethnic groups. | [Group 1] n=638; 18–72 y, mean=20 y; 60% female; 13% Black, 44% White, 15% Filipino, 28% Hispanic<br>[Group 2] n=1727; 18–79 y, mean=19 y; 66% female; 12% Black, 52% White, 14% Filipino, 22% Hispanic; California | 5-point Likert scale; Higher adherence to ethnic identity and beliefs. | 32 items; 4 factors: Ethnic Identity (12), Perceived Discrimination (9), Mainstream Comfort (6), Social Affiliation (5) |

[a] The term Gender/Sex is used because some studies measured gender.

[b] Additional Information includes the number of items finalized in the study, the number of factors/subscales, names of factors/subscales, the number of items included in each factor/subscale, and non-English languages used in the survey instrument, if any.

Table 2. Psychometric Properties of the Survey Instruments Identified by the Systematic Review

| Instrument (Authors, Year) | Validity Tests | Reliability Tests | Psychometric Properties |
|---|---|---|---|
| A Short Acculturation Scale for Filipino–Americans (dela Cruz et al, 1998)[17] | Construct (PCA)<br>Concurrent/Convergent (mean scores by demographic characteristics)<br>Criterion/Discriminant (mean scores by ethnic identification groups; multivariable regression) | Internal consistency (Cronbach's α, correlation with Tagalog version) | • Construct: PCA identified 3 factors, accounting for 61% of the total variation for English and Tagalog versions. The study of the scale for Hispanics also reported 3 factors.<br>• Concurrent/Convergent: No difference between males and females.<br>• Criterion/Discriminant: Those self-identified as "fifty-fifty Filipino/American" had the highest mean, followed by those self-identified as "Filipino more than American". Those self-identified as "very Filipino" had the lowest mean. Ethnic identification contributed the most to the variances (53% English version, 48% Tagalog version).<br>• Internal consistency: total (α=.85; r=0.85), subscales (r= 0.74–0.77) |
| A Short Acculturation Scale for Filipino–Americans (dela Cruz et al, 2018)[18] | Construct (EFA, parallel analysis)<br>Criterion/Discriminant (Ordinary least squares regression) | Internal consistency (Cronbach's α) | • Construct: EFA identified 2 factors; Language Use and Preference (FL=0.42–0.89), Social Ethnic Relations (FL=0.60–0.90); parallel analysis with 1000 re-sampling supported the factor structure.<br>• Criterion/Discriminant: Gender and ethnic self-identification were predictors of Language Use and Preference subscale score (P<.01); Ethnic self-identification was a predictor of Social Ethnic Relations subscale scores (P<.01)<br>• Internal consistency: total (α=.82), subscales (α=.81-0.86) |
| Filipino Cultural Scale (Guerrero, 2010)[19] | Construct (EFA, inter-factor correlation) | Internal consistency (Cronbach's α) | • Construct: EFA identified 7 factors; Social Orientation (FL= 0.30–0 .66), Family–Community Orientation (FL=0.32–0.62), Ethnic Affiliation (FL=0.35–0.97), Ethnic Knowledge (FL=0.35–0.75), Filipino Media (FL=0.56–0.89), Cultural Activities (FL=0.52–0.60), Gender Roles (FL=0.38–0.91). Inter-factor correlation (r=-0.28–0.42)<br>• Internal consistency: subscales (α=.57–.77) |
| Enculturation Scale for Filipino Americans (ESFA) (Del Prado & Church, 2010)[20] | Concurrent (correlation with theoretically related scales; correlation between long and short forms)<br>Criterion/Discriminant (difference between 1st and 2nd generations; correlation with characteristics)<br>Construct (PAF to full form, CFA to short form) | Internal consistency (Cronbach's α) | • Concurrent: ESFA total score and Asian Values Scale-reversed (r=0.56); ESFA Connection and Homeland and AAMAS Culture of Origin subscale (r=0.77); Short form with the corresponding subscales of long form (r=0.91–0.97)<br>• Criterion/Discriminant: Difference between 1st and 2nd generations in total scores (P<.01) and each subscale (P<.01); Immigration age (r=0.36), years in US (r=-0.35), years of US schooling (r=-0.40)<br>• Construct: PAF identified 3 dimensions; CFA supported 3 factors (CFI =0.86, RMSEA=0.04)<br>• Internal consistency: long form total (α=.89), subscales (α=.83–0.95); short form: total (α=.86), subscales (α=.79–.89) |

Table 2. Psychometric Properties of the Survey Instruments Identified by the Systematic Review (Continued)

| Instrument (Authors, Year) | Validity Tests | Reliability Tests | Psychometric Properties |
|---|---|---|---|
| Enculturation Scale for Filipino Americans-Short (Cotas-Giard et al, 2022)[21] | Divergent (correlation with a dissimilar scale);<br>Convergent (correlation with another scale for Filipino); Criterion/Discriminant (correlation and ANOVA with demographic variables);<br>Construct (CFA) | Internal consistency (Cronbach's α)<br>Stability (test-retest) | • Divergent: The Rosenberg Self-Esteem Scale (r=−0.037); the Kaufman Domains of Creativity Scale (r=0.009).<br>• Convergent: with the Acculturation Rating Scale for Filipino Americans (r=−0.62)<br>• Criterion/Discriminant: Number of years in US (r=−0.31) and amount of schooling (r=−0.49), generation (*P*<.001), ethnic identity (*P*<.001)<br>• Construct: CFA supported the 3-factor structure (CFI=0.83, TLI= 0.82, RMSEA=0.06).<br>• Internal consistency: Study1, total scores (α=.76), subscales (α=.72–.79); Study2, total scores (α=.79), subscales (α=.75–.86)<br>• Stability (r=0.96) |
| Familism Scales (Choi et al, 2018)[23] | Content (mean scores by ethnic group)<br>Construct (CFA, factor intercorrelations, FI between Filipino and Korean samples) | Internal consistency (Cronbach's α, item-total correlation) | • Internal consistency: initial scale (α=.63–.80; r=0.32–0.83)[a]<br>• Content: Filipino American parents had higher scores than Korean parents (*P*<.05) except for Traditional Manners and Etiquettes.<br>• Construct: CFA supported 7 factors from 28 out of 34 items. Reducing items improved the model fit statistics (CFI=0.885, RMSEA =0.08). Intercorrelation of 7 subscales (r=0.16–0.54). FI found configural invariance for 4 subscales and metric invariance (invariant in FL) for 3 subscales. Traditional Manners and Etiquette did not attain metric invariance.[a] |
| Familism Scales (Choi et al, 2021)[24] | Content (mean scores by ethnic group)<br>Construct (CFA, factor intercorrelations, FI between Filipino and Korean samples)<br>Discriminant (correlation between Filipino and Korean samples)<br>Criterion (correlation with acculturation variables and youth outcomes) | Internal consistency (Cronbach's α, item-total correlation) | • Internal consistency: initial scale with 6 subscales (α=.66–.83; r=0.30–0.77)[a]<br>• Content: Filipino American parents had higher scores than Korean parents (P<.05) except for Traditional Manners and Etiquette.<br>• Construct: CFA supported 5 factors from the initial scale: Caring for Aging Parents and Harmony and Sacrifices were highly correlated. Combining the 2 factors improved model fit statistics (CFI=0.89, RMSEA=0.06). Intercorrelation among 5 factors (r=0.15–0.60). FI found configural invariance for 3 subscales. Parental Expectation of Family Obligation attained metric, strong (similar item intercepts), and strict invariance (similar error variances).[a]<br>• Discriminant: the scales for Filipino and Korean were positively correlated with a few exceptions.<br>• Criterion: ethnic identity and 5 subscale (r=0.18–0.49), heritage cultural practices (r=0.22–0.56)[a] |
| Nā Mea Hawai'i Scale (Rezentez, 1993)[25] | Criterion/Discriminant (item analyses to identify items best differentiated the Hawaiian sample from non-Hawaiian samples) | Internal consistency (item-total correlation) | • Criterion/Discriminant: Of 34 items, 21 items differentiated the Hawaiian from Caucasian and Japanese subjects. These items were retained as the final scale.<br>• Internal consistency: item-total r=0.41–0.76 |
| Nā Mea Hawai'i Scale (Streltzer et al, 1996)[26] | Criterion/Discriminant (t-test on scores between Hawaiians and non-Hawaiians; t-test and correlation between high/low blood quantum groups among Hawaiians) | | • Criterion/Discriminant: Hawaiians had higher scores than non-Hawaiians (*P*<.001); correlation with blood quantum (r=0.31); the high blood quantum group had a higher score than the low blood quantum group (*P*=.002). |
| Hawaiian Culture Scale – Adolescent Version (Hishinuma et al, 2000)[22] | Discriminant (factor intercorrelations, t-test/ANOVA on scores for Hawaiians vs Non-Hawaiians)<br>Criterion (correlation with Hawaiian cultural variables) | Internal consistency (Cronbach's α) | • Discriminant: Intercorrelation among 7 subscales (Hawaiians r=0.19–0.58; non-Hawaiians r=0.19–0.57). The patterns of correlation between the 2 groups were similar. Hawaiians scored higher on all Hawaiian ethnic identity items (*P*<.001).<br>• Criterion: Positive correlation with the Hawaiian cultural variables (r>0.46).<br>• Internal consistency: Hawaiians (α=.82–.96) non-Hawaiians (α=.76–.96) |
| Pacific Cultural Affinity Scale, (Baumhofer et al, 2021)[27] | Construct (EFA, factor intercorrelations) | Internal consistency (Cronbach's α, item-total correlation) | • Construct: EFA identified 2 factors (r=0.51)<br>• Internal consistency: total scores (α=.85, r=0.06–0.66), subscales (α=.71–.85) |
| Suinn-Lew Asian Self-Identity Acculturation Scale (SL-ASIA) (Suinn et al, 1992)[28] | Construct (PCA) Criterion/Discriminant (mean scores between European Americans and Asian Americans)<br>Concurrent (score and demographic characteristics) | Internal consistency (Cronbach's α) | • Construct: PCA identified 5 factors from 17 items<br>• Criterion/Discriminant: English vs Asian language as a first language (*P*<.001)<br>• Concurrent: total years attending school in the US (r=0.61), age upon attending school in the US (r=-0.61), age upon arriving in the US (r=-0.49), years lived in a non-Asian neighborhood (r=0.41), self-rating acculturation (r=0.62) (all *P*<.001)<br>• Internal consistency: total scores (α=.91) |

Table 2. Psychometric Properties of the Survey Instruments Identified by the Systematic Review (Continued)

| Instrument (Authors, Year) | Validity Tests | Reliability Tests | Psychometric Properties |
|---|---|---|---|
| Asian American Multidimensional Acculturation Scale (AAMAS) (Gim Chung et al, 2004)[29] | Construct (EFA, CFA)<br>Criterion/Discriminant (correlation with generation) Concurrent (correlation with SL-ASIA, Cultural Identification Scale (CIS), Asian Value Scale (AVS)<br>Divergent (correlation with a dissimilar scale) | Internal consistency (Cronbach's alpha)<br>Stability (test-retest) | • Construct: CFA supported the 4 factors identified by EFA. The 4 factors represent Cultural Identity, Language, Cultural knowledge, and Food consumption (CFI=>0.95 for all scales).<br>• Criterion/Discriminant: generation in AAMAS-Culture of Origin (CO) (r=-0.36)<br>• Concurrent: correlations of AAMAS-CO, AAMAS-Asian American (AA), AAMAS-European American (EA) with SL-ASIA (r=-0.75, -0.31, 0.32), CIS-original (r=0.51, 0.26, NS), CIS-Anglo (r=-0.30, NS, 0.49), and AVS (r=0.37, 0.18, -0.25)<br>• Divergent: correlation with Rosenberg's Self-esteem Scale (CO r=0.10; AA r=0.03; EA r=0.17)<br>• Internal consistency: AAMAS-CO, -AA, -EA (α=0.87, 0.78, 0.81)<br>• Stability: r≥0.75 |
| Multigroup Ethnic Identity Measure (MEIM) (Phinney, 1992)[30] | Construct (PAF)<br>Criterion/Discriminant (Differences by demographic characteristics, correlation with self-esteem) | Internal consistency (Cronbach's α, Item-Reminder Correlation) | • Construct: PAF suggested 2 factors from 20 items, accounting for 30.8% and 11.4% of the variance.<br>• Criterion/Discriminant: White scored lower than Asian, Black, and Hispanic on the ethnic identity subscale (P<.05 for all). Self-esteem and Ethnic Identity for high school students (r =0.31) and college students (r=0.25).<br>• Internal consistency: total (α=.81, .90), subscales (α=.69, .86), item-reminder among Ethnic Identity Acivement (r=-0.17–0.52, r=0.03–0.79) for the 2 samples. |
| Ethnocultural Identity Behavioral Index (EIBI) (Yamada et al, 1998)[31] | Construct (PCA. Inter-correlations of the factors identified)<br>Criterion/Discriminant (t-test between US-born and not US-born individuals, ANOVA across ethnocultural groups) | Internal consistency (Cronbach's alpha, correlation among the Total score, 3 factors, and the main variables) | • Construct: PCA identified 3 factors, accounting for 60% of the variances.<br>• Criterion/Discriminant: US-born individuals had lower scores (*P*<.001); total scores and 3 subscales' scores were different across the ethnocultural groups (*P*<.01).<br>• Internal consistency: total scores (α=.90), each factor (α=.83–.88); total score and each factor (r=0 .77–0.89); among factors (r=0.45–0.80); total score and strength of identity (r=0.31); total score and cultural pride (r=0.48) |
| Scale of Ethnic Experience (Malcarne et al, 2006)[32] | Construct (CFA, factor intercorrelations)<br>Criterion (multivariate analysis of factor mean scores)<br>Concurrent (correlation with MEIM subscale) | Internal consistency (Cronbach's α)<br>Stability (test-retest) | • Construct: CFA supported 4 factors from 32 out of 73 items (factor loadings=0.41-0.84, CFI=0.87, RMSEA =0.058, SRMR = 0.07). Intercorrelation of 4 factors (r=0.20–0.56).<br>• Criterion: Significant main effect of factor mean score for ethnicity and gender (*P*<.001 for both).<br>• Concurrent: MEIM Ethnic Identity Achievement (r=0.72)<br>• Internal consistency: subscales (α=.76–.91)<br>• Stability: total scores (r=0.77–0.86), Ethnic Identity (r=0.70–0.86), Mainstream Comfort (r=0.69–0.82), Perceived Discrimination (r=0.46–0.82), Social Affiliation (r=0.59–0.82) |

Abbreviations: CFA = confirmatory factor analysis; EFA = exploratory factor analysis; FI = factorial invariance; FL = factor loadings, PCA = principal components factor analysis; PAF = principal-axis factor analysis.

[a] Results of analysis with data from Filipino Americans.

## Discussion

The current systematic review study identified 16 articles that reported psychometric properties of survey instruments of cultural identity/identification with Native Hawaiian, Pacific Islander, or Filipino cultures. Some studies focused on enculturation, such as the Enculturation Scale for Filipino Americans.[20] On the other hand, the instruments developed by Dela Cruz et al[17,18] and Rezentez[25] focused on acculturation.[17] Cotas-Girard et al described the differences between the 2 terms:

"*Enculturation is defined as the degree to which immigrants and later generations maintain and adhere to the norms of their Indigenous culture (such as the Philippines), while acculturation is the degree to which these individuals take on and become immersed in a host culture, such as the United States.*"[21]

The differences in the conceptualization of cultural identification reflect the scale design of the instrument. A higher score on an acculturation instrument indicates being immersed in a host culture (Westernized culture). In comparison, a higher score on an enculturation instrument indicates adhering to the norm of their Indigenous culture. Researchers need to be aware of the scoring system to ensure that the instrument of interest fits their study's research questions. Another finding was that some studies updated their instruments over time, suggesting that updating an instrument after reevaluating it is necessary to maintain its psychometric properties.

Some studies reported the associations between the instrument score and individuals' characteristics to support the instrument's validity. For example, Phinney examined the association between the scale score and self-esteem.[30] Baumhofer et al examined the interaction effect of cultural affinity (instrument score) and key demographic characteristics on island food consumption.[27] Their approaches are exemplified for future studies. For example, the degree of acculturation or enculturation could be a primary dependent variable to examine the association with attitude or behaviors. One may want to use the degree of acculturation or enculturation as a potential confounder when examining an association between a factor of interest and a health outcome. A survey instrument can be administered in a clinical trial study. Bender et al described their protocol for a weight loss intervention randomized controlled trial for Filipino Americans with type 2 diabetes.[36] They reported the study plan of using ASAFA to measure the acculturation levels of study participants.

There are several limitations that must be acknowledged. First, the current study used multiple databases to search articles but did not use all available databases. Thus, there might be some instruments not identified. Second, the findings of this study are limited to the inclusion/exclusion criteria set by the research team. For example, the search terms used did not encompass all specific ethnic groups within the Pacific Islanders, such as Samoans, Tongans, and Micronesians. The search might have missed survey instruments developed for such groups. On the other hand, the results included studies that tested an instrument even though they were not exclusively used for Native Hawaiians, Pacific Islanders, or Filipinos. For example, the studies for SL-AISA and MEIM tested using samples of non-specific Asian American races.[28,30] The AAMAS, EIBI, and the Scale of Ethnic Experience were evaluated with a study sample that did not include many Pacific indigenous people.[29,31,32] However, these studies were included based on the instruments' content. Further evaluation of these instruments is needed if they are to be used with Native Hawaiian, Pacific Islander, or Filipino participants. Third, despite using multiple terms in the search, some instruments not described using the terms might not be captured. A further systematic review can address these limitations. However, this systematic review was conducted with the current major databases and no limitations in publication date. Moreover, the assessment criteria for validity tests helped our literature search capture high-quality survey instruments. The project team will continue to inventory survey instruments for Native Hawaiians, Pacific Islanders, and Filipinos and plans to post information about instruments, including those that did not meet the inclusion/exclusion criteria, in the project's online repository.

### Recommendations for the Use of an Instrument Measuring Cultural Identity/Identification

It is important to investigate whether the instrument of interest has been updated before implementing it. Next, conducting a pilot study to test the instrument of interest is essential to ensure that all of the items are appropriate for the target group. For example, an instrument focusing on behavioral aspects developed a while ago may contain items that do not fit current lifestyles. Testing the instrument will allow item modification before launching the study. Lastly, researchers can benefit from performing validity and reliability tests using their sample data to ensure their research outcomes will be valid. Reporting study outcomes with the results of tests for validity (eg, RMSEA or CFI/TLI from CFA) and reliability (eg, Cronbach's alpha) will support the quality of the research. When researchers use an instrument that has not been fully investigated for validity and reliability, they can evaluate it with their study sample.

## Conclusions

In conclusion, this systematic review found 16 articles reporting reliable and valid survey instruments to measure the cultural identity/identification of Native Hawaiians, Pacific Islanders, and Filipinos. These instruments may be useful for studying the relationship between the degree of their cultural identity/identification and health status, one of the current perspectives on public health. This study may help those who need to find a survey instrument to measure the degree of cultural identity/identification.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Examining Implicit Racial Attitudes among College Students in Hawai‘i, a Project of the Hawai‘i Implicit Bias Initiative

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## Abstract

*For the past 2 decades, investigations into implicit racial bias have increased, building evidence on the impact of bias on health and health care for many minority communities in the US. However, few studies examine the presence and impacts of implicit bias in Hawai‘i, a context distinct in its history, racial/ethnic diversity, and contemporary inequities. The absence of measures for major racialized groups, such as Native Hawaiians, Pacific Islanders, and Filipinos, impedes researchers' ability to understand the contribution of implicit bias to the health and social disparities observed in Hawai‘i. The purpose of this study was to measure bias toward these underrepresented groups to gain a preliminary understanding of the implicit racial bias within the distinctive context of this minority-majority state. This study measured implicit racial bias among college students in Hawai‘i using 3 implicit association tests (IATs): (1) Native Hawaiian compared to White (N = 258), (2) Micronesian compared to White (N =257), and (3) Filipino compared to Japanese (N = 236). The mean IAT D scores showed implicit biases that favored Native Hawaiians over Whites, Whites over Micronesians, and Japanese over Filipinos. Multiple regression was conducted for each test with the mean IAT D score as the outcome variable. The analysis revealed that race was a predictor in the vast majority of tests. In-group preferences were also observed. This investigation advances the understanding of racial/ethnic implicit biases in the uniquely diverse state of Hawai‘i and suggests that established social heirarchies may influence implicit racial bias.*

## Keywords

*Implicit bias, racial bias, IATs, Hawai‘i, Native Hawaiian, Pacific Islander, Filipino*

## Abbreviations

*HIBI = Hawai‘i Implicit Bias Initiative*
*IAT = Implicit Association Test*
*NH = Native Hawaiian*
*PI = Pacific Islanders*
*SDO = Social Dominance Orientation*
*$SDO_7$ = Social Dominance Orientation Scale Version 7*
*UHM = University of Hawai‘i at Mānoa*

## Introduction

Numerous organizations across the United States (US) have designated racism as a public health crisis.[1] Racism impacts many facets of society, including the criminal justice system, the educational system, and the healthcare system. Models repeatedly show that racism affects people on many different levels, including systemic/institutional, interpersonal, and internalized,[2-4] and takes many different forms, including discriminatory laws and practices, exclusion or stereotyping, and hidden biases that can affect behavior and decision-making.[4-9] To fully comprehend the intricate paths through which racism affects health outcomes and the determinants of health, more studies and interventions are required.[1] This paper presents new findings from the Hawai‘i Implicit Bias Initiative (HIBI), a project created to engage in critical research, develop evidence-based resources, and increase awareness of implicit biases in Hawai‘i.[10]

Implicit bias refers to mental associations (eg, beliefs or attitudes) that are activated automatically when people think about social categories and can lead to discrimination.[11,12] The formation of bias is a natural part of human processing, but the specific characteristics of a person's bias are learned through their environment and context. Thus, implicit *racial* biases are thought to embody "overlearned" stereotypes and evaluative associations with racialized identities.[12] Research in this field has demonstrated a robust positive preference for White over Black people, as well as a stronger association of Black with negative stereotypes and White with positive stereotypes.[13,14] Many different disciplines have looked into the connection between implicit biases and behavioral outcomes, but the findings and interpretations of the growing body of research are conflicting and complex.[14]

There are few studies that have examined implicit racial bias in Hawai‘i, but it is an important setting to explore racial biases, as the racial makeup is distinctive, with high proportions of Native Hawaiians (NH), the Indigenous people of Hawai‘i, Asians, Pacific Islanders (PI), and persons who identify with more than 1 race. NH, PI, and Filipinos make up about 40% of the state's population.[15] Unfortunately, health, education, economic, and housing outcomes for NHPI in Hawai‘i are frequently grouped towards the bottom of population-level statistics.[16-19] Data on Filipino and Japanese groups are often aggregated under the single category "Asian," yet when disaggregated, results frequently reveal outcomes for Filipinos are worse relative to Japanese.[17-19] These racial disparities underscore the need to examine factors that extend beyond the biomedical realm and consider more complex causal pathways that include the relationship of racism, biases and broader social inequities with health for NH, PI, and Filipinos.

The current literature on implicit bias does not meaningfully capture the racial and ethnic communities or characterize the complex racial dynamics in Hawai‘i. Importantly, similar to Indigenous and racial/ethnic minority communities elsewhere in the US, the NH, PI, and Filipino groups have experienced discrimination and prejudices in Hawai‘i via historical and contemporary policies, practices, and attitudes that have created barriers to accessing the same opportunities and resources as other racial/ethnic groups.[20-24] Some smaller studies have found an implicit pro-White/anti-Micronesian bias, pro-Japanese/anti-Micronesian bias, and a greater Black-guilty/White-not-guilty bias in samples of Hawai‘i residents and students.[25-27] One larger study found pro-White/anti-Black bias in Hawai‘i.[28] More research needs to be done within Hawai‘i to improve our understanding of the influence of implicit bias on outcomes, such as incarceration, teacher discipline in the classroom, and medical decision-making. The current study begins to address this empirical gap by measuring implicit racial biases among college students in Hawai‘i. It reports results from novel Implicit Association Tests (IATs) (White-Native Hawaiian, White-Micronesian, and Japanese-Filipino) adapted to measure implicit biases. This study is an initial step in a broader effort to adapt IATs to the socio-cultural context of Hawai‘i with the aim of expanding the research to engage the wider public in an effort to better understand the influence of implicit bias on a health and social determinants of health in Hawai‘i.

## Methods

### Setting

The Hawai‘i Implicit Bias Initiative (HIBI) is an interdisciplinary, community-engaged research and education initiative seeking to conduct critical research, develop evidence-based resources, and increase community awareness of implicit biases in Hawai‘i. The HIBI research team includes 8 individuals from diverse fields, led by a 5-person Steering Committee from different schools within the University of Hawai‘i (Schools of Medicine and Law, and the Colleges of Education and Social Sciences). The team programmed multiple IATs to capture implicit biases salient to the racialized experiences of those living in Hawai‘i with a focus on undergraduate students from the University of Hawai‘i at Mānoa (UHM).

UHM is located on the island of O‘ahu and has 14 198 undergraduate students enrolled in the academic year 2022-2023. In-state residents make up 58% of the student body, international students account for 7%, and the remaining 36% are out-of-state, US national students. The undergraduate student population is diverse, with the highest percentage of students categorized as either Asian (35%) or White (24%). Sixteen percent identified as NH or other PI and another 16% identified as 2 or more races. All groups listed above were non-Hispanic.[29] Thirteen percent of the undergraduate student population is Hispanic.[30]

The IATs in this study assess attitudes and stereotypes toward groups that are frequently aggregated together in public health datasets and research; Japanese and Filipinos are frequently aggregated under Asian and NH and diverse PI communities are commonly aggregated under Asian or combined within the NHPI category. “Pacific Islander” is a pan-ethnic term that largely references those who share ancestral origins to island nations and territories in the western and southern Pacific Ocean. The term “Micronesian” is used in this study not as an ethnic, national, or regional identity, but as an identity that has been racialized in the context of Hawai‘i and is broadly applied by the press and in the wider social discourse to people with ties to islands in Micronesia, particularly Chuuk, Pohnpei, Kosrae, Yap, the Marshall Islands, and Palau, irrespective of how individuals themselves identify. These communities are targets of racism in the state, frequently in the form of dehumanizing prejudices and discrimination.[31-34]

### Participants and Procedure

Undergraduate students were recruited through the University’s psychological studies platform and consented prior to participating. The study was approved by the University of Hawai‘i Institutional Review Board (Protocol Number: 2020-00531). Participants completed 1 or more IATs (White-NH, White-Micronesian, Japanese-Filipino) that measured implicit bias and answered survey questions that measured social dominance orientation and demographics. Sample sizes were 258 for the White-NH task, 257 for the White-Micronesian task, and 236 for the Japanese-Filipino task.

### Measures

*IATS*

Participant’s implicit attitudes (good/bad) toward different racial/ethnic groups were measured using 3 new IATs. The IAT is the most widely used measure of implicit bias and is a computer-based, timed sorting experiment in which the sorting activity is conducted several times per participant under 2 opposing conditions.[12,14,35] For example, a participant would be asked to sort stimuli of positive terms (eg, joy, happiness) with Japanese/Good and negative terms (eg, sad, anger) with Filipino/Bad for Condition 1, and do the activity again with the opposite instruction (Condition 2) where negative terms sorted with Japanese/Bad and positive terms with Filipino/Good. The relative length of time it takes an individual to sort to the targets in different conditions is interpreted as an indication of the strength of the implicit association between the paired race and attitudes. The IAT can use pictures or words as exemplars for concepts. The 3 IATs administered in the current study utilize words rather than faces as exemplars for different racial/ethnic groups. These were determined by the research team and pretested with 15 UHM students. Stimuli for each of the tests are presented in **Table 1**. A variety of terms for each racial category were considered, including terms used in prior studies. Eventually, the selection was narrowed to improve equivalence between the groups being compared. Initially, names (eg, Kawika) were considered, but names as exemplars for the Micronesian category were

Table 1. Terms Used As Exemplars for Racial/Ethnic Categories in the Novel Implicit Association Tests[a]

| Hawaiian | White | Micronesian | Japanese | Filipino |
|---|---|---|---|---|
| Hawai‘i | Idaho | Chuuk | Mochi | Adobo |
| O‘ahu | Vermont | Palau | Tempura | Lechon |
| Kaua‘i | Wyoming | Yap | Udon | Pancit |
| Lana‘i | Iowa | Pohnpei | Osaka | Lumpia |
| Moloka‘i | Nebraska | Kosrae | Tokyo | Manila |
| Maui | Maine | Marshall Islands | Japan | Philippines |

[a] The positive and negative associations were measured using standard terms used in prior publicly available work to capture attitudes (eg, joy vs horrid)

problematic because of the substantial diversity and possible overlap with other groups. Place names and foods were chosen due to relative familiarity across groups.

*Social Dominance Orientation*

The Social Dominance Orientation Scale version 7 ($SDO_7$) was included to assess the support of each participant for inequality between social groups.[36] Items included statements like, “An ideal society requires some groups to be on top and others to be on the bottom.” or “Groups at the bottom are just as deserving as groups at the top.” Participants rated 8 items on a scale of 1-7 (strongly disagree to strongly agree). Higher mean scores indicated stronger support for inequality and group-based dominance. The $SDO_7$ measure was psychometrically evaluated against previous versions and found to correlate highly with the SDO version 6 and maintain its established validity in measuring intergroup conflict and inequality.[36]

*Demographics*

Participants were asked their age, gender identity, race/ethnicity, and the number of years living in Hawai‘i. Race/ethnicity was collected in 2 separate questions. The first asked participants to indicate all race/ethnicities they identify with and the second asked participants to select a single race they identified with. The second question included the option for participants to select multiracial, prefer to self-describe, or refuse to answer.

**Analysis**

The primary outcome was mean IAT *D* scores for each IAT test or “task” (eg, White-Native Hawaiian IAT). The IAT *D* score is the difference in the speed between the respondent’s performance in sorting a single set of stimuli to 2 different conditions. The score ranges from -2.0 to +2.0. An IAT *D* score of 0 is interpreted as neutral and as scores move further from 0, the stronger the bias in either direction. Secondary analyses examined the associations between IAT *D* scores and covariates. Data was collected using Qualtrics (Qualtrics, Provo, UT) and IAT *D* scores were computed using the iatgen.org Shiny App,[37] using a 2003 algorithm from Greenwald.[38] For each of the tasks, a one-sample *t*-test comparing the IAT *D* score to 0 examined whether there was a significant implicit bias toward the different racial/ethnic groups. Positive *D* scores indicate a positive bias toward the first ethnic group in the hyphenated task name.

For demographic variables, years lived in Hawai‘i were recoded to create a categorical variable: less than 5 years or 5 years or more. Because Japanese and Whites have consistently had higher educational attainment, income, and occupational status than other groups,[24,39] dichotomous racial variables were created for Whites and White and Japanese to compare these groups to other racial/ethnic groups. The $SDO_7$ score was calculated based on the standard scoring procedure.[36] Finally, a multiple regression with the *D* score as the outcome variable and demographic characteristics and SDO as predictors was conducted for each task.

## Results

For all tasks, mean age of participants was between 19 and 20 years, 80% were female, and a little more than half were living in Hawai‘i for less than 5 years (**Table 2**). Participation per test ranged slightly by race: 27-31%White, 12-14% Japanese, 12-15% Filipino, 5-8% NH, 7-9% multiracial, and 26-29% were of another race.

For the White-NH task, the one-sample *t*-test showed that participants had a positive bias toward NHs compared to Whites ($t(257)=-6.616$, $P<.001$, 95% CI: [-0.278, -0.150]). The multiple regression model found that White participants showed a slight positive bias toward Whites compared to NH ($M=0.095$, $SD=0.515$), whereas non-White participants showed a positive bias toward NH compared to Whites ($M=-0.361$, $SD=0.459$). Those who lived in Hawai‘i for 5 years or more ($M=-0.446$, $SD=0.424$) had a stronger positive bias toward NH than those who lived in Hawai‘i less than 5 years ($M=-0.034$, $SD=0.516$). Similar effects were found when examining the same multiple regression with race coded as White and Japanese compared to All Other Groups; however, the White and Japanese group showed a very slightly positive bias toward NH, which was in the opposite direction of the findings for the White group in the White vs non-White comparison.

Table 2. Characteristics of University of Hawai‘i Student Participants in Each Implicit Association Task

| Characteristics | Tasks | | |
|---|---|---|---|
| | **White-Native Hawaiian**<br>N=258 | **White-Micronesian**<br>N=257 | **Japanese- Filipino**<br>N=236 |
| **Age** | 19.65 (SD: 3.10) | 19.91 (SD: 3.64) | 19.93 (SD: 3.81) |
| | [Range: 18 – 45] | [Range: 18 – 45] | [Range: 18 – 48] |
| | **Percent (No.)** | **Percent (No.)** | **Percent (No.)** |
| **Gender** | | | |
| Male | 17.1% (44) | 16.0% (41) | 17.1% (40) |
| Female | 80.5% (207) | 80.9% (208) | 80.3% (188) |
| Non-binary[a] | 2.3% (6) | 3.1% (8) | 2.6% (6) |
| | 1 missing data | | 2 missing data |
| **Race[b]** | | | |
| White | 31.8% (82) | 30.9% (79) | 27.5% (65) |
| Japanese | 14.7% (38) | 12.5% (32) | 12.3% (29) |
| Filipino | 12.8% (33) | 14.5% (37) | 15.7% (37) |
| Native Hawaiian | 5.4% (14) | 5.1% (13) | 8.5% (20) |
| Multiracial | 8.2% (21) | 7.8% (20) | 9.7% (23) |
| Other groups | 27.1% (70) | 29.3% (75) | 26.3% (62) |
| | | 1 missing data | |
| **Reside in HI[c]** | | | |
| < 5 years | 55.5% (142) | 55.1% (141) | 52.1% (123) |
| > 5 years | 44.5% (114) | 44.9% (115) | 47.9% (113) |
| | 2 missing data | 1 missing data | |

[a] This category includes non-binary, genderqueer/gender non-conforming, and those who preferred to self-describe.

[b] Participants were asked 2 questions regarding their racial/ethnic identity. The first allowed for multiple responses, the second asked participants to identify a single category they most identify with, but included “multiracial,” “prefer to self-describe,” and the option to decline. This table reports the results of the second question with the racial/ethnic groups that are the focus on for this study.

[c] Reside in HI = Length of residency in Hawai‘i and is categorized as less than 5 years or equal to or greater than 5 years.

For the White-Micronesian IAT, the one-sample *t*-test indicated participants had a pro-White/anti-Micronesian bias ($t(256)=5.070$, $P<.001$, 95% CI: [0.094, 0.213]). The multiple regression showed that White participants ($M=0.327$, $SD=0.426$) had a stronger negative bias toward Micronesians compared to non-White participants ($M=0.074$, $SD=0.492$) (**Table 3**). Neither participant residency length nor SDO were significant predictors of the IAT *D* score. Similar effects were found when examining the same multiple regression with race coded as White and Japanese compared to All Other Groups; a pro-White preference was found on average across both groups (combined White and Japanese and all other participant groups), but with a weaker preference among All Others Group.

Lastly for the Japanese-Filipino task, the one-sample *t*-test revealed participants had a negative bias toward Filipinos compared to Japanese ($t(236)=5.798$, $P<.001$, 95% CI: [0.105, 0.213]). The multiple regression (with race coded as White, non-White) showed that none of the predictors significantly predicted implicit bias (**Table 3**). When race was coded instead as White and Japanese versus all other groups, participants’ race was a significant predictor of implicit bias ($t(233)=2.420$, $P=.016$), whereby, compared to other groups, White and Japanese participants had a stronger pro-Japanese/anti-Filipino bias ($M=0.227$, $SD=0.383$) compared to participants belonging to other groups ($M=0.111$, $SD=0.441$) (**Table 3**). Finally, an exploratory multiple regression with a different race coding, examining only Japanese and Filipinos, was conducted. The exploratory multiple regression model showed that participant race was a significant predictor of implicit bias ($t(62)=6.954$, $P<.001$), where Japanese showed a positive bias toward Japanese ($M=0.526$, $SD=0.282$) and Filipinos showed a positive bias toward Filipinos ($M=-0.160$, $SD=0.461$).

Table 3. Results of the Multiple Regression Analyses of Implicit Association Tests (IAT) Among University of Hawai‘i Students by Race Groups and Length of Residency

| Tasks | Mean IAT *D* (*SD*) | Mean IAT *D* (*SD*) | t-value (N) | *P*-value |
|---|---|---|---|---|
| | **White[a]** | **Non-White[a]** | | |
| White-Native Hawaiian | 0.095 (*SD*: 0.515) | -0.361 (*SD*: 0.459) | t(250) = 4.462 | <.001 |
| White-Micronesian | 0.327 (*SD*: 0.426) | 0.074 (*SD*: 0.492) | t(251) = 3.514 | <.001 |
| Japanese-Filipino | 0.094 (*SD*: 0.346) | 0.183 (*SD*: 0.445) | t(233) = -1.188 | .236 |
| | **White & Japanese[b]** | **Other[b]** | | |
| White-Native Hawaiian | -0.085 (*SD*: 0.556) | -0.330 (*SD*: 0.463) | t(250) = 2.323 | .021 |
| White-Micronesian | 0.249 (*SD*: 0.468) | 0.077 (*SD*: 0.488) | t(251) = 2.372 | .018 |
| Japanese-Filipino | 0.227 (*SD*: 0.383) | 0.111 (*SD*: 0.441) | t(233) = 2.420 | .016 |
| | **<5 Years[a]** | **>5 Years[a]** | | |
| White-Native Hawaiian | -0.034 (*SD*: 0.516) | -0.446 (*SD*: 0.424) | t(250) = -4.293 | <.001 |
| White-Micronesian | 0.206 (*SD*: 0.484) | 0.091 (*SD*: 0.485) | t(251) = -0.190 | .85 |
| Japanese-Filipino | 0.136 (*SD*: 0.386) | 0.184 (*SD*: 0.457) | t(233) = 0.126 | .9 |

[a] Multiple regression model with IAT *D* score as the outcome with participant race as White vs non-White, residency length (lived in Hawai‘i more than 5 years vs less), and social dominance orientation.

[b] Multiple regression model with IAT *D* score as the outcome with participant race as White & Japanese vs Other, residency length (lived in Hawai‘i more than 5 years vs less), and social dominance orientation.

*SD* = Standard deviation

## Discussion

This first study of the novel race attitude IATs developed by HIBI found implicit biases that were similar to findings from earlier studies conducted in Hawai‘i.[29,30] Participants generally had a positive preference for Whites compared to Micronesians. The average IAT *D* score was like that reported in the research investigating implicit attitudes toward Micronesians and Whites among obstetrician-gynecologists.[26] It is important to note that in addition to differences in the sample population (clinicians vs undergraduates), the exemplar terms for White and Micronesian used in the 2 studies were different; thus, there is some evidence for generalizability of this finding within the state. Moreover, contrary to Delafield and colleagues[26] who found the 2 factors to be significantly positively correlated, the time of residency in Hawai‘i was not a predictor of the IAT *D* score.[26] It may be that time spent in Hawai‘i is a proxy for exposure to messages regarding racialized groups at the environmental level. Participants who spent less time in Hawai‘i may respond to the term “Micronesian” as “other” or a “non-White” group in general and see that as less positive in comparison to an established racial categorization. Alternatively, environmental cues concerning the racial category of Micronesian may be so potent that students who move to Hawai‘i quickly absorb negative stereotypes and attitudes.

NH were seen favorably in comparison to Whites, which supports a finding by Levinson et al.[25] In the current study, the period of residency in Hawai‘i and participant race—coded as White vs non-White and White and Japanese vs all others—were both significant predictors of implicit bias in this task. The pro-White/anti-NH prejudice was most pronounced among White individuals. The preference was weaker when Japanese and White combined into 1 group and compared to all other groups, but it still leaned in the same pro-NH/anti-White direction as the all others group. NH were preferred above Whites by those who had lived in Hawai‘i for 5 years or more. The authors of the Levinson et al[25] study hypothesized that the connections revealed by the White-NH attitude IAT might be typical of contemporary Hawai‘i.[29] Although there is significant social inequality and NH communities generally have lower socioeconomic status, there has been a concerted effort to promote NH culture and values. NH communities themselves have participated in this effort through acts of defiance and a cultural revival movement. Given that in this study participants who lived in the state for less than 5 years displayed a slight pro-NH preference, it is also possible that the promotion of tourism to the islands, even superficially, as an alluring and welcoming destination for tourists, may have had an impact on the White-NH IAT results. Further research is needed to better understand how specific factors relate to test responses.

The results of this innovative examination of implicit biases in the Japanese-Filipino task revealed that Japanese were viewed more favorably than Filipinos and that neither race nor time in Hawai‘i predicted implicit bias. However, an exploratory analysis showed that implicit in-group preference had a significant impact, especially among Japanese participants. The direction of prejudice in this task and the White-Micronesian task is congruent with the socio-economic hierarchy and history of these cultures, albeit there are no studies that have looked at implicit attitudes among these populations.

Interpreting these research findings should be done with considerable care. First, IATs are limited by their design and cannot speak to the intersectionality of identities. The focus on race/ethnicity is 1 factor that has been measured widely and offers important contributions to the discourse around racism in the US, but there are other aspects of identity and context that may influence results. Second, these tasks employ new terms, as opposed to images or photographs, for each racial/ethnic group that are meant to be exemplars of the group. While the use of terms in IATs is not new, these exemplars are largely place names or names of foods affiliated with each racial/ethnic category. This approach was chosen within the confines of the study budget and the feasibility of determining what physical features may represent the diverse racial/ethnic groups in this investigation. While these findings are largely consistent with previously published studies conducted in Hawai‘i, it is possible that attitudes toward a group of people may be confounded with attitudes toward a place. This may be particularly relevant for the White-NH task, for which the islands names may elicit implicit positive emotions that may be confounded with their implicit attitudes toward NH people.

Additionally, this sample is a convenience sample of undergraduate students from a single academic institution that self-selected into the study. Students at academic institutions tend to have characteristics that are different from the general population; for example, roughly 55% of participants had resided in Hawai‘i for less than 5 years. However, it is unclear from the literature how these characteristics might have influenced the results of this study. A strength of the sample is that although the percentages of racial/ethnic groups do not reflect the general population of Hawai‘i, the sample was highly diverse.

This investigation was a first step in the broader mission of HIBI to engage in critical research on implicit bias in this uniquely diverse state. Additional research is needed on the influence of environmental-level messages regarding racial associations and stereotypes and opens the door for testing out other possible stimuli (eg, photographs or names) to provide more context for understanding these results. To assess the impact of implicit racial bias on broader determinants of health experienced by NH, PI, and Filipino communities in Hawai‘i, future studies must move beyond being solely descriptive. Gaining a deeper comprehension of factors affecting bias can aid in the creation of bias-mitigation treatments. This research might also be useful for NH, PI, and Filipino populations outside of Hawai‘i. The majority of respondents in a recent study of over 250 NHPI individuals from throughout the US reported having encountered discrimination at work, at school, or on the street.[40] Similar investigations exploring implicit racial biases against smaller populations that are underrepresented in research may be inspired by this investigation.

A key public health finding is that implicit racial bias may exist even in racially diverse environments. Understanding how racism, including implicit racial bias, operates and affects NH, PI, and Filipino communities is a crucial first step toward greater equity and justice, especially in light of the disparities in health, education, income, and criminal justice that exist in Hawai‘i.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Promoting Health Research among Underrepresented Students through the HUI SRC

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## Abstract

*The Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC) is focused on increasing participation of historically underrepresented populations, such as Native Hawaiians, other Pacific Islanders (NHPI), and Filipinos, in tomorrow's biomedical and health research workforce. This is achieved by promoting engagement and competency in entrepreneurial biomedical and health research among undergraduate students. The HUI SRC was modeled after the Morgan State University ASCEND SRC funded by the National Institute of General Medical Sciences. The HUI SRC is rooted in the Hawaiian cultural values of ho‘oku‘i, hui pū‘ana, and lōkahi, referring to the physical gathering space of the Student Research Center and the joining of people together around a unifying theme, in this case the pursuit of science. It is committed to intentionally engaging Indigenous knowledge and ways of doing in decolonizing research. This article describes the project and presents evaluation findings of the first year of implementation of the HUI SRC. The center was effective in increasing undergraduate students' science identity, academic self-concept, social self-concept, social support, peer support, and self-efficacy. These HUI SRC findings highlight the potential impact of undergraduate SRCs in expanding the pipeline of biomedical and health researchers from underrepresented populations, particularly among NHPI and Filipinos.*

## Keywords

*student research center, health, undergraduate, Native Hawaiian, Pacific Islander, Filipino*

## Acronyms

*ASCEND = A Student-Centered, Entrepreneurship Development Program*
*BUILD = Building Infrastructure Leading to Diversity Initiative*
*HUI SRC = Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center*
*HPU = Hawai‘i Pacific University*
*MSU = Morgan State University*
*NHPI = Native Hawaiian and Pacific Islander*
*NIH = National Institutes of Health*
*REDCap = Research Electronic Data Capture*
*SRC = Student Research Center*

Global preeminence in science and technology is contingent on having a highly educated, competent, and diversely represented cadre of well-trained scientists committed to promoting healthy individuals, families, and communities.[1,2] To promote health parity in marginalized communities, a diverse, inclusive, and equitable representation of scientists is imperative.[3-5] In the United States (US), only 10% of the faculty research positions are occupied by African Americans, Hispanics, Native Americans, or Native Hawaiian and Pacific Islanders (NHPIs) collectively, although they constitute over 30% of the US population.[6] This major leak in the educational pipeline is especially concerning in underrepresented communities, such as NHPI and Filipino communities, where educational pathways to careers in the scientific workforce are filled with challenges and barriers.[7-9] In response to these challenges, many training programs have successfully exposed diverse undergraduate students to research opportunities in the biomedical and health sciences, facilitating entrance into scientific careers. Although data specific to NHPI and Filipinos are not available, the workforce gap among underrepresented communities still persists.[10]

## Diversifying the Scientific Workforce

While the US increased the number of PhD degree holders over the past few decades, 43% of the PhD graduates are males from well-represented backgrounds (defined at Whites, Asians, and non-US residents). While these graduates hold 82% of all full professorships, they only make up 35% of all undergraduate biomedical degree recipients.[8] One of the main strategies for diversifying the biomedical workforce is to ensure that undergraduate students from different cultural backgrounds are recruited to participate in biomedical and health science research early in their education and are positioned for graduate school and careers in the scientific workforce. However, undergraduate student persistence, retention, and graduation can be jeopardized by a constellation of factors, including personal, socio-cultural, and environmental influences.[11,12] The need for relevant, evidence-based approaches for optimizing recruitment, education, and training outcomes, particularly of students from underrepresented communities, continues to persist.[1,2,6,8]

In 2014, the National Institutes of Health (NIH) supported 10 sites, including Morgan State University (MSU), as part of the Building Infrastructure Leading to Diversity (BUILD) initiative, which is 1 of the core components of the Diversity Program Consortium. The purpose of the BUILD initiative is to develop and test novel programs that support underrepresented undergraduate students in their pursuit of biomedical degrees and careers. As part of this initiative, MSU's A Student-Centered, Entrepreneurship Development (ASCEND) program increased the diversity of undergraduate student researchers and contributed to their sense of science identity, readiness to lead research, and matriculation in research-oriented graduate programs.[13] A novel component of ASCEND is the Student

Research Center (SRC), a student-led organization designed to be a hub for attracting, retaining, training, and engaging underrepresented undergraduate students in biomedical and health science research.

As part of its diversity initiatives, Hawai‘i Pacific University (HPU) engaged in the translation and implementation of MSU’s ASCEND SRC to promote science identity, academic self-concept, social self-concept, social support, peer support, self-efficacy, and leadership among NHPI, Filipinos, and other underrepresented students at HPU. The overall goal of the HPU Undergraduate Infrastructure Student Research Center (HUI SRC) is to attract, engage, and retain underrepresented undergraduate students in biomedical and health science research, thus preparing them to enter and complete graduate school and secure a career in the scientific workforce. The activities and outcomes of the HUI SRC are outlined in **Table 1**. The purpose of this article is to describe the HUI SRC and to report formative evaluation findings based on its first year of implementation.

## Methods

### Participants and Data Collection

Starting in Spring semester 2020, advertisements for HUI SRC members commenced using mechanisms such as classroom-based information sessions, distribution of electronic and paper flyers, postcards to HPU faculty and students, a HUI SRC website, social media campaigns (eg, Facebook, Instagram, Twitter, Snapchat), and presentations at different student-oriented and freshman orientation events. These methods were intended to create awareness of the benefits of HUI SRC among students, faculty, and administrators at HPU. All students enrolled at HPU were eligible to participate in student-level evaluations and interviews regardless of their age, gender, race, citizenship status, classification, major, and other demographic and background characteristics. As a whole, all students received campus-wide surveys to determine the efficacy and impact of the HUI SRC training and mentoring approaches on the HPU student body.

The project protocol was approved by the HPU Institutional Review Board as an Exempt study (Protocol #560420035). Data were collected and managed using a secure web-based survey and database Research Electronic Data Capture (REDCap; Vanderbilt University, Nashville, TN) hosted at the lead author’s institution. At the beginning of the Spring 2020 semester, students were able to sign up for the HUI SRC by completing an online interest form that included demographic information. Students providing consent were directed to complete an online baseline survey (~20-minutes). At the end of the semester (May 2021), a weblink for the post-survey was sent to the students who completed the baseline survey. Each student participant was offered a $5.00 electronic gift card per survey.

### Research Design

The program employed a retrospective pre-test and a pre- and post-test study design. A comparison group was not employed in this project, and participants served as their own controls. Specifically, HUI SRC students were asked to evaluate their levels of agreement on items related to 7 outcome areas—science identity, academic self-concept, personal and social self-concept, peer support for research and science, social support, science self-efficacy, and leadership—at baseline (see **Table 2**). Then, in May 2021, they were asked to rate themselves again and also to retrospectively rate their pre-involvement status in the

Table 1. Activities of the Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC) to Promote Health Research among Underrepresented Strudents , School Year 2020-2021

| Activities | Frequency | Desired Outcomes |
|---|---|---|
| **Extracurricular** | | |
| • Social events; health-related activities (eg, blood drives) | Bi-monthly | Enhanced peer and social support |
| **Research Training** | | |
| • Presentations from grant-funded researchers (Inspiration Series) | Every other month | Developing entrepreneurial thinking skills, increased science communication, enhanced science self-efficacy |
| • Mentorship from research-active faculty from HPU and the University of Hawai‘i | Ongoing | |
| **Entrepreneurial-Style Research** | | |
| • Student-initiated, competitive pilot awards (Health Research Concepts Competition) | Tri-annually | Developing research knowledge and skills, increased leadership and teamwork competency, enhanced science identity |
| **Dissemination** | | |
| • Funding for student-led presentations and publications | Annually | Developing communication skills, enhanced scientific writing and analytic competency, pursuit of graduate health research training |
| • Professional development workshops (eg, resume building, writing graduate school applications) | Annually | |

7 outcome areas. Compared with traditional pre- and post-test designs, retrospective pre-tests have proven to be more effective and accurate to capture change as a result of an intervention. [14] It was hypothesized that students would have an inflated sense of accomplishment or ability prior to the intervention, and the more they learned through the HUI SRC, the more likely they were to accurately gauge their growth in learning.

## Measures

The following demographic variables were collected: age, sex, race, ethnicity, major, grade, school year, educational goal, and level of research interest (scored from 0 to 100). Measures for the questionnaire were adapted from Morgan State University's ASCEND and/or the College Freshman Survey and College Senior Survey developed by University of California at Los Angeles.[15]

### *Science Identity*

The science identity construct used a 5-point Likert scale to describe how a student seeks to be a scientist. It was measured by 6 items (see **Table 2**). The Cronbach's Alpha coefficient of this scale was good to excellent (0.86 for pre-test items and 0.92 for post-test items).[16] These items were averaged to evaluate overall science identity.

### *Academic Self-concept*

For this construct, students were asked to rate themselves on certain traits to measure how well they felt they could learn compared with the average person their age on a 5-point Likert scale (1 = lowest 10%, 2 = below average, 3 = average, 4 = above average, and 5 = highest 10%) (see **Table 2**). The reliability of this project's outcomes was acceptable at post-test (Cronbach's alpha = 0.62 at baseline, 0.73 at post-test). These items were averaged to evaluate overall academic self-concept.

### *Social Self-concept*

For this construct, students were asked to rate themselves on certain traits to measure how they perceived themselves in relation to others compared with the average person their age on a 5-point Likert scale similar to that for the academic self-concept (see **Table 2**). In this project, its reliability was good (Cronbach's alpha = 0.81 at baseline, 0.88 at post-test). [16] These items were averaged to evaluate overall social self-concept.

### *Peer Support*

The peer-support section was comprised of seven, 5-point Likert items (1 = 0-1, 2 = 2-4, 3 = 5-7, 4 = 8-10, 5 = >10) asking about the number of friends or peers available to support one's research and/or scholarship (see **Table 2**). In this project, its reliability was good to excellent (Cronbach's alpha = 0.82 at baseline, 0.91 at post-test). [16] These items were averaged to evaluate the overall size of one's peer support network.

### *Social Support*

The social support measure was composed of eighteen, 5-point Likert items (see **Table 2**). In this project, its reliability was good to excellent (Cronbach's alpha = 0.86 at baseline, 0.96 at post-test). [16] These items measured a person's perception of social support from family, peers, and the educational community.

### *Self-efficacy*

This domain includes ten, 5-point Likert items examining students' research self-efficacy by asking how confident they felt about performing various research-related tasks (see **Table 2**). Responses were recorded on a 5-point Likert scale from 1 = not at all, 2 = somewhat, 3 = moderately, 4 = very, and 5 = absolutely. The Cronbach's Alpha coefficient of this scale was excellent (0.91 for pre-test items and 0.96 for post-test items). [16] The items were averaged to evaluate overall self-efficacy.

### *Leadership*

The leadership construct consisted of four, 5-point Likert items (see **Table 2**). In this project, its reliability was good (Cronbach's alpha = 0.83 at baseline, 0.88 at post-test). [16] These items were averaged to evaluate overall leadership.

## Statistical Analysis

Frequencies and percentages for categorical variables and means and standard deviations for continuous variables were reported to describe baseline demographics. Bivariate analyses were conducted to compare students who completed the post survey and students who did not complete the post survey, using 2 sample t-tests or Fisher's exact tests. Then, paired t-tests were performed to compare between baseline and posttest and between retrospective pretest and posttest. All analyses were implemented in SAS 9.4 (SAS Institute, Cary, NC) and $P < .05$ was considered statistically significant.

Table 2. Measures Used for Pre- and Post-Surveys of Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC) Participants, School Year 2020-2021

| Measure | Items | Scores |
|---|---|---|
| Science identity | *To what extent are the following statements true of you?*<br>(1) I am interested in scientific research<br>(2) My research interests include health and biomedical studies<br>(3) I have a strong sense of belonging to the community of biomedical scientists<br>(4) I derive personal satisfaction from contributing to a team that is doing important research<br>(5) I think of myself as a biomedical student<br>(6) I feel like I belong in the field of science | 1=strongly disagree<br>2=disagree somewhat<br>3= neutral<br>4=agree somewhat<br>5=strongly agree |
| Academic self-concept | *Rate yourself on each of the following traits as compared with the average person your age to provide the most accurate estimate of how you see yourself.*<br>(1) Academic ability<br>(2) Drive to achieve<br>(3) Mathematical ability<br>(4) Intellectual self-confidence | 1=lowest 10%<br>2=below average<br>3=average<br>4=above average<br>5=highest 10% |
| Social self-concept | *Rate yourself on each of the following traits as compared with the average person your age to provide the most accurate estimate of how you see yourself.*<br>(1) Leadership ability<br>(2) Public speaking ability<br>(3) Social self-confidence | 1=lowest 10%<br>2=below average<br>3=average<br>4=above average<br>5=highest 10% |
| Peer support | *Indicate the number of friends (peers or near-peers) for each items.*<br>(1) Who can help them if they have a question about their research<br>(2) Who are ready to work with them on their research<br>(3) Who helps with their research<br>(4) Who encourage them to do research<br>(5) Who encouraged them to apply to graduate school<br>(6) Who encourages them to engage in research<br>(7) Who have the same goal of getting into graduate school and becoming researchers | 1=0-1<br>2=2-4<br>3=5-7<br>4=8-10<br>5=>10 |
| Social support | *To what extent are the following statements true?*<br>(1) My family thinks it is important that I do research<br>(2) My family thinks it is important that I continue my education as a graduate student<br>(3) I belong to an elite group of student researchers<br>(4) I am determined to pursue a career in health research<br>(5) I am determined to pursue graduate training<br>(6) HPU appreciates my talent in research<br>(7) HPU faculty motivate and support me to pursue a research career<br>(8) I can count on a support network that encourages me to continue my research when I feel frustrated<br>(9) I have great self-esteem about research<br>(10) I have many friends who can answer my research questions<br>(11) I have great access to a support group who can answer may questions about graduate school applications<br>(12) I feel included in the HPU student community<br>(13) I care about what happens at HPU<br>(14) I belong to HPU student community<br>(15) I have a forum to provide my opinion about what happens at HPU<br>(16) I have fair access to educational and research opportunities<br>(17) HPU students care about my opinion<br>(18) I enjoy being a HPU student. | 1=strongly disagree<br>2=disagree<br>3=no opinion<br>4=agree<br>5=strongly agree |
| Self-efficacy | *Indicate your level of confidence in your ability to:*<br>(1) using technical science skills (use of tools, instruments, and/or techniques)<br>(2) generating a research question<br>(3) determining how to collect appropriate data<br>(4) explaining the results of a study<br>(5) using scientific literature to guide research<br>(6) integrating results from multiple studies<br>(7) asking relevant questions<br>(8) identifying what is known and not known about a problem<br>(9) understanding scientific concepts<br>(10) seeing connections between different areas of science and mathematics | 1=not at all<br>2=somewhat<br>3=moderately<br>4=very<br>5=absolutely |
| Leadership | *To what extent are the following statements true of you?*<br>(1) I am an effective leader<br>(2) I have effectively led a group to a common purpose<br>(3) I have held an official leadership position in an organization<br>(4) I have provided leadership to an organization, whether or not I held an official position | 1=strongly disagree<br>2=disagree<br>3=no opinion<br>4=agree<br>5=strongly agree |

HPU = Hawai‘i Pacific University

## Results

From a total of 77 students who completed the interest form, 51 of them completed the baseline survey. Of the students who completed the baseline survey, 31 of them completed the post-test survey. No significant difference was identified in the demographics between students who finished the post-survey and those who did not, except for college major and ethnicity (**Table 3**). Compared to non-completers, post-survey completers had a higher percentage of psychology majors (25% of completers versus 3% of non-completers, *P* = .03) and Hispanics (40% versus 13%, *P* = .04). Of the 51 who completed the baseline survey, the average age of the student participants were 21.4 years (*SD* = 3.0). Most of them were female (80%) and had an educational goal of finding jobs related to their majors after graduation. The 5 majors most represented by project participants were biology (24%), marine biology (22%), biochemistry (20%), nursing (16%), and psychology (12%). Participants reported 12 different majors across the university (see **Table 3** for full list). Thirty-nine percent were in their junior year and had a GPA of 3.7-4.0. Of those who completed the post-test, 23% identified as Filipino, 13% as NHPI, 45% as White, 13% as other Asian, and 13% as other.

**Table 4** shows the comparison between baseline and post-test and between retrospective pre-test and post-test in the outcome measures. Overall, students overestimated their abilities in all measures upon baseline, with baseline scores higher than retrospective pre-test scores in science identity, academic self-concept, personal and social self-concept, peer support for research and science, social support, science self-efficacy, and leadership. When asked to re-assess these scores retrospectively, student participants rated themselves lower on baseline and higher on post-test. Comparing retrospective pretest scores with posttest scores, and there were significant improvement in all of the outcome measures (*P* < .01) except leadership (*P* = .70).

Table 3. Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC) Participant Characteristics, School Year 2020-2021

| Variable | Total (N=51) No. (%)[b] | Post-Survey | | *P*-value[a] |
|---|---|---|---|---|
| | | Completed (N=31) No. (%) | Not completed (N=20) No. (%) | |
| **Age (Mean ± SD)** | 21.4 ± 3.0 | 21.6 ± 3.4 | 20.9 ± 2.1 | .44 |
| **Research Interest (Mean ± SD)** | 81.9 ± 25.2 | 82.1 ± 24.3 | 81.5 ± 27.3 | .94 |
| **Sex** | | | | |
| Male | 10 (20%) | 6 (19%) | 4 (20%) | >.99 |
| Female | 41 (80%) | 25 (81%) | 16 (80%) | |
| **Ethnicity** | | | | |
| Hispanic | 12 (24%) | 4 (13%) | 8 (40%) | .042 |
| Non-Hispanic | 39 (77%) | 27 (87%) | 12 (60%) | |
| **Race** | | | | |
| NHPI | 5 (10%) | 4 (13%) | 1 (5%) | .2 |
| Filipino | 9 (18%) | 7 (23%) | 2 (10%) | |
| Other Asian | 7 (14%) | 4 (13%) | 3 (15%) | |
| White | 22 (43%%) | 14 (45.2%%) | 8 (40.0%) | |
| Other | 8 (16%) | 2 (6%) | 6 (30%) | |
| **Status** | | | | |
| Freshman | 7 (14%) | 3 (10%) | 4 (20%) | .39 |
| Sophomore | 9 (14%) | 6 (19%) | 3 (15%) | |
| Junior | 20 (39%) | 14 (45%) | 6 (30%) | |
| Senior | 10 (20%) | 4 (13%) | 6 (30%) | |
| Other | 5 (10%) | 4 (13%) | 1 (5%) | |

Table 3. Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC) Participant Characteristics, School Year 2020-2021 (Con't)

| Variable | Total (N=51) No. (%)[b] | Post-Survey Completed (N=31) No. (%) | Post-Survey Not completed (N=20) No. (%) | *P*-value[a] |
|---|---|---|---|---|
| **Major[a]** | | | | |
| Biochemistry | 10 (20%) | 4 (13%) | 6 (30%) | .163 |
| Biology | 12 (24%) | 9 (29%) | 3 (15%) | .32 |
| Marine Biology | 11 (22%) | 7 (23%) | 4 (20%) | >.99 |
| Biomedical Engineering | 2 (4 %) | 1 (3%) | 1 (5%) | >.99 |
| Chemistry | 2 (4%) | 0 (0%) | 2 (10%) | .149 |
| Communication Studies and Practices | 2 (4%) | 2 (7%) | 0 (0%) | .51 |
| Environmental Science | 1 (2%) | 1 (3%) | 0 (0%) | >.99 |
| International Studies | 1 (2%) | 1 (3%) | 0 (0%) | >.99 |
| Nursing | 8 (16%) | 7 (23%) | 1 (5%) | .127 |
| Psychology | 6 (12%) | 1 (3%) | 5 (25%) | .029 |
| Public Health | 2 (4%) | 2 (7%) | 0 (0%) | .51 |
| Social Work | 4 (8%) | 1 (3%) | 3 (15%) | .29 |
| **GPA** | | | | |
| <3.2 | 14 (27%) | 6 (19%) | 8 (40%) | .141 |
| 3.3-3.6 | 14 (28%) | 11 (36%) | 3 (15%) | |
| 3.7-4.0 | 23 (45%) | 14 (45%) | 9 (45%) | |
| **Educational Goal[c]** | | | | |
| Job related to my major | 37 (73%) | 23 (74%) | 14 (70%) | .74 |
| Job not related to my major | 2 (4%) | 2 (7%) | 0 (0%) | .51 |
| Graduate school in science | 26 (51%) | 16 (52%) | 10 (50%) | .91 |
| Graduate school outside the Sciences | 6 (12%) | 2 (7%) | 4 (20%) | .195 |
| Medical degree | 16 (31%) | 12 (39%) | 4 (20%) | .22 |
| Pharmacy | 2 (4%) | 1 (3%) | 1 (5%) | >.99 |
| Dentistry or Veterinary degree | 9 (18%) | 7 (23%) | 2 (10%) | .45 |
| Other | 5 (10%) | 1 (3%) | 4 (20%) | .071 |

NHPI = Native Hawaiian or Pacific Islander, GPA = grade point average

[a] *P*-value was calculated based on Chi-square test, Fisher's exact test, or two sample t test.

[b] The sum of percentages may not be 100% due to rounding.

[c] Multiple answers allowed.

Table 4. Comparison of Outcome Measures for Student Participation in the Hawai‘i Pacific University Undergraduate Infrastructure Student Research Center (HUI SRC), School Year 2020-2021

| Outcome[a] | Baseline (N=51) | Retrospective Pretest (N=31) | Posttest (N=31) | *P*-value: Baseline vs Posttest[b] | *P*-value: Retrospective Pretest vs Posttest[b] |
|---|---|---|---|---|---|
| Science identity | 4.2 ± 0.7 | 3.8 ± 1.0 | 4.2 ± 0.9 | .75 | .001 |
| Academic self-concept | 3.8 ± 0.6 | 3.7 ± 0.7 | 3.8 ± 0.7 | .62 | .005 |
| Social self-concept | 3.9 ± 0.8 | 3.7 ± 0.9 | 3.8 ± 0.8 | .49 | .005 |
| Social support | 3.9 ± 0.5 | 3.7 ± 0.6 | 4.0 ± 0.7 | .37 | .003 |
| Peer support | 2.2 ± 0.7 | 1.9 ± 0.9 | 2.4 ± 0.9 | .16 | <.001 |
| Self-efficacy | 3.7 ± 0.7 | 3.5 ± 0.8 | 3.8 ± 0.8 | .45 | <.001 |
| Leadership | 4.3 ± 0.6 | 4.0 ± 0.8 | 4.1 ± 0.8 | .31 | .7 |

[a] All measures were averaged over multiple Likert type scale questions scored 1-5 (see **Table 2**).

[b] Paired-sample t-tests were used to calculate the *P*-value.

## Discussion

Rooted in the commitment to social justice and founded on an entrepreneurial research training model established by MSU's ASCEND SRC, the goal of the HUI SRC is to develop a diverse cadre of biomedical and health researchers from underrepresented communities. This was achieved through opportunities to develop undergraduate students' science identity, confidence in leading research, and interest in graduate school and the scientific workforce. Perceptions of leadership were not significantly improved, which may have reflected either high confidence in students' leadership ability from the beginning or a misunderstanding of the meaning of the concept. Furthermore, peer support in science was relatively low, which may have been an artifact of COVID-19 restrictions. Future research needs to examine the role of peers and peer support in engagement and persistence in health and biomedical research.

Compared with other ethnic groups, there were relatively few NHPI and Filipino students that participated in the HUI SRC. Although NHPI and Filipino students were not underrepresented compared to their proportion in the HPU student body, it is important to note that these students are minoritized at the university and have historically struggled with socio-economic barriers to accessing higher education and a lack of a sense of belonging in a system built for a dominant culture.[8-9] As evidenced by the high numbers of biology, marine biology, and biochemistry majors in the HUI SRC, the findings from this project may have been biased toward biomedical majors. This bias was perhaps due to preconceived notions around exclusivity of biomedical research to only health sciences and biomedical majors. The COVID-19 pandemic also impacted the recruitment, engagement, and survey participation for the HUI SRC, potentially for NHPI and other represented students, resulting in a small sample size.

## Limitations

The reliance on a participant's ability to recall information in a period of time could be a limitation of the retrospective pre-test design. Additional investigation is needed to understand how use of the retrospective pre-test may be appropriate for formative evaluations of institutional interventions that engage undergraduate students in research, as opposed to traditional pre/post-test designs.

## Implications for Future Research, Policy, and Education

The initial results of this project have positioned HUI SRC to make valuable contributions to a diverse, inclusive biomedical and health research workforce with implications for future research, policy, and education. Bernard, et al point out the fact that science and medicine workforces continue to lack diversity. [17] However, the NIH BUILD[18] and UNITE[19] initiatives are committed to further funding workforce diversity and measuring success. The HUI SRC embodies and contributes to advancing justice, equity, diversity, and inclusion at HPU.

In terms of implications for bridging higher education to the biomedical and health care workforce, efforts that engage students earlier and more effectively in real-world health research opportunities should result in retention, better-trained students, and better-informed citizens with abilities to critically think and generate solutions to address societal problems, particularly related to health and well-being of NHPI, Filipinos, and other underrepresented communities. [13] The HUI SRC provides the structure to bridge education to workforce through knowledge expansion, mentorship, and entrepreneurial research activities. Such structures can help in overcoming the challenges of, and leverage the opportunities incumbent with, the environment of a small private liberal arts university.

## Conclusions

These findings provided formative evidence that the HUI SRC was effective in increasing students' confidence and perceived competence in conducting entrepreneurial biomedical and health research at a minority serving undergraduate institution. As a result of the formative evaluation of the SRC, more training, mentorship, and support for HUI SRC students will be provided in leadership within multidisciplinary research teams, and more targeted recruitment, engagement, and support of NHPI and Filipino students as HUI SRC members and primary researchers will be implemented. The ongoing implementation and assessment of this program at HPU will provide key data to evaluate the portability and potential broader implementation of this model in expanding access for underrepresented groups in biomedical research careers, particularly Native Hawaiians, other Pacific Islanders, and Filipinos.

## Conflict of Interest

None of the authors identify a conflict of interest.

## Disclosure

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# Community-Focused Policy Advocacy: Evaluating Hawai‘i’s Historical Trauma Legislation

Lorinda Riley SJD; Anamalia Su‘esu‘e BS

## Abstract

*Research aimed at reducing health disparities must move beyond the academic and provide practical value. Developing policy briefs that provide a description of the current policy framework along with evidence-based recommendations that can be shared with decision-makers is one way to accomplish this. Researchers, then, can lend their authority to increase awareness moving the policy process forward. The purpose of this paper is to outline a way to develop policy briefs and provide an example of this methodological framework through a case study. The case study was developed as part of a community-engaged research project exploring the conceptualization of historical trauma among Native Hawaiian youth. The policy brief was developed by first searching the Hawai‘i State Legislature database in Westlaw limiting the search to the past 10 years for legislation related to historical trauma, structural racism, or related concepts. The results encompassed 104 bills and resolutions, of which 11 passed and 93 failed to pass. Successful legislation acknowledged the role of racism to health and supported the use of trauma-informed care but stopped short of addressing historical trauma. Several gaps were identified including a failure to address collective trauma or trauma specific to colonization suggesting a reluctance to acknowledge intergenerational trauma as an element of present experiences. The policy brief developed for this project was provided to community partners to support their advocacy efforts. This manuscript showcases a process researchers can use to analyze legislative records and develop policy briefs that can support their community partners.*

## Keywords

*policy analysis, community-engaged research, historical trauma*

## Abbreviations and Acronyms

*ACE = adverse childhood experiences*
*AI = American Indian*
*HLS = Historical Loss Scale*
*HT = historical trauma*
*NH = Native Hawaiian*

## Introduction

Research is most impactful when it has practical influences. One way to accomplish this is to ensure results are disseminated to decision-makers in a form where they understand its value and implications.[1–3] When advocating, community collaborators double as constituents allowing them to reach legislators through multiple angles.[4,5] A spectrum of community-engaged research exists. At one end lies community-engaged research where the community is involved in some, but not all aspects of a project, and at the other is community-based participatory research, where the community drives the research from beginning to end as full participants.[6,7] Research in Indigenous communities is particularly well suited for the latter model.[8] Because of prior bad experiences, Indigenous communities may be less open to new research without the ability to engage in the design and re-assert control when needed.[9–11] Regardless of the type, community-engaged research honors the special knowledge that community members have, including the critical role they play in guiding researchers to issues of importance.[1–3]

### Academics as Policy Advocates

Similar to community-engaged research, translational research seeks to produce results that are meaningful and that benefit humans.[12-14] While translational research is often discussed in reference to basic science, the idea of translating research into something usable can be transferred across disciplines.[15] For example, legislators focused on evidence-based policy making require research to justify policy action.[16] Translational research, then, provides an opportunity to translate dense academic work into evidence that legislators can use to inform policymaking.

The idea of engaging in the policy process can be uncomfortable for some academics.[17-19] Scientists, especially, worry that advocacy may damage their reputation of neutrality, calling into question future work. However, policy advocacy, when supported by evidence, increases social justice.[20] Within the Native Hawaiian (NH) community there is a history of advocacy, including civil disobedience, that has resulted in several successful grassroots-oriented policy advocacy campaigns.[21] Despite these efforts, there are persistent issues where community advocacy on its own has not yet proven successful. Academics and other experts have an opportunity to add value in support of community efforts.[22] While people tend to associate advocacy with testimony and lobbying activities, it can also take the form of educating legislators, issuing policy briefs, and disseminating research results in a more understandable format. These differing types of advocacy, varied by audience, require different skill sets.[23] Academics can complement community advocates who often draw on morality and emotion in addition to facts, by lending legitimacy of their built expertise[24] when developing a policy brief.

A concise, unbiased, evidence-based, policy brief is an excellent way for academics and researchers to support community.[23,25-26] Policy briefs start with a problem and then summarize research on a topic to provide an accurate description of the current policy framework before providing several recommendations for future action. Because these briefs are intended for decision-makers, bureaucrats, and legislative staff who have significant policymaking experience, but limited specialized knowledge, the use of plain language is critical.[27] Incorporating policy briefs as part of the research design provides reciprocity to community stakeholders while diversifying one's dissemination strategy.

### Example of Policy Brief in Support of Community Advocacy

In a recent research project exploring whether and how NH justice-involved and at-risk youth experience historical trauma (HT), the researchers incorporated the development of a policy brief in their research design. HT is the cumulative, emotional, and psychological wounding in a person's lifespan and across generations in a community.[28] Considering the extensive, detrimental impact that colonization has had on Indigenous communities, research focused on American Indian (AI) HT has grown in recent years. Laying much of the groundwork is Braveheart who articulated the concept of HT among AI and identified a number of associated symptoms.[28] Building on this work, Whitbeck et al[29] developed a Historical Loss Scale (HLS) and the Historical Loss Associated Symptom Scale. Using these scales, scholars have found that thoughts of historical loss are associated with increased stress, emotional distress, and substance dependence.[30,31]

With similar, though not identical, histories of colonization and loss, the application of the HLS to NH provided mixed results.[32] A qualitative study on NH HT found distinct ways that NHs described historical loss compared to AIs.[33] These results were validated by this study, which identified several unique understandings of historical loss among NH justice-involved youth.[34] In order to provide evidence of the link between NH HT and NH disparities, including high rates of chronic disease, cancer mortality,[35,36] obesity,[37] substance misuse,[38] depression,[39] adverse childhood experiences (ACE),[40] and incarceration,[41] a measure specific to NH is needed.

Some decision-makers, under the guise of colorblind policy, resist acknowledging HT, which minimizes the effects of colonization by situating it solely in the past. Because of this, a well-written policy brief can help decision-makers understand the issue, articulate the need for change, and identify possible action. This paper explores how academics can use their relative power to advance policy change. The paper then discusses the methodological framework before providing a case study of a NH HT policy brief to illustrate how to integrate policy briefs in the research dissemination process.

## Method

This research project is informed by Indigenous principles, which elevate reciprocity[42] in research. Prior to beginning the research project, the team met with criminal justice stakeholders and the NH community to better understand their needs. It became apparent that despite advocacy efforts in the legislature, NHs, especially juveniles, were still overrepresented in the criminal justice system. Collectively, the research team and community collaborators determined that incorporating a policy brief into the research project would be beneficial.

There are a number of ways to create policy briefs; however, most have similar attributes.[26,43-46] The showcased methodology incorporates 5 steps. This methodological framework was developed by the lead author after years of practical policy experience as well as teaching policy analysis at post-secondary institutions. It clarifies the process for analysis of the current policy framework, while focusing on identifying feasible policy alternatives. Moreover, it incorporates socializing the brief among community collaborators and stakeholders for feedback, which many of the existing methods do not.

To understand Hawai‘i's current policy context, the team searched, within the last 10 years, 3 databases within Westlaw: Hawaii Historical Proposed Legislation, Hawaii Historical Enacted Legislation, and Hawaii Revised Statutes Unannotated. The following boolean legal search string was used: ‘‘Native Hawaiian’/1 health or wellbeing’, ‘‘Native Hawaiian’/p youth’, ‘Historical trauma’, ‘Intergenerational trauma’, ‘‘Native Hawaiian’ /5 incarceration’, and ‘‘Native Hawaiian’ /1 health or wellbeing’. Boolean legal search terms allow researchers to search for all the instances where a term falls within a certain number of words as another term. For example, ‘Native Hawaiian’ /5 incarceration searches for all legislation that references ‘Native Hawaiian’ within 5 words of incarceration.

After reviewing for topical relevance, a total of 104 unique measures resulted from the search, which were saved for further analysis. See **Table 1** for a Sample of a Policy Matrix. Once data from the relevant measures (n=11) were summarized and extracted, the current policy framework was outlined before identifying gaps and providing 2 feasible recommendations. Prior to finalizing the policy brief, community partners reviewed the draft and provided feedback.

Table 1. Sample Policy Matrix Showing Extracted Legislative Data

| Year | Measure | Title | Sponsors | Senate Committees | House Committees | Passed | Project's summary |
|---|---|---|---|---|---|---|---|
| 2021 | HCR11<br>HD1<br>SD1 | Requesting the Hawaii State Commission on the Status of Women to Convene a Task Force to Study Missing and Murdered Native Hawaiian Women and Girls. | Eli, Belatti, Branco, Decoite, Hashimoto, Ichiyama, Kapela, Kitagawa, Lowen, marten, Matayoshi, Matsumoto, McKelvey, Mizuon, Morikawa, Nakamura, Nakashima, Nishimoto, Perruso, Takumi, Tam, Tarnas, Todd, Wilderberger, Yamashita, McDermott | HWN, JDC/WAM | HHH, JHA | Yes | Calls for the creation of a task force to conduct study on missing and murdered NH women and girls. Names HT (ie, land dispossession, sexual violence, incarceration etc.) among NH women and girls as an area of concern. |

HWN=Hawaiian Affairs, JDC=Judiciary, WAM=Ways and Means, HHH=Health, Human Services, & Homelessness, JHA=Judiciary & Hawaiian Affairs, NH=Native Hawaiian, HT=historical trauma

## Results

The highlighted framework for developing a policy brief requires 5 steps: (1) clearly describe the problem; (2) analyze current policy; (3) identify efficacy and gaps; (4) develop of policy alternatives; and (5) socialize among community for feedback (**Figure 1**).

### Step 1: Description of the Problem

Articulating a strong problem statement is critical to political advocacy. The issue must be framed in a manner where policymakers and the public will perceive it as a problem for which policy can provide a solution.[23] The description of the problem must sufficiently detail the importance of the problem.[43] Collaborating to frame the problem statement will aid in providing the structure of the brief. Once the articulation of the problem is agreed upon, it is important to test that problem statement to identify possible assumptions and causal connections.

### Step 2: Analyze Current Policy Framework

Once all relevant laws, policies, and pending legislation have been identified, it is helpful to create a matrix that lists important policy information, including a summary of the law or pending measure.[23] Because the legislative process is highly political it is critical to capture the political environment in which the law was considered by including sponsors and committee referrals.[18,23,47] Categorizing laws and policies may support critical evaluation and gap analysis in Step 3 if the topic has a heavy policy footprint. However, a topic with fewer policies may not require this sub-step.

### Step 3: Identify Efficacy and Gaps

Cataloging the efficacy of the current policy system facilitates identification of areas for improvement.[43] Communicating with experts, community members, and other stakeholders can also help determine the efficacy of certain policies along with existing gaps.

### Step 4: Develop Policy Alternatives

Because a policy brief is intended to be informative rather than persuasive, it is critical that policy alternatives are informed by evidence.[48,49] Using the research in Step 2 as a baseline, policy alternatives should be feasible. A feasible alternative must be clearly worded, justified, and implementable.[18,43] In other words, even if the scientific literature points to a drastic policy solution, one should consider whether this is a viable option.[50,51] On the

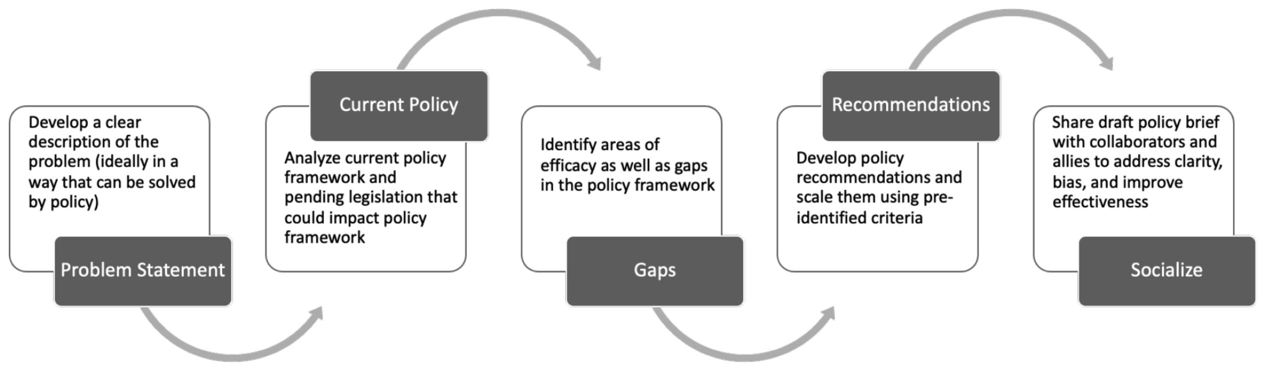

Figure 1. Steps for Developing an Effective Policy Brief

other hand, even an alternative that is unlikely to be adopted does not warrant exclusion as it may serve to spotlight the upper limits or may help contrast other alternatives.

The first step in identifying appropriate alternatives is to brainstorm as many policy solutions as possible. Next, a decision matrix is created listing each possible solution while evaluating its viability in several categories. Decision matrices should always include doing nothing as an option to provide a baseline.[52] Weights can be included for each category when certain criteria are more important in determining viability or raw numbers can be used, depending on preference and need.

### Step 5: Socialize Among Community for Feedback

Policy advocacy is a strategic endeavor and while a policy brief should strive to be unbiased, it must also be effective. Socializing the draft among community collaborators and allies is crucial to improving the brief. Socialization helps identify areas for clarification, additional feasible alternatives, and real-world examples that illustrate policy concepts.[53, 54]

## Case Study

In a research project exploring the conceptualization of HT among NH youth, a policy brief, was developed, which serves as an example of this methodological framework.

### Step 1: Description of the Problem

The initial problem statement focused on the lack of programs addressing HT; however, a full accounting of programs had not been undertaken to support this proposition. After consulting our collaborators, the researchers refocused on wellbeing - settling on the high rate of incarceration, suicidality, depression and other symptoms associated with HT, which reduces individual wellbeing and Hawai‘i’s economic productivity.

### Step 2: Analyze the Current Policy Framework

Data was extracted from the 11 measures that passed into law; however, failed measures were also analyzed. One recent measure, HR90, declared racism as a public health crisis and recognized racism as the root of HT. Another, HCR130, apologized for the banning of *‘Ōlelo Hawai’i* (Hawaiian language) in public schools while describing the resultant disparities. Successful legislation tended to be related to individual trauma, including Act 209, which established a trauma-informed task force in the Department of Health to make recommendations for trauma-informed care; and SB2482, which created a temporary Office of Wellness and Resilience to support issues and solutions identified by the task force. Although these measures show strides towards acknowledging and healing trauma, the review revealed that successful legislation focuses on individual trauma and not intergenerational, colonial, or HT.

### Step 3: Identify Efficacy and Gaps

Analyzing failed measures allows us to identify some gaps. For example, both HR90 and HCR130 were resolutions, which do not carry the full force and effect of law. Rather, resolutions express the “sentiments” or “beliefs” of the House, Senate, or entire Legislature and can be used in litigation to interpret the intent of the legislature. Moreover, while these resolutions acknowledge the ongoing effects of colonial trauma, they do not carry appropriations or direct remediation by any state entity. This dissonance continued in March 2020 when SR91 and SCR131 were introduced outlining the negative impact of ACEs and encouraging the incorporation of NH cultural practices that address HT in preventative interventions. Both measures were referred, however, no hearings were held likely due to COVID-19 impacts and Hawai‘i’s stay-at-home order.[55-57]

### Step 4: Develop Policy Recommendations

When brainstorming for policy options, the team considered community collaborator feedback, existing literature, and other jurisdictions. One suggested policy solution was to develop a mandatory comprehensive HT intervention within all public schools. However, given that, to date, Hawai‘i’s legislature failed to pass a law referencing HT, this alternative’s adoption is deemed unlikely. After analyzing the policy options from the brainstorming session, the team used a decision matrix with researcher-developed weights to identify 4 policy options, Hawai‘i’s legislature should: (1) acknowledge HT; (2) establish a NH HT Task Force to study and address HT; (3) continue to eliminate status offenses and support restorative diversionary programs; and (4) fund programs that heal HT. The weighting structure was informed by dialogue with community collaborators as well as political considerations. See **Table 2** for a Decision Matrix of all selected recommendations.

While the legislature may harbor concerns that acknowledging HT could create liability, the first option was included despite its low score because of its symbolic value. The higher weighting placed on viability of passage reduced the overall appeal of this alternative; however, the need to acknowledge past and ongoing harms is imperative for community healing. Alternatively, establishing a NH HT Task Force to investigate the impact and trauma of colonization, including boarding schools, land loss, and displacement scored much higher.[58, 59] Drawing upon actions by other jurisdictions and the incremental nature of this alternative further increases the appeal of this option. The same analysis was conducted across all alternatives.

### Step 5: Socialize Among Community for Feedback

Sharing and socializing the draft brief among our community collaborators and allied stakeholders was a citical step in the process. Our collaborators clarified the exact audience and intended use of the brief leading us to include local examples

Table 2. Policy Alternative Decision Matrix

| Criteria | Weights | Option 1: Legislature acknowledge NH HT | Option 2: NH HT Task Force | Option 3: Eliminate status offense & Support restorative programs | Option 4: Fund programs that heal HT |
|---|---|---|---|---|---|
| Effectiveness of Addressing Problem | 2 | + | + | + | + |
| Ease of Implementation | 1 | + | + | + | + |
| Cost of Implementation | 2 | + | + | + | + |
| Viability of Passage | 3 | - | - | +/- | +/- |
| Public Optics | 2 | +/- | + | +/- | + |
| Time to Results | 2 | - | +/- | - | - |
| Total + |  | 4 | 5 | 5 | 5 |
| Total - |  | 3 | 2 | 3 | 2 |
| Net value |  | **1** | **3** | **2** | **3** |
| Weighted total + |  | 7 | 9 | 10 | 10 |
| Weighted total - |  | 7 | 5 | 5 | 5 |
| Final Weighted value |  | **0** | **4** | **3** | **5** |

NH=Native Hawaiian, HT=historical trauma

Note: This sample matrix provides frequently used criteria along with sample weights. An option that meets the criteria receives a +, while an option that does not meet the criteria receives a -. Options that neither fully meet, but do have some elements of a criteria may recieve a +/-. All of the + and – are added up and then multiplied by the appropriate weights to receive a final weighted value, which is then used to compare across the policy options.

to illustrate the types of programs that could be supported. The third and fourth alternatives incorporated clear examples of organizations with programs such as Adult Friends for Youth, which serves high-risk youth using behavioral redirection,[60] and Residential Youth Services and Empowerment (RYSE)[61] at Kawailoa Youth and Family Wellness Center,[62] which supports NH houseless youth. These examples illustrate the feasibility of the alternatives increasing the brief's effectiveness and versatility.

## Recommendations

Reciprocity is critical when conducting community-engaged research among Indigenous communities. Given the NH history of advocacy and civil disobedience, social justice minded researchers may want to support NH advocacy efforts by developing policy briefs. There are 5 steps to drafting a policy brief: (1) clearly describe the problem; (2) analyze current policy framework; (3) identify efficacy and gaps; (4) develop policy recommendations; and (5) socialize draft for feedback. However, based on the team's experience in developing the NH HT policy brief there are a few additional considerations to share.

First, communication is key to policy advocacy. The decision whether to develop a policy brief should be decided early in the collaboration and should consider the utility of this activity. Because the US governance system encourages experimentation, prior efforts may have occurred, which may be unknown without talking to others. Conversations that extend beyond the scope of the project will allow researchers to better understand the historical context, including prior advocacy efforts.

Second, work smarter, not harder. Make use of legal databases whenever possible. Most states publish laws and pending bills on the state legislature's website; however, not all states have invested in the infrastructure to easily search these documents. Obtaining access to a legal research database through a public law library, court library, or by collaborating with an attorney will speed up the research process.

Third, practical solutions are generally the best solutions. Unlike in the ivory tower, an advocacy solution that is practical from both a policy stance and financial stance is ideal. Incrementalism is often preferred since it is less risky, so framing a proposal as an expansion and the next logical step in a progression is pragmatic.

Finally, don't be afraid to directly engage in advocacy. While one of the benefits of academics developing policy briefs is that it draws upon their legitimacy as unbiased experts, it is also important that researchers take their place as members of the community. As such, it is entirely appropriate for academics to support their collaborators and advocate for a specific position or a change in policy. Being able to articulate one's positionality helps retain legitimacy as researchers as well as community members.

Growth occurs in moments of discomfort. Developing policy briefs and supporting policy advocacy may be uncomfortable for academics. However, engaging in this type of work allows researchers to give back to the community and helps to build a stronger relationship between researcher and community, which can begin to repair damage from past extractive research techniques. Drafting policy briefs is one way to refocus research around social justice and lead to a more translation-oriented paradigm.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# A Comparison of Strategies to Increase Household Survey Response Rates in a Predominantly Indigenous Community Population

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## Abstract

*The present study describes 4 strategies for increasing response rates to a community-based survey on youth violence in an ethnically diverse population in Hawai‘i. A total of 350 households were mailed a Safe Community Survey using 4 different randomly assigned incentive strategies. The strategies varied by length of survey and timing of incentive for completion (given before completion, after completion, or both). In univariate analyses, there were no significant differences across survey strategies on participant demographics, community perceptions of violence-related behaviors, or percent of missing items. However, in multivariate regressions, respondents' sex and percent of missing items on the surveys were consistently significant predictors across multiple outcomes. Although the use of strategies to increase response rates in community-based surveys might be desirable, resulting data need to be examined for the potential that strategies might recruit different populations, which may have an impact on the data obtained. This study offers lessons and recommendations for surveying Native and Indigenous communities.*

## Keywords

*Indigenous, Native Hawaiian, survey response, community research, youth violence*

## Abbreviations and Acronyms

AAPI = Asian Americans and Pacific Islanders
APIYVPC = Asian/Pacific Islander Youth Violence Prevention Center
Std = standardized estimate
Unstd = unstandardized estimate

## Introduction

Community-based surveys of injury and violence are a widely used method of collecting otherwise unavailable data.[1] Such surveys have limitations (eg, higher costs, difficulty accessing homes, safety of interviewers, selection bias, and sampling error), which can often be overcome with well-designed mail surveys.[1,2] Even utilizing methods with strong evidence of effectiveness, however, response rates and sample representativeness can still pose threats to conclusions. Careful examination of methods used and their impact on data is necessary to ensure reliability and validity of data. This paper compares strategies for conducting mail surveys to assess perceptions of youth violence in a largely Indigenous population in Hawai‘i.

### Youth Violence Prevention

Although Asian Americans and Pacific Islanders (AAPIs) have been historically characterized as having lower rates of youth violence than other racial/ethnic groups,[3,4] studies disaggregating this population have found higher rates among subgroups.[5] Research in Hawai‘i has found Native Hawaiian, Samoan, and Tongan youth have higher rates of violence, even when not taking into account covariates such as socioeconomic status.[6-10] The Asian/Pacific Islander Youth Violence Prevention Center (APIYVPC) aims to reduce and prevent interpersonal youth violence for AAPIs.[11-13] The Center's Safe Community Survey measured residents' perceptions of youth violence, and tested innovative survey methods with a predominantly Indigenous community.

### Survey Methodology

Monetary incentives have long been used to increase response rates in mailed surveys. Although some responders will participate without compensation, others might make a cost-benefit decision (eg, time/effort to complete the survey).[14] For those potential respondents, incentives may increase their appraisal of the benefits of completion. In particular, it has been demonstrated that incentives are more effective in recruiting participants from low-income and minority communities, compared to more advantaged populations.[15] There is also evidence that effects of incentives vary by type and timing. Church's meta-analysis,[16] for example, reported that noncontingent incentives (ie, prepaid incentives delivered with the survey) show consistent effects on response rates (an estimated 19% improvement) while contingent incentives (ie, those delivered after completion of the survey) do not have a significant effect.

Several theories have been posed to explain the effects of noncontingent incentives. Social exchange theory suggests prepaid incentives are viewed by potential participants as an extension of trust and token of appreciation.[17] Potential participants are therefore motivated to live up to that expectation and are more likely to return the survey. Similarly, the norm of reciprocity posits that prepaid incentives engender a feeling of obligation in the potential participant, who is then motivated to return the favor and complete the survey.[18] Leverage-salience theory offers a more general explanation, suggesting that what influences the decision to participate is not the same for everyone.[19] In other words, different design features (or levers) will motivate different groups to participate.

In addition to incentives, other survey design features such as topic, length, or sponsor of the survey might also influence responding.[20] Length of the survey, for example, might weigh into cost-benefit considerations, or might be daunting to those who have difficulty reading or understanding English. Familiarity with the sponsor might increase (or decrease) likelihood of responding. This is only a short list of all conceivable design features that might influence participation.

A question that follows is whether motivating different groups to participate provides different results. Much of survey method research has focused on response rates and nonresponse bias, but this is only 1 goal. Representativeness of the sample and data is equally, if not more important. Incentives or other strategies might draw respondents different than those who would otherwise not participate.[14-15, 20-21] If design features influence the sample, data quality, or response distributions, then conclusions must be informed by those differences.

### Present Study

This study examined how incentives and survey length affected responses to the Safe Community Survey. The following protocols were assessed:

- Strategy A: 2-part, 199-item survey, $5 bill (noncontingent incentive), and stamped envelope so additional compensation could be mailed (contingent incentive). Participants who returned both parts of the survey received $65. If only part 1 was completed, they received $15.
- Strategy B: shorter 65-item survey and $5 bill.
- Strategy C: short survey and stamped envelope so $5 contingent incentive could be mailed.
- Strategy D: short survey, $5 noncontingent incentive, and stamped envelope so additional $5 incentive could be mailed.

The hypotheses, based on Dillman's theory,[17] were that higher response rates would be found for short surveys and the amount of incentive would exert influence. Additional hypotheses, based on Biner and Kidd's study,[14] were that the longer survey would have more missing items, as would the short survey for which respondents only receive an incentive after returning the survey. Higher representation of men and individuals with lower socioeconomic status was expected for Strategy A (largest incentive). Also expected was that individuals with vested interest in the topic would be more likely to be recruited, regardless of method.

## Methods

### Procedures

All procedures were approved by the University of Hawaiʻi at Mānoa Committee on Human Studies. A total of 350 households were randomly selected from 2 geographically adjacent communities on Oʻahu – 175 households from each community – using the Hawaiʻi property tax database (ie, all addresses for the 2 communities were included in the sampling pool). Community A is more suburban with predominantly Caucasian residents and higher educational levels and income. The population of Community A is more than 4 times larger than Community B. Community B is more rural with a large population of Native Hawaiians, broader range of incomes, higher percent of owner-occupied residences, and larger family sizes. Injuries from assaults are consistently higher in Community B than Community A and the rest of the State.[22]

Of the 175 households selected from each community, 100 households were randomly assigned to Strategy A, while Strategies B, C, and D each received 25. More households were assigned to the long survey, because a goal of the project was to accomplish a comprehensive epidemiologic study of community perceptions of youth violence. The parallel use of Strategies B, C, and D allowed the various methodologies to be concurrently tested. Though multiple survey waves were conducted throughout the APIYVPC's history, data presented here stem from the 2009 survey administration, the inaugural implementation of the four survey strategies upon which subsequent survey waves (the Safe Community Survey and other APIYVPC surveys) were founded upon.

### Measures

Instructions requested the adult household member with the most recent birthday complete the survey (if not possible, any adult member was eligible). Packets included a cover letter, a consent form to keep (returning the survey indicated consent), a stamped postcard to refuse participation, a long or short survey, a stamped envelope to return the completed survey, and a stamped envelope for the incentive (Strategies A, C, and D).

The short version consisted of 4 pages (65 questions, almost all multiple-choice and Likert-type): demographics; sense of community; youth physical and non-physical violence, and substance abuse; and community risk/protective factors (eg, economic stress, racism, family influences, and after school programs). The long version consisted of 10 pages (199 items) and included all items on the short version, plus additional multiple-choice or Likert-type questions about the respondent and the community, including items from the Sense of Community Index,[23] The Community Toolbox,[24] and Hawaiʻi Social Capital Benchmark Survey.[25] Community partners also contributed questions. The full survey is available upon request.

*Youth Violence*

Respondents were presented a list of 21 incidents, and asked if they *strongly agree*, *agree*, *disagree*, or *strongly disagree* that each item is a problem in their community regarding youth. Eight indicators of physical violence—*gang violence*, *physical violence*, *murder*, *robbery/burglary*, *bullying*, *sexual assault*, *dating violence*, and *ultimate fighting*—demonstrated acceptable internal consistency (Cronbach's alpha = 0.84). Three indicators of non-physical violence—*verbal/emotional violence*, *spreading rumors*, and *cyberbullying*—also demonstrated acceptable internal consistency (Cronbach's alpha = 0.77). Seven incidents, including *property damage*, *gangs*, *possession of weapons*, *loitering*, *truancy*, *reckless driving/speeding*, and *drunk driving,* formed a composite of youth delinquent behavior (Cronbach's alpha = 0.82). Scale scores were computed as the mean of all items within a construct, for respondents who answered at least 70% of items for a scale.

*Youth Substance Use*

Respondents were asked how problematic they viewed use of specific substances among youth in their community, using a scale of *Not used by youth*, *Used by youth but not a problem*, *Used by youth and somewhat of a problem*, or *Used by youth and a severe problem*. The long survey included 15 substances, and the short version included 4. The 4 items common to both surveys were *cigarettes/tobacco*, *beer*, *marijuana*, and *ice or crystal methamphetamine* (Cronbach's alpha = 0.84). Scale scores were computed as the mean of the 4 items, for all respondents who answered at least 3 (ie, 75%) of the items.

*Demographics*

Respondents were asked to indicate their sex, current age, and in which of the 2 communities they lived. Respondents also reported how many people live in the household (on a 10-point response scale from *1* to *10 or more*), and whether they rent or own the place they live, both of which were used as indicators of socioeconomic status. Parental status was obtained by asking whether or not the respondent has a child under the age of 18.

### Analytic Strategy

Bivariate analysis using SAS version 9.4 software (SAS Institute Inc., Cary, NC) compared characteristics of the respondents and percentage of missing items across the 4 recruitment strategies, including Pearson chi-squared tests for categorical variables and analysis of variance (ANOVA) for continuous variables. Multivariate analysis determined the impact of recruitment strategy and demographics on the 4 outcomes—*physical violence, non-physical violence, delinquent behavior, and substance use.* Specifically, predictor variables included survey length, non-contingent incentive (yes/no), contingent incentive (yes/no), percent of missing items, age, sex, home ownership, number living in household, has a child, and community.

## Results

### Sample Description

Of the 350 surveys mailed, 56 were undeliverable. Of the 294 delivered surveys, 139 were completed, for a 47% return rate. Two-thirds of respondents were women, and respondents were likely to be homeowners and tended not to be parents (**Table 1**). Response rates by community were not significantly different, with approximately 50% of Community A and 45% of Community B surveys completed. There were significant differences based on household size and parental status. Community B respondents had more people on average living in their household (4.44 for Community B vs. 2.96 for Community A), and were more likely to have a child (44% for Community B vs. 25% for Community A). Both communities reported similar levels of physical violence, non-physical violence, delinquent behavior, and substance use. There was no significant difference in the percentage of items left blank (6% and 4% for Communities A and B, respectively).

### Bivariate Analysis

As shown in **Table 2**, bivariate analysis revealed no significant differences by strategy in response rates, demographics, missing responses, and violence outcomes. Although numerically there appeared to be a wide spread in response rates, from a high of 55% for Strategy D to a low of 39% for Strategy C, the differences by strategy were not significant. Respondent groups were not significantly different with respect to age, sex, home ownership, household size, or parental status. Ratings of physical and non-physical violence, delinquent behavior, and substance use were similar regardless of strategy.

All strategies resulted in similarly low percentages of missing responses, ranging from an average of 6% for Strategy C, to 2% for Strategy D. Though not clearly reflected in the significance test for that variable, the standard deviations for missing responses were noticeably elevated for Strategies A and C (SDs = 15% and 16%), compared with Strategies B and D (SDs = 5% and 2%), suggesting more variability in missing responses among populations recruited by Strategies A and C.

### Multivariate Associations

Across the violence-related outcomes, there were no significant effects of survey length or type of incentive. For physical and non-physical violence, and delinquent behavior (**Table 3**), sex was a significant predictor such that female respondents reported more of a community problem than males. Percentage of missing responses was also a significant predictor for those 3 outcomes, with individuals who completed fewer items reporting less problems. For non-physical violence, parental status was a significant predictor, with parents reporting more community problems than non-parents. Community, home ownership, and household size were not significant predictors for these models.

Table 1. Demographic and Outcome Variables by Community, Asian/Pacific Islander Youth Violence Prevention Center Safe Community Survey

| | **Community A**<br>**(n = 69)**<br>**Mean (SD) or %** | **Community B**<br>**(n = 70)**<br>**Mean (SD) or %** | **Test of Significance[a,b]**<br>***Pearson chi-squared tests for categorical variables; ANOVA for continuous variables*** |
|---|---|---|---|
| **Response rate %** | 50% | 45% | $\chi^2$(1, N = 294) = 0.59, *P* = .44 |
| **Age (in years)** | 52.91 (15.40) | 51.35 (13.74) | F(1, 130) = 0.38, *P* = .54 |
| **Sex** | | | |
| Male | 32% | 34% | $\chi^2$(1, N = 135) = 0.06, *P* = .81 |
| Female | 68% | 66% | |
| **Home Ownership** | | | |
| Rent | 17% | 7% | $\chi^2$(1, N = 137) = 3.18, *P* = .07 |
| Own | 83% | 93% | |
| **Number Living in Household** | 2.96 (1.68) | 4.44 (2.73) | F(1, 137) = 14.85, *P* < .001 |
| **Has a Child** | | | |
| No | 75% | 56% | $\chi^2$(1, N = 115) = 4.60, *P* = .03 |
| Yes | 25% | 44% | |
| **Physical violence[c]** | 3.09 (0.74) | 3.10 (0.62) | F(1, 136) = 0.01, *P* = .92 |
| **Non-physical violence[c]** | 3.31 (0.94) | 3.50 (0.85) | F(1, 136) = 1.64, *P* = .20 |
| **Delinquent behavior[c]** | 3.51 (0.80) | 3.57 (0.76) | F(1, 136) = 0.20, *P* = .66 |
| **Substance use[c]** | 3.21 (0.68) | 3.24 (0.64) | F(1, 130) = 0.05, *P* = .82 |
| **Percent of items missing** | 5.82 (13.81) | 4.21 (11.82) | F(1, 137) = 0.54, *P* = .46 |

[a] Chi-square results reported using format: $\chi^2$ (degrees of freedom, N = sample size) = chi-square statistic value, *P* value
[b] ANOVA results reported using format: F (degrees of freedom) = F value, *P* value
[c] Physical violence, non-physical violence, delinquent behavior, and substance use were rated on 4-point scales, with higher scores indicating stronger agreement that the issue is a problem in the respondents' community.

To ensure collinearity was not masking effects of survey characteristics, bivariate correlations between each of the characteristics (survey length, noncontingent incentive, contingent incentive) also were examined. Results (not shown) indicated no significant bivariate relationships between any characteristic and any outcome.

## Discussion

Participant recruitment is a concern of community-based researchers, particularly when investigating complex issues such as youth violence. This study investigated not only perceptions of youth violence in a largely Indigenous community, but also strategies to enhance participation in community-based epidemiologic studies. Response rates were not significantly different across strategies. However, the relatively large span of response rates (38.6% to 54.6%) suggests sample size and statistical power might have limited the ability to detect differences in this and other variables. The pattern of response rates was partially consistent with the hypothesis that the lowest rate would be with Strategy C. Though only suggested here, previous research supports the assertion that by ignoring the power of noncontingent incentives, researchers could be limiting their response potential.[16]

There were no significant demographic differences among samples. This was consistent with the hypotheses regarding parental status and age, but not with respect to lower socioeconomic populations and men. Strategies appeared to recruit groups similar in age and household size. However, sample size might have limited detection of differences, and generalization of findings to the State and beyond Hawai'i. Compared to the total population of Communities A and B,[26] more study participants were women (67% versus 47%) and home owners (88% versus 57%). Singer and colleagues[15] indicate that individuals in lower socioeconomic situations and men tend to be harder to recruit in research. Specifically, stability in one's housing situation has been associated with increased likelihood of survey participation.[27] This reiterates known limitations of methods that rely on mail, in terms of excluding houseless individuals and those in unstable housing situations.

There were also no significant differences in quality of data (missing responses) or in data obtained. This suggests reports of community perceptions were robust to the variations in the strategies. Given aforementioned concerns about statistical power, examination of means and standard deviations for the 4 outcomes was performed. In every case, highest and lowest values were separated by less than a standard deviation, suggesting null results are not simply a function of sample size.

Table 2. Demographic and Outcome Variables by Survey Strategy, Asian/Pacific Islander Youth Violence Prevention Center Safe Community Survey

| | **Strategy A [long, noncontingent and contingent incentives] (n = 80) Mean (SD) or %** | **Strategy B [short, noncontingent incentive only] (n = 18) Mean (SD) or %** | **Strategy C [short, contingent incentive only] (n = 17) Mean (SD) or %** | **Strategy D [short, noncontingent and contingent incentives] (n = 24) Mean (SD) or %** | **Test of Significance[a,b] *Pearson chi-squared tests for categorical variables; ANOVA for continuous variables*** |
|---|---|---|---|---|---|
| **Response rate** | 49% | 41% | 39% | 55% | $\chi^2$(3, N = 294) = 3.25, *P* = .35 |
| **Age** | 52.17 (14.42) | 53.44 (17.52) | 53.20 (11.71) | 50.32 (15.28) | F(3, 128) = 0.18, *P* = .91 |
| **Sex** | | | | | |
| Male | 31% | 24% | 29% | 52% | $\chi^2$(3, N = 135) = 4.76, *P* = .19 |
| Female | 69% | 76% | 71% | 48% | |
| **Home Ownership** | | | | | |
| Rent | 11% | 11% | 6% | 23% | $\chi^2$(3, N = 137) = 2.95, *P* = .40 |
| Own | 89% | 89% | 94% | 77% | |
| **Number Living in Household** | 3.64 (2.41) | 4.11 (2.42) | 4.22 (2.58) | 3.22 (2.11) | F(3, 135) = 0.79, *P* = .50 |
| **Has a Child?** | | | | | |
| No | 72% | 63% | 53% | 59% | $\chi^2$(3, N = 115) = 2.65, *P* = .45 |
| Yes | 28% | 38% | 47% | 41% | |
| **Youth physical violence[c]** | 3.15 (0.69) | 2.97 (0.66) | 3.05 (0.75) | 3.04 (0.64) | F(1, 137) = 0.47, *P* = .70 |
| **Youth non-physical violence[c]** | 3.47 (0.88) | 3.26 (0.96) | 3.37 (0.98) | 3.32 (0.9) | F(1, 134) = 0.38, *P* = .77 |
| **Youth delinquent behavior[c]** | 3.56 (0.76) | 3.59 (0.85) | 3.44 (0.91) | 3.52 (0.72) | F(1, 134) = 0.14, *P* = .93 |
| **Youth substance use[c]** | 3.25 (0.67) | 3.32 (0.51) | 3.03 (0.86) | 3.22 (0.53) | F(3, 128) = 0.63, *P* = .60 |
| **Percent of items missing** | 6.20 (14.71) | 2.73 (5.05) | 6.32 (16.44) | 1.61 (2.05) | F(3, 135) = 1.02, *P* = .38 |

[a] Chi-square results reported using format: $\chi^2$ (degrees of freedom, N = sample size) = chi-square statistic value, *P* value

[b] ANOVA results reported using format: F (degrees of freedom) = F value, *P* value

[c] Youth physical violence, non-physical violence, delinquent behavior, and substance use were rated on 4-point scales, with higher scores indicating stronger agreement that the issue is a problem in the respondents' community.

Linear regressions disentangled the effects of survey characteristics that might call conclusions into question. None of the characteristics (length, incentive type) predicted outcomes in the presence of demographic variables, community, and missing responses. Nor were any simple bivariate correlations between characteristics and outcome variables significant. Thus, survey strategy does not appear to have influenced the outcomes.

However, respondent sex and percentage of missing responses were significant predictors in 3 of the 4 regressions. Lower ratings of problems were reported by men and respondents who left more questions blank. This suggests strategies successful in recruiting more participants from these populations might result in dampened estimates of perceptions with those issues. It is not possible to determine for which groups the perceptions are more accurate, and thus, no recommendations can be made for attempting to or refraining from recruiting certain populations.

The relationship between missing responses and outcomes has implications for statistical techniques that impute values for missing data. In this study, the degree to which respondents left items blank was related to their reports of violence. Imputing data without taking that into account may lead to biases. Studies are needed to investigate the threshold of "incompleteness" (percentage of unanswered items) that merits omission rather than imputation.

Other limitations merit mention as well. Measures of socioeconomic status (home ownership, number in household) may not have been ideal. "Renter" typically refers to renting from a homeowner, not in apartments or public housing. Data from those demographics might lead to different results. Additionally, although home ownership is often a proxy of higher socioeconomic status, this might function differently in Community B, with a larger population on Hawaiian Homestead land. Whether results are generalizable beyond this population is a question for future investigations. However, Indigenous populations in the United States (Native Hawaiians and Native Americans included) tend to have similar, poorer health statistics than nonindigenous populations, suggesting results might generalize to other minority populations.[28]

Table 3. Estimates Predicting Youth Violence and Violence-Related Outcomes from Survey Characteristics and Demographic Variables, Asian/Pacific Islander Youth Violence Prevention Center Safe Community Survey

| | Youth physical violence | | | | Youth non-physical violence | | | | Youth delinquent behavior | | | | Youth substance use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Unstd[a] | SE[a] | Std[a] | *P*[a] | Unstd[a] | SE[a] | Std[a] | *P*[a] | Unstd[a] | SE[a] | Std[a] | *P*[a] | Unstd[a] | SE[a] | Std[a] | *P*[a] |
| Survey length[b] | 0.081 | 0.18 | 0.061 | - | 0.257 | 0.25 | 0.141 | - | 0.061 | 0.21 | 0.04 | - | 0.016 | 0.18 | 0.013 | - |
| Non-contingent incentive[c] | 0.059 | 0.24 | 0.03 | - | -0.032 | 0.32 | -0.012 | - | 0.101 | 0.27 | 0.044 | - | 0.059 | 0.23 | 0.032 | - |
| Contingent incentive[c] | 0.053 | 0.23 | 0.028 | - | 0.104 | 0.31 | 0.039 | - | -0.202 | 0.26 | -0.091 | - | -0.249 | 0.23 | -0.135 | - |
| Percent of items missing | -4.03 | 1.93 | -0.211 | *P* = .039 | -6.418 | 2.6 | -0.243 | *P* = .015 | -6.913 | 2.19 | -0.314 | *P* = .002 | -0.88 | 2.18 | -0.043 | - |
| Age | 0.012 | 0.01 | 0.251 | *P* = .043 | 0.008 | 0.01 | 0.133 | - | 0.007 | 0.01 | 0.127 | - | 0.005 | 0.01 | 0.116 | - |
| Sex[d] | 0.312 | 0.14 | 0.226 | *P* = .031 | 0.443 | 0.19 | 0.232 | *P* = .023 | 0.349 | 0.16 | 0.219 | *P* = .034 | 0.035 | 0.14 | 0.027 | - |
| Home ownership[e] | 0.248 | 0.19 | 0.133 | - | 0.148 | 0.26 | 0.057 | - | 0.175 | 0.22 | 0.081 | - | 0.036 | 0.19 | 0.02 | - |
| Number living in household | -0.02 | 0.03 | -0.077 | - | -0.013 | 0.04 | -0.036 | - | -0.028 | 0.03 | -0.095 | - | -0.01 | 0.03 | -0.044 | - |
| Has a child[f] | 0.181 | 0.18 | 0.133 | - | 0.586 | 0.24 | 0.31 | *P* = .017 | 0.159 | 0.2 | 0.101 | - | -0.092 | 0.18 | -0.072 | - |
| Community[g] | -0.011 | 0.14 | -0.008 | - | -27 | 0.19 | -0.015 | - | -0.013 | 0.16 | -0.008 | - | 0.109 | 0.14 | 0.088 | - |
| $R^2$ | 0.141 | | | | 0.183 (*P* = .034) | | | | 0.167 | | | | 0.057 | | | |

[a] Multivariate regression analyses presented: Unstd = unstandardized estimate; SE = standard error; Std = standardized estimate; and P values for statistically significant items (ie, *P* < .05).
[b] Survey length was coded as short = 0, long = 1.
[c] Noncontingent incentive and Contingent incentive were coded as no = 0, yes = 1.
[d] Sex was coded as male = 0, female = 1.
[e] Home ownership was coded as rent = 0, own = 1.
[f] Has a child was coded as no = 0, yes = 1.
[g] Community was coded as Community A = 0, Community B = 1

Use of different strategies within communities could have resulted in information-sharing. Respondents might become aware that others could receive larger incentives, and might have been less inclined to participate. Finally, although linear regression analyses decomposed strategies into specific characteristics, the effect of amount of incentive ($70, $10, $5) could not be separated. Previous research suggests monetary compensation alone exerts a greater effect on response rate than increases in dollar amount.[29] Thus, reporting effects of amount was unlikely to provide insight to others using different survey lengths than these; although this warrants consideration for future studies.

The 2 communities were significantly different only with respect to 2 variables. Community B residents were more likely to be parents, and have larger households. Notably, ratings of violence in the communities were not significantly different, despite earlier studies showing Community B had more youth assaults. Although sample size might have influenced those other results, this nonsignificant finding cannot be attributed to low power, since average ratings for physical violence were essentially identical.

## Conclusion

Community surveys can be of unique value and an inexpensive source of data on a range of issues, including residents' perceptions of problem severity and incidents that do not come to medical or legal attention. However, recruitment should be purposely planned, as measurement error may be introduced if not carefully evaluated. This study describes a process to introduce, implement, and evaluate recruitment strategies. Additional research could have public health implications in disadvantaged populations by helping to ensure representativeness of the samples.

## Conflict of Interest

None of the authors identify a conflict of interest.

## Disclosures

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# Scoping Review of Interventional Studies in Chronic Disease for Native Hawaiian, Pacific Islander, and Filipino Populations in the United States

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## Abstract

*Native Hawaiians (NHs), Pacific Islanders (PIs), and Filipinos experience health disparities in the United States (US) and need interventions that work for them. The purpose of this paper is to present a review of interventions designed to address chronic disease in Native Hawaiian, Pacific Islander, and Filipino populations in the US that were tested for clinical impact through a randomized controlled trial (RCT). Articles were identified through a search of 4 databases, citation chasing, and colleagues. The 23 included articles reported on 21 interventions addressing 4 chronic conditions—cancer, obesity, cardiovascular disease, and diabetes. All projects were guided by advisory groups, and all interventions were theory-based and tailored to the population, with culturally- and language-appropriate educational materials delivered by same-race individuals in familiar church, club, or home settings. About half were tested through cluster RCT. The majority of the interventions were successful, confirming the value of developing and delivering interventions in partnership with community. Given the growing numbers of NHs, PIs, and Filipinos in the US, more investigational studies are needed to develop and test culturally tailored and grounded interventions that meet the health needs of these populations.*

## Keywords

*Scoping review, randomized controlled trial, intervention, indigenous, Native Hawaiian, Pacific Islander, Filipino, chronic disease, health disparities*

## Abbreviations

*CVD = cardiovascular disease*
*DPP = Diabetes Prevention Program*
*DSME = diabetes self-management education*
*HbA1c = hemoglobin A1c*
*NH = Native Hawaiian*
*RCT = randomized controlled trial*
*PI = Pacific Islander*
*PLP = Pili Lifestyle Program*
*PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analysis extension of Scoping Reviews*

## Introduction

In the United States (US), Native Hawaiian (NH), Pacific Islander (PI), and Filipino individuals experience disproportionately high rates of cardiovascular disease (CVD), cancer, diabetes, and obesity in comparison with other racial groups.[1-6] Innovative and tailored interventions are needed for these populations, as mainstream educational messaging and programs may not be accessible or acceptable to these populations, depriving them of standard and cutting-edge therapies. Numerous studies have examined health disparities in chronic diseases among NH, PI, and Filipino populations; however, it is unclear how many interventional studies, employing randomized controlled trial (RCT) designs, have documented evidence of their effectiveness in managing chronic disease. The purpose of this study was to conduct a scoping review of interventions designed to improve management of chronic disease in NH, PI, and Filipino individuals. The review included only interventions tested through RCT, as this is the gold standard for examining intervention impact.

This work builds on 2 other reviews. The review by McLean et al[7] included 10 studies describing culturally grounded or adapted interventions for NH individuals. Findings supported the effectiveness of tailored interventions, and also suggested an increase over time in published interventional studies focused on NH individuals. Another relevant review, by Domingo et al,[8] reviewed CVD interventions developed for Filipino individuals in the US and identified key tailoring strategies associated with intervention effectiveness. The current scoping review was conducted to identify effective chronic disease interventions for NH, PI, and Filipino populations to encourage widescale implementation of "what works" and to identify gaps in the research literature.

## Methods

### Search Strategy

Following guidelines based on the Preferred Reporting Items for Systematic reviews and Meta-Analysis extension of Scoping Reviews (PRISMA-ScR),[9] a systematic search was conducted to identify RCTs in chronic disease with a primary focus on NH, PI, and/or Filipino individuals. PubMed, Web of Science, Ovid MEDLINE, and EBSCO Host were searched in June 2022. Search terms included *(Native Hawaiian OR Pacific Islander OR Filipino) AND (randomized controlled OR clinical trial OR intervention) AND (evidence based OR promising OR potential) AND United States NOT (Aboriginal OR Maori OR Australia).* Additional relevant articles were identified through citation chasing and colleague recommendations.

### Inclusion/Exclusion Criteria

Articles were published from 2000 through June 2022 and reported on RCT testing of a chronic disease intervention tailored to NH, PI, and/or Filipino individuals in the US. Studies that included more than 1 race/ethnic group were included if NH, PI, and/or Filipino individuals comprised the majority of the sample or if data were analyzed and reported separately for these groups. Articles were excluded if they: (1) did not report health outcomes; (2) were observational or qualitative studies; (3) were conducted outside of the US; or (4) reported aggregated data with Asian Americans.

### Data Extraction and Synthesis

Articles meeting inclusion criteria were read in full, and the following data were extracted: (1) study authors; (2) study location; (3) disease or condition targeted by the intervention; (4) population the intervention was tailored to; (5) tailoring strategies; (6) study design; (7) sample size; (8) intervention and control conditions; and (9) health outcomes. Findings were analyzed separately for interventions addressing cancer, obesity, CVD, and diabetes.

## Results

The search strategy yielded 946 articles (**Figure 1**).[9] After 208 duplicates were removed, 738 articles were reviewed by title and abstract, and 678 records were excluded. The remaining 60 articles were read in full, and 37 were excluded because they did not meet inclusion criteria. The remaining 23 records reported on the testing of 21 interventions: 9 articles (8 interventions) relevant to cancer; 5 articles (4 interventions) addressing obesity; 3 articles (3 interventions) focusing on CVD; and 6 articles (6 interventions) concerning diabetes.

### Cancer

Nine articles described 8 interventions relevant to cancer prevention and control (**Table 1**). [10-18] Three interventions were designed to increase colorectal cancer screening among Filipino individuals[10-13] and 1 among NH individuals,[14] 2 addressed either breast cancer[15] or cervical cancer screening among PI individuals,[16] and 1 promoted breast and cervical cancer screening among Filipino individuals.[17] A navigation intervention in Hawai‘i was designed to improve screening for 4 different cancers (breast, cervical, prostate, and colorectal) among NH and Filipino individuals.[18]

All 8 interventions were theory based. The 2 based on Social Support Theory encouraged participants to invite family members and friends to the educational sessions.[10,16] Health Belief Theory guided the design of the interventions for Filipino participants reported by Maxwell et al[11-13,17] and an intervention for Samoan participants reported by Mishra et al.[15] Social cognitive theory guided the interventions tailored for NH and Filipino individuals by Braun et al.[14,18] All projects were guided by advisory groups, and all interventions were tailored to the population, with culture- and language-appropriate educational materials delivered by same-race individuals in familiar church, club, or home settings. Intervention duration and follow-up differed widely, from 1 session with a 4-week follow-up[15] to 4 sessions over multiple months with a 6-month follow-up.[13]

The 7 interventions designed to improve screening compliance through health education were tested through cluster RCT.[10-16] For the 4 conducted in California, Maxwell et al randomized Filipino-serving organizations to intervention and control conditions in 2005-2009[11,12] and again in 2011-2014[13]; Mishra et al randomized Samoan churches[15]; and Tanjasiri et al randomized CHamoru and Samoan churches and Tongan clans.[16] In Hawai‘i, Braun et al randomized Native Hawaiian civic clubs.[14] The Cuaresma et al study, conducted in Hawai‘i, randomized lay health educators to deliver either the intervention or control conditions, and lay educators recruited Filipino participants from their social networks.[10] The sample sizes of the cluster RCTs ranged from 2 to 61 clusters and included 121 to 809 individuals.[10,14,15] The cancer-screening navigation study in Hawai’i included 488 NH and Filipino Medicare recipients individually randomized to navigation and control conditions.[18]

Among the 8 cancer screening studies, 3 limited recruitment to individuals not previously screened.[11,13,15] Maxwell et al realized a 30% screening rate among Filipino participants in the intervention group, compared to a 9% screening rate in the control group.[11] However, in testing an enhanced version of this intervention, the difference between screening rates at follow-up was not significant. The authors speculated this was due to the similarity of the experimental and control conditions.[13] Mishra et al limited recruitment to Samoan women not compliant with mammogram screening and saw a significant improvement only among the subset of women who were aware of mammography at pretest but had not had a mammogram.[15] Authors of the other 5 screening interventions noted that their advisory groups preferred they include all club/group/community members regardless of their current screening status.[10,14,16-18] Four of these studies saw no or minimal improvements in intervention vs. control group, with authors noting a relatively high levels of self-reported screening compliance at baseline for both groups. The exception was the study testing cancer-screening navigation in Hawai‘i, where significant improvements were seen in breast, cervical, prostate, and colorectal cancer screening.[18] Although this study did not restrict recruitment to those non-compliant with screening recommendations, the authors noted relatively low compliance with screening recommendations at baseline. Thus, only 2 of the 8 cancer interventions proved to be effective.

### Obesity

Five articles described 4 interventions designed to control obesity by increasing healthy eating and physical activity (**Table 2**). [19-23] One focused on Filipino individuals in San Diego,[19] 2 on NH and PI individuals in Hawai‘i;[20-22] and 1 on children aged 2-8 years in the broader US-Affiliated Pacific.[23]

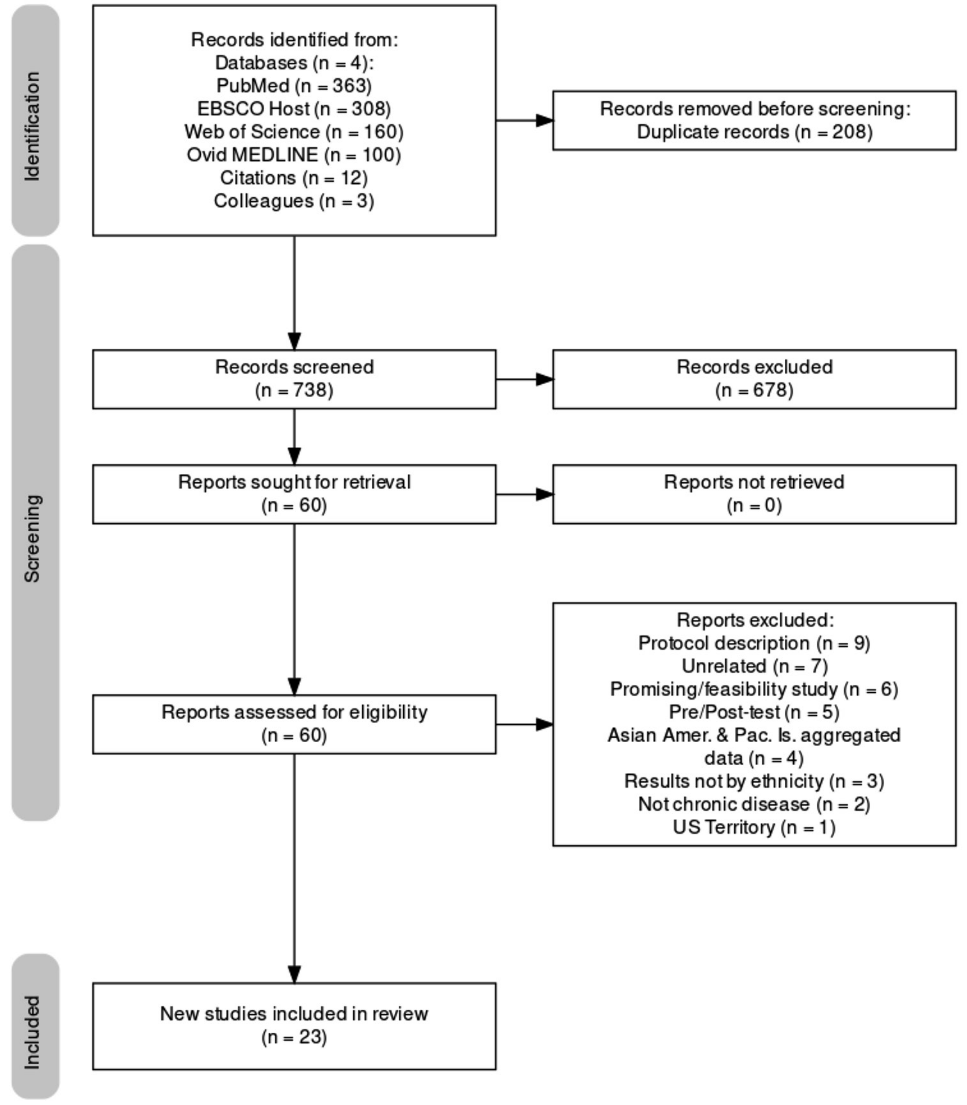

Figure 1. PRISMA 2020 flow diagram for review of randomized controlled trial interventions developed to address chronic conditions in Native Hawaiians, Pacific Islanders, and Filipinos

All 4 interventions were informed by qualitative research with community members and were multi-level, recognizing that behavior is influenced at the individual, family, organizational, and policy levels. For example, the 2-year Children's Healthy Living (CHL) intervention included 19 activities to influence interpersonal (training role models, parents, and teachers), community (increasing access to healthy foods and environments for safe play), and organizational and policy (strengthening preschool wellness policies) influences in communities across the Pacific.[23] The 9-month lifestyle program called PILI, or PILI Lifestyle Program (PLP), and its spinoff PILI@Work addressed the importance of family and social networks, physical environments, and organizational policy, as well as individual knowledge and goal-setting, in facilitating behavior change.[20-22] The 14-month San Diego intervention employed individual, environmental, and policy strategies to promote healthy eating and physical activity among Filipino individuals.[19]

Two interventions were tested through cluster RCTs. Dirige et al randomized 18 Filipino-serving organizations to a nutrition and physical activity intervention vs. a cancer education control.[19] Novotny et al randomized 27 communities in 5 jurisdictions (Alaska, American Samoa, Commonwealth of the Northern Mariana Islands, Guam, and Hawai‘i) to intervention, delayed intervention, and temporal conditions.[23] The other 2 interventions were based in organizations, but randomization was at the individual level. In PILI, Kaholokula et al randomized individuals who had completed a 3-month weight-loss

Table 1. Cancer Control Interventions for Native Hawaiian, Pacific Islander or Filipinos in the United States

| | | Intervention | | | Testing | | |
|---|---|---|---|---|---|---|---|
| **Citation** | **Location and population** | **Intervention intent** | **Theory based** | **Tailored to population** | **Design** | **Sample** | **Outcomes** |
| Braun et al (2005) | NH adults (age 50+) in Hawai'i | Promoting CRC screening | Yes | Yes | CRCT | E: 69 adults in 8 civic clubs<br>C: 52 adults in 8 civic clubs | ↔ CRC screening |
| Cuaresma et al (2018) | Filipino adults (age 50-75+) in Hawai'i | Lay health educator (LHE) approach to CRC screening | Yes | Yes | CRCT | E: 158 adults recruited by 11 LHE<br>C: 176 adults recruited by 15 LHE | ↔ CRC screening in bivariate analysis<br>↑ OR 1.9 (CI=1.0-3.5) in multivariate analysis |
| Maxwell et al (2010, 2011) | Filipino adults (age 50 to 70) non-adherent to CRC screening guidelines in California 2004-2009 | Promoting CRC screening (CRC1) | Yes | Yes | CRCT | 548 adults in 45 orgs in small groups<br>E (A)=202 adults in 36 groups<br>E (B) =183 adults in 7 groups<br>C=163 adults in 30 groups | ↑ CRC screening for interventions A & B |
| Maxwell et al (2016) | Filipino adults age 50-75 non-adherent to CRC screening guidelines in California 2011-2015 | Promoting CRC screening (CRC2) | Yes | Yes | CRCT | E: 423 adults in 10 organizations<br>C: 250 adults in 7 organizations | ↔ CRC screening |
| Mishra et al (2007) | Samoan women non-compliant with mammogram screening guidelines in California 1998-2001 | Promoting mammography use | Yes | Yes | CRCT | E: 406 women in 32 churches<br>C: 403 women in 29 churches | ↔ mammography screening |
| Tanjasiri et al (2019) | PI couples in California | Promoting cervical cancer screening | Yes | Yes | CRCT | E: 249 women and 150 men in 39 groups<br>C: 343 women and 200 men in 42 groups | ↔ cervical cancer screening |
| Maxwell et al (2003) | Filipino women in California 1998-2001 | Promoting breast and cervical cancer screening | Yes | Yes | CRCT | E: 213 women in 24 groups<br>C: 234 women in 24 groups | ↔ breast and cervical cancer screening |
| Braun et al (2015) | NH and Filipino Medicare-eligible adults in Hawai'i 2006 and 2009 | Promoting CRC, breast, cervical, and prostate cancer screening | Yes | Yes | RCT | E=242 adults<br>C=246 adults | ↑ CRC screening<br>↑ Pap screening<br>↑ mammography screening<br>↑ Prostate-specific antigen |

↔ No significant difference between the intervention and control group in outcome
↑ Significant improvement in the intervention group in outcome
C = Control group
CRC = Colorectal cancer
CRC1 = Colorectal cancer initial effectiveness trial
CRC2 = Colorectal cancer implementation trial
CRCT = Cluster randomized controlled trial
E = Experimental group
LHE = Lay health educator
NH = Native Hawaiian
PI = Pacific Islander
RCT = Randomized controlled trial

program into 6-month weight-loss-maintenance programs, testing a culturally tailored approach vs. a standard behavioral approach.[21,22] In PILI@Work, Ing et al randomized individuals in NH-serving organizations that completed a 3-month weight-loss program into a 9-month weight-loss-maintenance program; 1 group received the intervention in person and the other by DVD.[20] The sample sizes ranged from 144 adults in Hawai'i to 8 371 children across the Pacific.[21-23]

Dirige et al measured consumption of fruit, vegetable, and low-fat foods, physical activity level, and stage of change at baseline and 18 months post baseline. Longitudinal mixed-effects regression models indicated that intervention participants made significant improvements in physical activity, low-fat diet, and stages-of-change outcomes.[19] Kaholokula et al found that intervention participants who completed at least half of the prescribed sessions were 5.1-fold more likely than control participants to maintain their initial weight loss. Among those who finished their weight-loss intervention, those in the PLP version and those with greater weight loss prior to randomization were more likely to maintain their weight loss at 9 months.[21,22] Ing et al found equal levels of weight-loss maintenance in both experimental arms, ie, those watching the DVDs vs. those receiving the intervention in-person.[20] In CHL, intervention communities showed significant improvement compared with control communities in decreasing children's overweight and obesity prevalence, waist circumference, and acanthosis nigricans prevalence at 2-year follow-up.[23] Thus, 4 of the 4 obesity interventions proved to be effective.

### Cardiovascular Disease

Three interventions addressed CVD (**Table 3**).[24-26] The *Mālama Pu'uwai* (Caring for Heart) intervention compared a 4-module, heart failure education program to standard heart failure education.[24] This intervention, informed by interviews with NH and PI individuals, addressed cultural factors, including cultural foods relevant to heart failure and culturally relevant coping strategies. Two articles reported on *Ola Hou,* a hula-based dance intervention to reduce blood pressure and cardiovascular risk.[25,26] This intervention included 3 hours of hypertension education and 12 weeks of hula training; its development was informed by Hawaiian cultural experts and social cognitive theory. One article reported the results of a pilot study[24] and the other the results of a larger trial.[26]

For *Mālama Pu'uwai*, 150 patients (62% NH or PI) hospitalized for heart failure or cardiomyopathy at The Queen's Medical Center were recruited and randomized to the culturally tailored heart-failure program or standard heart failure education.[24] For the pilot testing of the hula intervention, 55 NH and PI individuals with hypertension were recruited through community health centers and randomized to *Ola Hou* or a wait-list control.[25] In the larger trial, 263 NH and PI individuals with uncontrolled hypertension from 6 community-based organizations were randomized to hula or an education-only control group.[26] The primary outcomes for *Mālama Pu'uwai* were differences in cardiac mortality and hospital readmission. Neither were significant; however, risk ratios were less than 1.0 for readmissions and the combined endpoint of deaths and readmissions for the intervention group.[24] For the *Ola Hou* pilot study, the hula intervention group had significantly lower systolic blood pressure at 3 months in both the intention-to-treat and complete case analyses, after adjusting for age, heart disease status, and baseline blood pressure.[25] For the larger trial, the intervention group had a significantly greater reduction in systolic and diastolic blood pressure, hypertension stage, and 10-year risk for CVD than the control group.[26] Thus, 2 of the 3 CVD interventions proved to be effective.

### Diabetes

Six articles reported on the testing of 6 educational interventions for individuals with or at risk of diabetes (**Table 4**).[27-32] Bender et al trialed 2 different educational interventions for Filipino individuals in California. Fit&Trim was an adaptation of the Diabetes Prevention Program (DPP) with a 3-month weight-loss component and a 3-month weight-loss-maintenance component.[27] The Pilipino Americans Go4Health (PilAm Go4Health) intervention included similar components but incorporated accelerators and mobile technology.[27,28] Inouye et al also focused on Filipino individuals with their 6-month, 8 session, values-based educational invention called Health is Wealth[29] Also in Hawai'i, the Partners in Care intervention, previously designed and evaluated with African Americans and Latinos, was tailored by the PILI investigators for NH, PI, and Filipino individuals to include 12 sessions delivered by peer educators.[30] Ing et al examined the impact of augmenting the Partners in Care intervention with a 3-month social support group.[31] A family-focused model of Diabetes Self-Management Education (Family DSME) in Arkansas focused on a Marshallese population and included family motivational interviewing, goal setting, and behavior change.[32] All of the interventions were informed by social cognitive theory, and the Bender interventions also were informed by the transtheoretical model for health behavior change.[27,28]

For the Fit&Trim and PilAm Go4Health interventions, Filipino individuals meeting the DPP criteria for high-risk for diabetes were recruited through flyers, social media, presentations, and snowball sampling.[27,28] Health is Wealth included Filipino participants at high-risk for diabetes recruited primarily through Catholic churches in Hawai'i with large numbers of Filipino congregants.[29] Partners in Care recruited NH, PI, and Filipino individuals from community health centers and Hawaiian-serving organizations in Hawai'i,[30] and Ing et al randomized participants who completed the Partners in Care intervention into the social support group or the control condition.[31] The Family DSME intervention was offered to Marshallese living in Arkansas with type-2 diabetes.[32]

Table 2. Obesity Control Interventions for Native Hawaiian, Pacific Islander or Filipinos in the United States

| | | Intervention | | | Testing | | |
|---|---|---|---|---|---|---|---|
| **Citation** | **Location** | **Intervention intent** | **Theory based** | **Tailored to population** | **Design** | **Sample** | **Outcomes** |
| Dirige et al (2013) | Filipino adults in San Diego 2002-2003 | Increase healthy eating and physical activity | Yes | Yes | CRCT | E: 337 adults in 9 organizations<br>C: 336 adults in 9 organizations | ↑ physical activity<br>↑ low-fat diet<br>↑ stage of change for fruit/veg and fat intake<br>↔ 5 fruit/veg a day |
| Novotny et al (2018) | Children (age 2-8) in Alaska, Hawai‘i, and the US-affiliated Pacific | Reduce childhood obesity | Yes | Yes | CRCT | $E_{T1}$: 3 517 children in 9 communities<br>$E_{T2}$: 1 342 children in 9 communities<br>$C_{T1}$: 1 491 children in 9 communities<br>$C_{T2}$: 1 295 children in 9 communities | ↑ overweight and obesity prevalence<br>↑ waist circumference<br>↑ acanthosis nigricans |
| Kaholokula et al (2012, 2013) | PIs adults in Native Hawaiian-serving organizations in Hawai‘i 2007-2008 | To increase weight loss and weight loss maintenance | Yes | Yes | RCT | 144 completed weight-loss program, then randomized<br>E=72<br>C=72 | ↑ weight-loss maintenance among those completing ≥half sessions |
| Ing et al (2018) | PIs adults in Native Hawaiian-serving organizations in Hawai‘i 2000-2005 | To increase weight loss and weight loss maintenance | Yes | Yes | RCT | 217 completed weight-loss program, then randomized<br>$E_1$: 83<br>$E_2$: 73 | ↑ weight-loss maintenance in both experimental arms |

↔ No significant difference between the intervention and control group in outcome
↑ Significant improvement in the intervention group in outcome
C = Control group
$C_{T1}$ = Control Time 1
$C_{T2}$ = Control Time 2
CRCT = Cluster randomized controlled trial
E = Experimental group
$E_{T1}$ = Experiment Time 1
$E_{T2}$ = Experiment Time 2
PI = Pacific Islander
RCT = Randomized controlled trial

Table 3. Cardiovascular Disease Control Interventions for Native Hawaiian, Pacific Islander or Filipinos in the United States

| | | Intervention | | | Testing | | |
|---|---|---|---|---|---|---|---|
| **Citation** | **Location** | **Intervention intent** | **Theory based** | **Tailored to population** | **Design** | **Sample** | **Outcomes** |
| Mau et al (2017) | NHPI adults with heart failure in Hawai‘i | To reduce cardiac-related mortality and readmission | None mentioned | Yes | RCT | E: 75<br>C: 75 | ↔ cardiac mortality and hospital readmissions |
| Kaholokula et al (2017) | NHPI with hypertension in Hawai‘i | To reduce hypertension | Yes | Yes | Wait list RCT | E: 27<br>Waitlist C: 28 | ↑ blood pressure control & Health-related quality of life |
| Kaholokula et al (2021) | NHPI with hypertension in Hawai‘i | To reduce hypertension | Yes | Yes | Wait list RCT | E: 131<br>Waitlist C: 132 | ↑ blood pressure control & 10-year cardiovascular event risk |

↔ No significant difference between the intervention and control group in outcome
↑ Significant improvement in the intervention group in outcome
C = Control group
E = Experimental group
NHPI = Native Hawaiian and Pacific Islander
RCT = Randomized controlled trial

Table 4. Diabetes Control Interventions for Native Hawaiian, Pacific Islander or Filipinos in the United States

| | | Intervention | | | Testing | | |
|---|---|---|---|---|---|---|---|
| Citation | Location | Intervention intent | Theory based | Tailored to population | Design | Sample | Outcomes |
| Bender et al (2018) | Filipino adults at risk of Type 2 DM in California | To improve diabetes management | Yes | Yes | Wait list RCT | E: 33<br>C: 34 | ↑ weight loss |
| Bender et al (2017) | Filipino adults at risk of Type 2 DM in California | To improve diabetes management | Yes | Yes | Wait list RCT | E: 22<br>C: 23 | ↑ weight loss |
| Inouye (2014) | Filipino adults at risk of Type 2 diabetes in Hawai'i | To improve diabetes management | Yes | Yes | Wait list RCT | E: 22<br>C: 18 | ↑weight loss & waist circumference |
| Sinclair et al (2013) | NHPI adults with Type-2 DM in Hawai'i | To improve diabetes management | Yes | Yes | Wait list CRCT | E: 48 in 2 community health centers and 1 Native Hawaiian community organization<br>C: 34 in 2 community health centers and 1 Native Hawaiian community organization | ↑ A1c control |
| Ing (2016) | NHPI adults with Type-2 DM in Hawai'i | To improve diabetes management | Yes | Yes | RCT | E: 25<br>C: 22 | ↔ A1c or blood pressure or behavior |
| McElfish et al (2019) | Marshallese adults with Type-2 DM in Arkansas | To improve diabetes management | Yes | Yes | RCT | E: 110<br>C: 111 | ↑ A1c control |

↔ No significant difference between the intervention and control group in outcome
↑ Significant improvement in the intervention group in outcome
C = Control group
DM = Diabetes mellitus
E = Experimental group
NHPI = Native Hawaiian and Pacific Islander
RCT = Randomized controlled trial

Filipino participants in the Fit&Trim intervention realized greater weight reduction compared to the control, and 57% of the intervention group also maintained their weight loss.[27,28] PilAm Go4Health participants also realized significantly greater weight loss compared with the nonintervention group, and 82% continued to maintain this weight loss at the 3-month follow-up.[27,28] Filipino participants in the Health is Wealth intervention showed a significant reduction in weight and waist circumference compared to the control group.[29] Sinclair et al found significant baseline-adjusted differences at 3 months between the Partners in Care and control groups in intent-to-treat, A1c, and performing diabetes self-management strategies.[30] However, Ing et al did not find statistically significant differences in longer-term A1c management between the Partners in Care participants randomized to follow-up social support groups compared to the control.[31] For the Family DSME intervention in Arkansas, participants in the intervention group experienced significantly higher reductions in HbA1c compared to the control group in both the intention-to-treat and complete case analyses.[32] Thus, 5 of the 6 diabetes interventions proved to be effective.

## Discussion

A scoping review was conducted to obtain a broad overview of literature available on interventional studies in chronic disease among NH, PI, and Filipino individuals in the US. The search yielded 23 articles reporting on findings from RCTs that tested the efficacy of 21 interventions to address cancer, obesity, CVD, or diabetes in these populations. All interventions were theory-based and tailored to the community of interest, and many studies recognized the importance of social and environmental influences on behavior change, especially social connection, and conducted their interventions within families and social organizations, including clubs, churches, and communities.[33]

Effectiveness varied by chronic disease target. For example, all of the obesity interventions were effective, as were 2 of the 3 CVD interventions and 5 of the 6 diabetes interventions. These finding suggest that interventions that are culturally adapted, developed in partnership with the community of interest, and based on theory and culture can be effective in promoting healthy behaviors.[34-36] However, only 2 of the cancer-related interventions were effective. The other 6, although skillfully designed, were challenged because community partners required that the cancer screening intervention be offered to all club/church members, rather than focusing on those out of compliance with screening guidelines, as well as by the possibility of cross-group contamination.[37]

There were several limitations to the review. Only 23 RCT in chronic disease in NH, PI, and Filipino individuals were published over 22 years, suggesting the need for more culturally tailored and controlled design interventional research. Some RCT studies may have been missed, as a large number of relevant studies were found through citation chasing and colleagues. The review also excluded studies conducted solely in the US-Affiliated Pacific, studies not focused on chronic disease (eg, psychological interventions), and interventions not tested through RCT.

## Conclusion

This review identified effective and promising interventions to improve chronic disease outcomes in NH, PI, and Filipino individuals. These interventions were theory-based and developed and delivered in partnership with community. Given the growing numbers of NH, PI, and Filipino individuals in the US, programmers should consider replicating the most relevant and successful interventions from this review in NH, PI, and Filipino communities. Researchers developing other interventions should test them with RCT designs to expand the evidence base of effective interventions to meet the health needs of these populations.

## Conflicts of Interest

None of the authors identify a conflict of interest.

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# The Hawai‘i NHPI Data Disaggregation Imperative: Preventing Data Genocide Through Statewide Race and Ethnicity Standards

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## Abstract

*Federal race and ethnicity data standards are commonly applied within the state of Hawai‘i. When a multiracial category is used, Native Hawaiians are disproportionately affected since they are more likely than any other group to identify with an additional race or ethnicity group. These data conventions contribute to a phenomenon known as data genocide – the systematic erasure of Indigenous and marginalized peoples from population data. While data aggregation may be unintentional or due to real or perceived barriers, the obstacles to disaggregating data must be overcome to advance health equity. In this call for greater attention to relevant social determinants of health through disaggregation of race and ethnicity data, the history of data standards is reviewed, the implications of aggregation are discussed, and recommended disaggregation strategies are provided.*

## Keywords

*Native Hawaiian, Pacific Islander, data disaggregation, data standards, race and ethnicity, multiracial, indigenous health, data genocide*

## Abbreviations

*AA = Asian American*
*AAPI = Asian American and Pacific Islander*
*AIAN = American Indian and Alaska Native*
*COFA = Compact of Free Association*
*HJH&SW = Hawai‘i Journal of Health & Social Welfare*
*NHPI = Native Hawaiian or Pacific Islander*
*NH = Native Hawaiian*
*NHPI 3R = Native Hawaiian and Pacific Islander Response, Recovery, and Resilience Team*
*OMB = Office of Management and Budget*

## Background

The COVID-19 pandemic demonstrated the critical importance of timely and relevant demographic data.[1–3] Commonly measured factors associated with health outcomes include age, gender or sex, and race and ethnicity. National standards for the collection of race and ethnicity are set by the Office of Management and Budget (OMB), which defines race as having to do with a person's "origins".[4] The OMB further clarifies that responses are based on self-identification and should not be interpreted primarily as biological or genetic constructs but as social, cultural, and ancestral characteristics.

These present-day race categories are an unfortunate legacy of a time in America's history when proportional democratic representation was allocated according to the number of White and enslaved (Black) persons in each state.[5] Additional categories were later added to support immigration policies, but following the civil rights movement of the 1960s, racial statistics were repurposed to support the enforcement of civil rights laws aimed at equal access to housing, education, and employment. Today, these "statistical race" categories are often used in health research as a proxy for racial discrimination and other historical and contemporary systemic factors that affect social determinants of health.[6,7]

The first national race and ethnicity data standard was established in 1977, with OMB Directive 15.[8] This mandate included Asian American or Pacific Islander (AAPI) as 1 of 5 minimally required racial and ethnic groups. These standards were revised in 1997 in response to robust community advocacy with the addition of the Native Hawaiian or Pacific Islander (NHPI) group as a new minimum category distinct from Asian Americans. Yet more than 25 years later, many states and federal agencies still fail to abide by the 1997 race and ethnicity standard.[9] By continuing to use the broader AAPI label, these organizations render smaller NHPI communities invisible. Although the OMB race and ethnicity standards are currently under review,[10] it is unlikely that any national standard for race and ethnicity data will meet the needs of Hawai‘i's more diverse population. Hawai‘i is the only state where Asians, Native Hawaiians, and Pacific Islanders collectively comprise a majority of the population.

## Diversity Among NHPI Populations

The inadequacy of the federal minimum race categories is clear when examining social determinants of health within these statistical racial groups. Heterogeneity among the NHPI population across a wide range of socioeconomic and demographic indicators has been documented using the American Community Survey and other data sources.[11,12] Variation exists among the NHPI community for bachelor's degree attainment (2.6%-16.4%), per capita income ($5963-$20 664), limited English proficiency (2%-51%), and home ownership (3%-54%).[11,12]

While the people living in Hawai‘i who have ancestry from any of the thousands of islands spanning the vast Pacific Ocean may share certain commonalities of environment, climate, or colonial histories, each island population possesses a distinct history, culture, social, and political affiliation with the US. Additional differences stem from the status of Native Hawaiians as an Indigenous population in contrast to Pacific Islanders who have immigrated to Hawai‘i at different times and for different economic and political reasons.[13]

## Diversity Among Pacific Islander Populations

As of 2010, there were 13 distinct non-Hawaiian Pacific Islander populations with at least 100 members living in Hawai‘i, collectively comprising 4-5% of the state's population.[14] According to principles of epidemiologic analysis of categorical data, categories should be constructed based on external information, and groups that are different with respect to the phenomena under study should not be combined.[15] For example, when Pacific Islanders are combined with Native Hawaiians, any aggregate NHPI statistics will primarily reflect the experience of the larger Native Hawaiian population, concealing any disparities that might exist within the smaller Pacific Islander population. Without oversampling by design, few surveys can make statistically reliable or meaningful conclusions about Pacific subpopulations. And yet, each of these groups has a unique history, political, and socioeconomic status that contributes to their overall health status.[16] Attempts to stratify this diverse population into statistically manageable subgroups have often relied on the geographic regions of origin such as Micronesia, Polynesia, and Melanesia. or by political affiliation with the US, such as the Compacts of Free Association (COFA).

While convenient for data tabulation, these broad, umbrella terms perpetuate reductive stereotypes that are not meaningful to Pacific Islanders and are uninformative for public health interventions. These geographic regions in the Pacific were originally created by a French explorer and naval officer named J*ules Sébastien César Dumont D'Urville based* on racial biases and assumptions.[17] As the Samoan poet Albert Wendt has described, these "fictional" [18] categories are based on externally and artificially imposed boundaries that often pose a barrier to meaningful engagement since there is no distinct regional language or culture for Micronesia, Polynesia, or Melanesia. During the COVID-19 pandemic in Hawai‘i, disaggregated Pacific Islander data supported the creation of a team of community health workers who were better equipped to establish trust and translate ever-changing health guidance using their deep and specific knowledge about the cultures and languages of each of the affected island nations. -

## Multiracial Diversity

A second major change established by the 1997 OMB standard included the requirement to allow respondents to identify with more than 1 race. Data from the 2020 census reveals a rapidly increasing multiracial population nationally, with Hawai‘i having the largest multiracial proportion at 27% based on the OMB minimum categories.[19] While placing all persons who select more than 1 race into a single multiracial category complies with minimum reporting requirements and creates mutually exclusive groupings, it is also possible toprovide the number of persons who identify with each race "alone or in combination" with any other race. The conventional approach of reporting 1 multiracial category and listing only those who identify with a single race "alone" disproportionately affects Indigenous peoples who have managed to survive through generations of intermarriage after having their populations reduced to near extinction by disease and systematic violence.

Historians estimate that the Native Hawaiian population declined from as many as 700 000 – 1 000 000[20] to roughly 30 000 following American and European contact and subsequent immigration from east Asia.[13,20,21] For this reason, the Native Hawaiian Health Act of 1988 defined Native Hawaiian as a person who is a "descendent of the aboriginal people who, before 1778, occupied and exercised sovereignty in the area that now comprises the State of Hawai‘i."[22] This recognizes the need for an inclusive definition that accounts for the impact of colonialism initiated when Captain James Cook arrived on the shores of the Hawaiian Islands.

## Impact of Data Aggregation

In 2021, 71% of Native Hawaiians also identified with at least 1 other race in the American Community Survey. When data are reported using a "Native Hawaiian alone" category and a single multiracial category, the result is an effective reduction in the Native Hawaiian-identifying population by over two-thirds (**Table 1**). Over half of Native Hawaiians are therefore made invisible in the data when combined with all other multiracial populations. Similarly, Pacific Islanders are disproportionately affected when NHPI are reported as a single group since they represent just just one-sixth of all persons who identify as NHPI living in the state. Any health disparities between Pacific Islanders and Native Hawaiians are masked when combined with the much larger Native Hawaiian population (**Table 1**). Statistics describing the combined NHPI group will inevitably reflect the Native Hawaiian experience, which can differ considerably from the Pacific Islander experience depending on the factors under study.

Table 1. Native Hawaiian and Pacific Islander Population Estimates for the State of Hawai‘i, by Classification Method, American Community Survey 2021, Table S0201

| | **Race Alone** | **Race Alone or in combination** |
|---|---|---|
| Total Population | 1 441 553 | 1 441 553 |
| NHPI | 145 556 (10.1%) | 380 825 (26.4%) |
| Native Hawaiian | 90 370 (6.3%) | 309 807 (21.5%) |
| Pacific Islander[a] | 55 186 (3.8%) | 71 018 (4.9%) |

[a] Not including Native Hawaiians
NHPI = Native Hawaiian or Pacific Islander

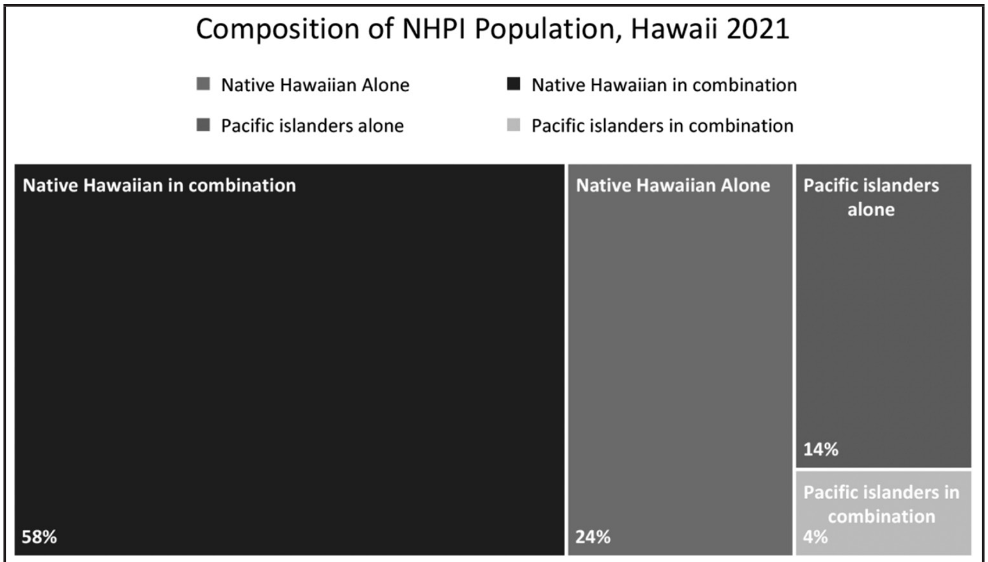

Figure 1. Native Hawaiian and Pacific Islander Population Estimates for the State of Hawai‘i, by Classification Method, American Community Survey 2021, Table S0201

## Practical and Ethical Implications of Aggregation

Adherence to the OMB standards for racial classification is not without negative consequences. Failure to collect and report data beyond the minimum federal categories in populations with large racial and ethnic diversity within these categories contributes to the ongoing marginalization of historically oppressed populations. When broad categories like "Native Hawaiian and Other Pacific Islander" and "Multiracial", are used to describe people living in Hawai‘i, any underlying health disparities within these groups are masked, diverse experiences are erased, and efforts to improve outcomes for those facing the greatest systemic barriers are unnecessarily delayed.

The undercounting and misclassification of marginalized populations reinforces the hegemonic dominance of the majority at the expense of populations with the greatest social needs. This phenomenon of systematic erasure is frequently experienced by Indigenous and immigrant populations who have been subjected to American colonialism and military occupation. American Indian and Alaska Native (AIAN) data advocates have described the statistical suppression of their populations as data genocide.[23,24] This insidious form of racism is a contemporary expression of more overt historical discrimination against minoritized populations. When attempts to exterminate Indigenous peoples through state-sanctioned violence were unsuccessful, other compulsory acculturation strategies were employed, such as forcibly placing Native youth into boarding schools to "kill the Indian, save the man."[25] Similar efforts were made to eradicate or limit Native Hawaiian identity through suppression of the Hawaiian language and practices. The teaching of Hawaiian language was banned from schools and was also discouraged from being spoken at home. Beginning in 1906, the Programme for Patriotic Exercises in the Public Schools attempted to Americanize the Hawaiian children by severely punishing them if they spoke Hawaiian at school.[26] Although the aggregation or outright omission of NHPI data represents a form of racism, individual instances of aggregation may be warranted when there are concerns about protecting privacy, avoiding stigmatization, or ensuring statistical reliability. However, these concerns must be weighed against the critical need for better data to uplift historically underserved communities, with intentional equity-focused efforts designed to address the marginalization that can manifest in the absence of data about certain communities.

## National NHPI Disaggregation Efforts

The imperative to disaggregate data has been highlighted by numerous health policy advocates who point to data reporting gaps for NHPI as a form of structural racism.[9,27,28] Among those calling for better data are the Asian American (AA) and NHPI Interest Group of the National Institutes of Health (NIH) Community Engagement Alliance Against COVID-19[29] and the President's Advisory Commission on Asian Americans, Native Hawaiians, and Pacific Islanders.[30] Community advocacy in several continental US jurisdictions has resulted in legislation mandating data disaggregation by government agencies such as in New York State (A6896), [31] California (AB1726),[32] Oregon (REALD),[33] Massachusetts (H3361),[34] and Rhode Island (H5453).[35] Surprisingly, the State of Hawai‘i lags behind these states in the development of racial disaggregation and standards legislation, despite having greater proportional representation from AA and NHPI populations.

## Local Efforts

During the pandemic in Hawai‘i, advocacy by NHPI community leaders and organizations associated with the Hawai‘i NHPI Response, Recovery, and Resiliency Team (NHPI 3R) led to the creation of an NHPI-specific contact tracing team. Leaders and members of the affected communities advocated for the continued collection and reporting of detailed COVID-19 race and ethnicity data.[36,37] Without disaggregated data, the COVID-19 disparities within the NHPI and Asian populations would have remained hidden, unnecessarily delaying the use of tailored, culturally responsive efforts. Some Department of Health programs have been disaggregating NHPI data for decades.[38] However, racial and ethnic reporting often regresses to the minimum required standard, likely related to dependence on federal resources (eg, data collection forms), information system limitations, and the convenience of tabulating groups using broader population categories.

## A Way Forward

It has been said that inequity stems from power imbalances since health and other policies have been shaped by legacies of racial, economic, and political exclusion and segregation.[39,40] If those in positions of authority to set research agendas, dictate data reporting standards, and conduct public health research fail to challenge the status quo, the result will be the perpetuation of marginalizing and oppressive systems that favor historically privileged social groups. Rather than continuing to be unwittingly complicit in harmful or unhelpful data practices, health researchers and health officials in Hawai‘i are in a position to become national leaders in demonstrating how to thoughtfully disaggregate data for diverse, multiracial populations.

One of the principles underlying health equity is the notion that one size does not fit all. If equality of health outcomes is to be achieved, then it must include tailored and focused policy interventions that account for root causes such as the longstanding historical, social, and political conditions that have created those inequalities.[41] Without disaggregated public health data, there can be no accountability or monitoring of progress toward correcting the systemic racism that has pervaded America’s history.

To estimate how frequently NHPI data is aggregated in Hawai‘i, the authors identified 35 articles based on research published in the *Hawaii Journal of Health & Social Welfare* between 2020-2022 and that provided any demographic details about the study population. Among these studies, only one-third (34%) presented the race and ethnicity data in disaggregated form. The remaining two-thirds of studies combined Native Hawaiians with Pacific Islanders and/or included Native Hawaiians in a multiracial category. For the 12 such studies published in 2022, this figure was much lower: just 8% (n=1) presented data separately for Native Hawaiians and Pacific Islanders. These examples demonstrate that the aggregation of Native Hawaiians and Pacific Islanders remains a common practice in health research and more work is needed to improve the quality and relevance of data about racial and ethnic disparities in Hawai‘i.

While research priorities and resource limitations may not always allow for the oversampling needed to draw conclusions about specific Native Hawaiian and Pacific Islander subpopulations, programs that serve these communities broadly should not assume that the subgroups are monolithic. Instead, public health programs and biomedical research should dedicate resources to collecting detailed and relevant demographic information that will support appropriately stratified analyses and ensure that culturally appropriate and language-specific resources are made available during all health interactions. **Table 2** provides a list of considerations for population researchers when conducting studies within the state of Hawai‘i. The list is based on the decades of experience of the authors in working directly with these communities and analyzing population datasets. Although not responsible for collecting data, journal editors can also support data disaggregation by encouraging robust methods during the review process and requesting that authors provide an explanation of barriers encountered during the collection or tabulation process that might have prevented appropriate disaggregation. Engagement with affected communities throughout the research process will ensure meaningful categories are used so that relevant and actionable data can be made available to empower communities and create policies that promote social justice and health equity. Finally, **Table 3** provides a series of strategies that can be used to overcome the most common barriers to disaggregation. Although the application of socially and culturally relevant categories may entail costs associated with additional effort and resources, the benefits of having more granular race and ethnicity data will often outweigh these costs. Once disaggregation becomes the commonly accepted standard, future costs will be greatly reduced as tools and methods that support increased data disaggregation are developed and shared.

| Table 2. Recommendations for Health Researchers and Journal Editors When Conducting and Reviewing Studies that Include Diverse Populations, Especially those that Make Ethnic Comparisons |
|---|
| 1. Consider the relevance of social factors associated with race and ethnicity that go beyond federal Office of Management and Budget (OMB) minimum standards for the collection, analysis, and reporting of population health data. Avoid statements that imply that race is measure of biological or genetic traits and instead describe race as a social construct and proxy for systemic racism and social determinants of health. |
| 2. Provide the total number of persons who identify as Native Hawaiian, whether alone or in combination with some other race. Do not divide Native Hawaiians into separate single race and multiracial categories. |
| 3. Separate Pacific Islanders from Native Hawaiians, and to the extent possible, further separate Pacific Islander subpopulations from each other. Do not use a single NHPI category. If disaggregation would result in small numbers, apply cell suppression rules (eg, counts between 1 and 9 and rates based on fewer than 20 events not displayed). |
| 4. When in doubt about appropriate racial categorization, consult with Native Hawaiian and Pacific Islander subject matter experts or organizations or identify examples in the literature. |

Note: These recommendations are compliant with the 1997 OMB standards and are explicitly endorsed in federal guidance which states that "in no case shall the provisions of the standards be construed to limit the collection of data to [these] categories" and that "the collection of greater detail is encouraged", so long as "additional categories can be aggregated into these minimum categories. Regarding respondents who select more than 1 category: "data producers are strongly encouraged to provide the detailed distributions, including all possible combinations of multiple responses to the race question" and suggest that data producers "report the total selecting each particular race, whether alone or in combination with other races."

Table 3. Common Barriers and Strategies for Data Disaggregation

| Barrier | Strategy |
|---|---|
| Small sample, insufficient data | Oversample small populations of interest |
| | Use small sample statistical methods (nonparametric tests, exact statistics, eg, Fisher's exact test, Welch's t-test or ANOVA)[42,43] |
| | Display 0 and censored cells in tables with footnotes instead of aggregating disparate groups to avoid suppression. |
| | Pool samples across space (geography) or time (multiple years of data) |
| | Provide confidence intervals or notes regarding instability of estimates based on small numbers. |
| | Use discussion section to describe efforts or barriers to enumeration and inclusion or why aggregation is appropriate for study hypothesis and why future work is needed to explore phenomena within subpopulations. |
| Lacking data collection tools | Use census-style race data collection tools that provide separate check boxes for Native Hawaiians and Pacific Islander populations. |
| | Develop forms that expand upon the census race and ethnicity questions by adding more detailed groups. |
| | Create and share population reference data, data collection tools and sample analyses through open-source platforms (eg, GitHub). |
| Lacking expertise in racial analysis | Follow examples where data has been disaggregated. |
| | Seek out consultation or guidance from organizations and researchers with prior experience, especially when inferences or conclusions are made about historically marginalized populations. |

## Conclusion

Racial and ethnic data aggregation practices can result in a form of erasure called data genocide and represent an insidious example of systemic racism that is a major obstacle to achieving health equity. Structural racism and settler colonialism can manifest as limited data on health disparities for historically underserved and marginalized communities.[9] Although there may be practical reasons for aggregating racial data, the negative impact of failing to disaggregate outweighs these concerns and justifies the use of innovative strategies to overcome common barriers.

The aggregation of NHPI groups, as well as the use of a single "Multiracial" category containing many of these individuals, detracts from the value of important health studies since over half of the Native Hawaiians in study populations are likely to be counted in the multiracial category and Pacific Islander disparities are masked by the larger Native Hawaiian group. When insurmountable barriers beyond the control of the researchers exist (eg, use of secondary data sources relying on federal data collection tools) researchers should describe these limitations in the text and highlight the need for additional research to understand whether patterns observed in the aggregate are applicable to subpopulations or if effects are modified by culture, language, racism, or other factors associated with race and ethnicity. Researchers should expect marked heterogeneity within the NHPI population unless the data or prior studies show otherwise. If the purpose of the study is to make inferences about Native Hawaiians or Pacific Islanders, then sample size calculations should be done prior to the study to ensure sufficient statistical power during the design and data collection phases.

Several efforts are underway nationally to promote greater data disaggregation. Thoughtful attention to social, cultural, and historical context during the study design, data collection, analysis, and reporting phases of health research will result in a more robust and relevant evidence base for policymakers and health practitioners. If the goal of health research is to create actionable data that promotes the health of all, then greater data disaggregation by race and ethnicity is imperative.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# *No Kākou, Na Kākou* - For Us, By Us: Native Hawaiians and Pacific Islanders Informing Race Data Collection Standards for Hawaiʻi

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## Abstract

*This article describes recommendations for standardized race data collection developed by the Hawaiʻi Native Hawaiian and Pacific Islander COVID-19 Response, Recovery, and Resilience Team (NHPI 3R Team). These recommendations attempt to address the expressed desires of Native Hawaiians and the diverse Pacific Islander communities in Hawaiʻi who seek greater visibility in data and research. The Native Hawaiian and Pacific Islander (NHPI) racial category is 1 of the 5 racial categories listed in the 1997 Statistical Policy Directive #15 issued by the Office of Management and Budget (OMB). The OMB directive sets the minimum standard for collection of race data in federal surveys, administrative forms, records, and other data collection. The NHPI 3R Team's recommendation provides a standard for detailed data collection that could improve smaller communities' ability to identify, advocate for, and address their own needs. The article also describes lessons learned through the collaborative and iterative process that was led by members and leaders of NHPI communities impacted by data driven decisions and policies. The NHPI 3R Team focused on expanding and standardizing race data collection as part of their COVID-19 response efforts, but implementation of the recommendations could produce benefits well beyond the pandemic.*

## Keywords

*Native Hawaiian, Pacific Islander, COVID-19, Race, Data Collection, Data Standardization*

## Abbreviations

*DRC = Data and Research Committee*
*HDOH = State of Hawaiʻi Department of Health*
*NHPI = Native Hawaiian and Pacific Islander*
*NHPI 3R Team = Hawaiʻi Native Hawaiian and Pacific Islander COVID-19 Response, Recovery, and Resilience Team*
*OMB = Office of Management and Budget*

## Background

Hawaiʻi has the highest percentage of Native Hawaiians and Pacific Islanders (NHPI) in the United States (US). According to 2020 US Census Bureau estimates, there are 400 000 NHPI (alone or in combination) in Hawaiʻi, making up 28% of the population.[1] The NHPI category is 1 of the 5 racial categories listed in the White House's Office of Management and Budget (OMB) 1997 Statistical Policy Directive #15. Besides NHPI, the categories include: American Indian or Alaska Native, Asian, Black or African American, and White. Directive #15 sets the *minimum* standard for collection of race data in federal surveys, administrative forms, records, and other data collection.[2]

Agencies are encouraged to collect more specific racial data, but not less than the OMB minimum categories. For example, the Census Bureau has historically collected race data at a more granular level; however, for reporting purposes, racial data are generally aggregated into the 5 minimum standard categories. More detailed race and ethnicity data may be available in supplementary tables (eg, Table B01003 from the American Community Survey).[3] These population statistics are used for a variety of purposes, such as determining resource allocation, assessing the rates of health conditions within communities, and evaluating the impact of policies and events on different racial and ethnic groups. We highlight these applications because they are particularly important to advancing equity for communities that face social and health disparities.

The large representation of NHPI in Hawaiʻi provides a unique ability to "see," in data, the rich diversity of NHPI groups. While there are common threads that bind NHPI communities, there are also important differences. In Hawaiʻi, the history and experiences of Hawaiʻi's Indigenous population, Native Hawaiians, differs in many ways from the Samoan community, which in turn differs from the Marshallese or Tongan communities. For example, relationships to the Hawaiian islands, political status, language access, and cultural practices often vary between communities categorized under the single yet broad NHPI race group. These differences can have important implications for developing effective health policies, efficient disaster responses, and successful public health communications and interventions.

Some programs and institutions within Hawaiʻi collect race data that extends beyond the minimum OMB standards. For example, within the State of Hawaiʻi Department of Health (HDOH), the Office of Health Status Monitoring and the Chronic Disease Prevention and Health Promotion Division have been collecting and reporting race data for years with Native Hawaiians (alone or in combination) separated from other Pacific Islanders.[4] However, this approach is not standardized nor consistently applied within or across State or private agencies.[5] In the context of the COVID-19 pandemic, the lack of data collection standards across Hawai‘i, particularly in the earliest phase of the pandemic, created obstacles for addressing, monitoring, and assessing COVID-19 related impacts as well as for essential communication with the public.[6-8]

Concerns about data collection and reporting were raised within weeks of the first positive COVID-19 test in Hawai‘i. The HDOH initially reported COVID-19 rates using the aggregated NHPI category rather than disaggregating Native Hawaiians from Pacific Islanders as was done with several other HDOH data reports.[7] Worrying reports from inside Pacific Islander communities indicated a rapid spread of COVID-19; however, this was not apparent in the HDOH NHPI case reports. In response to the alarming spread of COVID-19 and concerns about the existing system's capacity to detect and address the specific needs of NHPI communities, the Hawai‘i NHPI COVID-19 Response, Recovery, and Resilience Team (NHPI 3R Team) was established in May 2020.[9] The team is co-led by NHPI community leaders and has participation from over 60 different community, government and educational agencies, organizations and departments. Its mission is to "improve the collection and reporting of accurate data, identify and lend support to initiatives across the Hawaiian Islands working to address COVID-19 among Native Hawaiians and Pacific Islanders, and to unify to establish a presence in the decision-making processes and policies that impact our communities."[9]

An early achievement of the NHPI 3R Team's Data and Research Committee (DRC) was collaborating with the HDOH Disease Outbreak Control Division to improve reporting of COVID-19 statistics by disaggregating NHPI data. This change revealed the extent of the disparity in COVID-19 cases among Pacific Islander communities and prompted greater and more targeted action.[8,10,11] This manuscript describes a DRC data collection improvement project to benefit NHPI communities now and well beyond the context of the pandemic.

## Approach

As a NHPI-led team , the DRC has worked continually for the past 2 years to develop recommended standards for collecting race data for NHPI communities in Hawai‘i. The methods used to produce these recommendations are detailed in the drafted standards document.[9] The standards are population-based (using 2010 Census data) and expand the Pacific Islander categories to include any group with 100 or more individuals (alone or in combination) enumerated in the State of Hawai‘i population data.

While other data improvement efforts are underway at the national[12-13] and local level,[5,14] including proposals for updating OMB's Race and Ethnicity Statistical Standards,[15] these recommendations are specific to and generated by NHPIs in Hawai‘i and for Hawai‘i. Team members have expertise in epidemiological methods, health research, program implementation and management, health care, healthcare administration, advocacy, and community outreach with and within NHPI communities. Additionally, the team, as a collective, has experience and knowledge across diverse, but germane, contexts and circumstances. Some examples include team members navigating their personal experience of invisibility/erasure in reported race data due to aggregation, trying to find data relevant for serving the stated needs of their communities, researching health outcomes for NHPI communities in the absence of relevant or valid data, and providing direct service and outreach with their communities in order meet needs that were not addressed due to language or other barriers. Insights resulting from these first-hand experiences were uniquely valuable to the development of the recommendations and are echoed in the literature from Hawai‘i and elsewhere and were.[7,8,11,16-18] For these reasons, we believe the recommendations put forth here are inclusive and highly relevant to the NHPI communities in Hawai‘i.

## Recommendations

The DRC recommended list of race categories is presented in **Table 1**. The DRC has also provided a set of guidelines for race data collection. These guidelines are specific to data collection; however, the DRC is working on race data reporting that will be disseminated at a later date.

Table 1. Recommended List of Detailed Native Hawaiian and Pacific Islander Race Categories for Data Collection, with Alignment to Federal 1997 Office of Management and Budget (OMB) Minimum Race Categories

| Recommended State of Hawai‘i Race Categories | OMB Standards Minimum Race Category |
|---|---|
| Native Hawaiian | Native Hawaiian or Other Pacific Islander |
| Chamorro/CHamoru | |
| Chuukese | |
| Fijian | |
| I-Kiribati | |
| Kosraean | |
| Marshallese | |
| Palauan/Belauan | |
| Pohnpeian | |
| Samoan | |
| Tahitian | |
| Tokelauan | |
| Tongan | |
| Yapese | |
| Other Pacific Islander (please specify) | |

Guidelines for race data collection:

- Racial categories should specify as much detail as possible.
- Respondents should be allowed to select more than 1 race (eg, check all that apply, mark one or more boxes).
- Respondents should self-identify their race selection (except in instances where consultation with others, such as a family member for identification purposes, is more practical or necessary, such as responding to EMS in an emergency).
- Persons who select “Other Pacific Islander” or any “Other” category should have space to write in their specific race.

## Lessons Learned

There were 4 main lessons learned while developing these recommendations that may be useful to other communities advocating for greater visibility in data and research.

1) *It is important to be aware of limitations*. Initially the group considered producing a standard that would recommend amendments to the full list of OMB racial categories. However, as the group progressed in the conversations around the NHPI granular data collection, it was understood that this group did not include the communities and voices needed to provide the same detail of recommendations for other racial categories. Therefore, the focus was narrowed to recommendations focused on data collection for NHPI groups. The team hopes that sharing the process and methods used can help other teams derive a list that has broad representation and relevant recommendations for their racial and ethnic communities.

2) *Definitions are elusive and evolving*. Race is a social construct. Constructions of race by official government entities and within the informal social sphere are consistently evolving.[19-21] Often, these definitions are created for a specific political purpose and, historically, were created to uphold racist hierarchies.[22-23] These entrenched hierarchies have powerful influences on the lived experiences of individuals and communities categorized into racial groups.[24-25] However, race, ethnicity, ancestry, and nationality are concepts that are frequently conflated, intertwined, and overlapping. In fact, Native Hawaiian is the only named race in the OMB standards connected to a specific and unique language and a distinctly defined ancestry and place.

For other communities aggregated into racial categories that do not overlap with their specific cultural or ethnic affiliation, including Pacific Islanders, the aggregation can mask information critical to preserving and protecting their health and well-being. In this way, the use of broad aggregate race categories for data collection hinders the ability to identify, assess, and effectively address the health needs of the diverse (in terms of language, culture and/or practices) communities contained within a single racial category. Yet, creating a standardized list that represents all the iterations of more granular race or ethnic communities can collide or conflict with the other priorities, including privacy issues, practicality, and broad implementation. In the face of these challenges, the DRC tried to walk the line, resulting in an approach that was an improvement, but also a compromise. Ultimately, the team settled on including more granular categories, while also using a population cutoff point which would exclude Pacific Islander communities representing less than 100 individuals.

3) *The list is a living document.* Creating a standard for concepts that are constructed in changing societal contexts and using population cutoffs that can shift with in and out migration or due to other population dynamics, means that this list should not be considered a static document. These recent efforts have created parameters and articulated a proposed methodology; however, the team members recognize that the context and populations will change over time, requiring the standard to be reviewed and modified at regular intervals based on changing detailed census population counts and community feedback to maintain its relevance and usefulness. If categories change, there may be a period where data is not reportable or different sampling or analytical approaches are needed (eg, oversampling, qualitative methods) to better understand how outcomes or certain factors overlap/diverge in relation to other groups. Additionally, more granular collection of race and ethnicity data does not preclude aggregation for analysis purposes entirely. However, determinations regarding aggregation to provide a meaningful analysis should be made in conversation with community representatives, justified as it relates to the context of the investigation, and explicitly described in any research reports.

4) *No Kākou, Na Kākou* (for us, by us). The work of the DRC on this issue coincided with increased dialog nationally on the topics of diversity, inclusion, and representation. These conversations, alongside the stark racial disparities the pandemic highlighted, spawned substantial interest in the race data collection recommendations being developed by the team. The DRC has received numerous requests to share information about the process and our recommendations. In all the conversations, the importance of having diverse NHPI voices represented, engaged, and empowered as decision-makers and leaders is emphasized, especially when the data is generated from their communities.

## Conclusion

The recommendations for standardized race data collection outlined here are the result of a lengthy but thoughtful, collaborative, and iterative approach led by members and leaders of the communities most impacted by data driven decisions and policies. The effort tackled the complexity of race as a social construction influenced by historic and contemporary racist hierarchies; an ethnic and familial heritage; and an intimate and personal identity. The resulting recommendations attempt to respond to the expressed needs of smaller communities to be more visible in data in order to identify, advocate for, and address their own needs, as well as allocate critical resources.

Furthermore, greater visibility in data reduces the risk of smaller communities being neglected in public health response efforts and political spheres.

The NHPI-led team came together at the beginning of the COVID-19 pandemic in hopes of keeping our communities safe and preventing COVID-related deaths. It is the team's goal that this standardized list and recommendations, updated as necessary, will not only facilitate recovery, but also be used to support resilience into the future for generations to come.

## Conflict of Interest

None of the authors identify a conflict of interest.

## Acknowledgments

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# Modeling Poverty and Health for Native Hawaiian and Pacific Islander and Asian Ethnic Populations

James Davis PhD; Deborah A. Taira ScD; Eunjung Lim PhD; John Chen PhD

## Abstract

*This study examined differences in poverty and health among Native Hawaiians and Pacific Islanders (NHPI) and 6 disaggregated Asian ethnic subgroups and an aggregated Other Asian category. Participants were followed longitudinally for 2 years using data from 2009 to 2019 from the Current Population Survey, a monthly survey conducted by the Census Bureau. Having 2 years of data enabled the study to assess both prevalence of poverty and fair/poor health in only 1 of the 2 years and in both years. For NHPI, 13.5% were in poverty 1of the 2 years and 7.1% in both years. Asian ethnicities showed high variability ranging from a low of 6.4% for 1 year and 1.9% for 2 years among Asian Indians to 16.0% for 1 year and 6.3% for 2 years among Vietnamese. Fair/poor health also showed ethnic variability, made most apparent after age-sex adjustment in regression models. For poverty, after adjustment, Asian Indians, Filipinos and Japanese had significantly lower odds of being in poverty at least 1 year than NHPI. For having fair/poor health, Asian Indians and Japanese experienced lower odds than NHPI for both 1 and 2 years and Filipinos for 1 year, after age/sex adjustment. The results emphasize the diversity of Asian and Pacific Islander populations, the variability of poverty over time, and the importance of using disaggregated data to understand ethnic differences in poverty and health. These findings can be used to inform future modeling of social determinants on poverty and health among NHPI and Asian subgroups.*

## Keywords

*Poverty; Self-reported health; Native Hawaiian and Pacific Islander; Ethnic disaggregation*

## Abbreviations

*CPS = Current Population Survey*
*NHPI = Native Hawaiians and Pacific Islanders*
*OMB = Office of Management and Budget*

## Introduction

Native Hawaiians and Pacific Islanders (NHPI) and Asians are often aggregated into a single group, rendering understanding of health and poverty for a single ethnicity impossible. In 1997, the Office of Management and Budget (OMB) recommended disaggregating the Asian or Pacific Islander category into 2 categories: Asians and NHPI.[1] In 2000 the Census first separated Asians and NHPI in data reports in line with the recommendation issued in 1997.[2] In 2003, the Secretary of the Department of Health and Human services approved the separation of Asian race category from the NHPI race category and added 6 Asian subcategories on the US death and birth certificates and reports.[3-5] These 6 ethnic groups comprise a majority of the Asian Americans reporting a single race.[6] The Asian groups vary in socioeconomics and language abilities, with Asian Indians, Filipinos, and Japanese in the higher socioeconomic tier and Koreans, Vietnamese, and Chinese in the lower tier.

Past failure to disaggregate data by race and ethnicity has limited the ability to understand risks of racial and ethnic minority groups.[7] States have often excluded Asian Americans, Native Hawaiians, and Pacific Islanders from health department metrics, or include them infrequently.[8] When data are available, populations often contrast substantially. As an example, a study of a Filipino population reported that Filipinos differed from other Asians and NHPI populations in prevalence across 10 social and 4 health related variables, as well as having greater employment in health care and service industries.[9] A second study of major COVID-19 stressors, discrimination, and mental health reported variation across South Asian, East Asian, and Southeast Asian participants.[10]

Native Hawaiians and Asians have led the call to disaggregate data to inform programs and policy efforts to address health disparities.[11-13] Disaggregated data are essential for policy and resource allocation.[14] A key informant interview of leaders of national databases identified a number of issues affecting disaggregation: (1) lack of sufficient funding, (2) small numbers of minority members in some populations, (3) Asian Americans and NHPI lack of identity with the OMB racial/ethnic categories, and (4) difference in state laws governing data collection practices.[15]

The COVID-19 pandemic emphasized the consequences of not disaggregating health data. For example, failure to gather disaggregated data led to delays (nationally and locally) in recognizing the impacts of COVID-19 on the NHPI community.[16-18] Leaders in the Native Hawaiian and Asian communities have come together to advocate to end the practice of data aggregation by public health agencies and health-related researchers. For NHPI, successful programs respect the history and culture; they are community-based, engaging the community in all phases from the start.[8]

A study of 1.4 million patients in Kaiser Permanente Northern California compared health behavior and chronic diseases among Asian ethnicities and NHPI.[18] Results were reported for all Asians and all NHPI combined, and findings suggested that NHPI had greater prevalence of smoking, obesity, hypertension, diabetes, and coronary artery disease, and the risks of chronic diseases for NHPI were consistent with other studies reporting that NHPI have a high prevalence of cardiometabolic disease and a high risk of mortality.[19-21] Therefore, the authors recommended that NHPI should not be grouped with Asians in determining prevalence. Also, when Asian ethnic subgroups were disaggregated, Filipinos had a greater burden than the combined all Asian reference group for smoking, hypertension, diabetes, and coronary artery disease, but not for hypertension.

Poverty is a major determinant of health disparities among ethnic groups.[22] Poverty affects food supply, housing, employment, and health care. Poverty creates disparities across measures of health status, morbidity, and mortality.[23] Measurement of differences in poverty and health gaps between ethnicities can help identify opportunities for tailored interventions.[24]

This study followed NHPI and 6 Asian subgroups and an Other Asian category longitudinally, examining poverty as a critical social determinant of health and self-reported health as a global indicator of health. The study uses disaggregated data for NHPI and Asian subgroups to explore differences in poverty and associations between poverty and health. The objective was to examine ethnic differences among NHPI and Asians to quantitatively document the importance of disaggregating individual ethnicities for research, health planning, and policy. The hypothesis was that being in poverty in 1 or both years would affect the likelihood of being in poor/fair health in the second year.

## Methods

### Study Design and Population

Using data from the Current Population Survey (CPS), the study used a longitudinal study design to examine racial/ethnic differences in the prevalence and persistence of both poverty and self-reported health. The CPS is a monthly survey conducted by the Bureau of the Census. On average, 60 000 households are surveyed each month, with the primary purpose of providing data on employment and unemployment and workforce participation. The CPS uses a multistage probability-based sample of households designed to represent the civilian noninstitutional population of all 50 states and the District of Columbia. The sample is made up of addresses, and the interviewer verifies the eligibility of the household in person (eg, the address is not a vacant lot). One person, 15 years and older, per household is chosen as the head of the household. The head of the household is the person who primarily provides information on everyone living at the address. Participants are in the CPS for 16 months, with data collected for 4 months, not collected for 8 months, then collected again for a final 4 months (a 4-8-4 design). Thus, longitudinal data are available on participants who participated in the annual Social and Economic Supplement 2 times, a year apart. Additional information on social determinants was collected in the supplement. **Figure 1** illustrates the 4-8-4 design, which provides overlapping cohorts to replenish the study population.

Response rates for this survey average 75%. Interviewers administer the CPS questionnaire across the country through both in-person and telephone interviews. The first interview is always in-person to verify eligibility. Subsequent interviews have the option to be be conducted by telephone.

The CPS data were extracted using Integrated Public Use Microdata Series Current Population Survey (IPUMS CPS) Version 10.0 (University of Minnesota, Minneapolis, MN) a publicly available data extraction tool.[25] For poverty, the study used an amount that approximates 185% of the poverty threshold for a household the size of the respondent's household. This amount changes depending on when the interview was conducted, because poverty thresholds are revised annually by the US Census Bureau. This threshold is the income-eligibility threshold for food and nutrition assistance programs. Respondents are asked if their household income is greater or less than a given amount based on the size of the respondent's household.

The CPS disaggregates NHPI and 6 Asian ethnicities: Chinese, Japanese, Korean, Vietnamese, Filipinos, Asian Indians, and includes an Other Asian category. The study population included participants in the CPS enrolled between the years 2010 and 2019 who were age 15 years and older, and who identified themselves as NHPI or Asian ethnicity (Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese or Other Asian). Data on NHPI was included from 2010. Disaggregated data on Asian populations were available from 2013. Individual participants contributed 2 consecutive years of data as illustrated for a hypothetical participant in **Figure 1**.

Institutional Review Board Approval was not sought for this study as it involved analysis of de-identified, publicly available data.

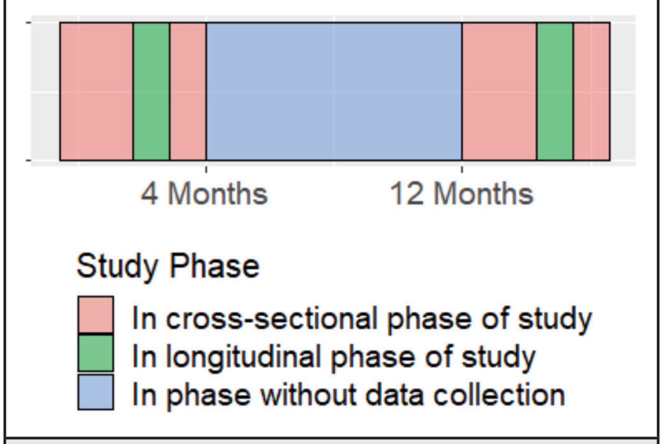

Figure 1. Example of Data Collection for an Individual Participant

### Study Variables

Ethnicities were 6 disaggregated Asian ethnicities and an aggregated Other Asian category, and combined NHPI category, as the NH and PI subgroups were not disaggregated. Poverty was based on all respondents who live in a family collectively and based on a comparison of the total income for the previous year to the poverty threshold. All members of each family unit were assigned the same value. For each participant, poverty was categorized as being in poverty 0 years, 1year, or 2 years. Self-reported health was assessed by a 5-category question (excellent, very good, good, fair, and poor) and collapsed into 2 categories. Thus, participants could be in fair/poor health (vs. excellent, very good, or good) in 0 years, in 1 year, or in 2 years. Transitory effects were defined as being in poverty or having fair/poor health during 1 of the 2 years; more chronic effects were defined as being in poverty or having fair/poor health 2 years. Age at enrollment was analyzed as 4 age groups (18 to 24, 25 to 39, 40 to 64, and 65 years or older). Sex was categorized as male and female.

### Data Analysis

An initial descriptive analysis provided the number of participants by age group and sex. The percent of participants in poverty 0 years, 1 year, or 2 years were examined by ethnicity. Similarly, the percent of participants in fair/poor health 0 years, 1 year, or 2 years were summarized by ethnicity. To gain a better understanding of ethnic difference in poverty and health, multinomial logistic regression models were created. The reference categories were not being in poverty either year (0 years) and not having fair/poor health in either year (0 years). The reference ethnicity was NHPI. In addition, logistic regression models were created to examine the extent that poverty for 1 or 2 years was associated with having fair/poor health in the second year. Ethnicity was not included in an initial model because adjusting for ethnicity could obscure the association between poverty and health. A second model included ethnicity. Analyses were conducted using R version 4.2.1 (R Foundation for Statistical Computing, Vienna, Austria) with the R survey packages,[26] and two-tailed $P < .05$ was considered statistically significant.

## Results

The number of participants by ethnicity varied ranging from 1174 Chinese to 432 Koreans (**Table 1**). The age distributions were fairly diverse. For example, the percent under age 40 years ranged from 22.5% for Japanese and 26.4% for Filipinos to 48.9% for Asian Indians and 48.5% for NHPIs.

Among specific ethnicities, Asian Indians were least likely to be in poverty for either 1 or 2 years (6.4% and 1.9%, respectively) followed by Japanese (7.8% and 1.4%, respectively) (**Figure 2**). By contrast, Vietnamese, Chinese, and NHPI were the most likely to experience poverty (16.0% and 6.3% for Vietnamese, 13.1% and 7.6% for Chinese, and 13.5% and 7.1% for NHPI for 1 and 2 years).

Asian Indians reported the best health, with only 8.1% in fair or poor heath for 1 year and 1.8% for 2 years (**Figure 3**). Without adjusting for age, the poorest health was reported among Japanese and NHPI (15.2% for 1 year and 4.7% for 2 years and 15.0% for 1 year and 5.1% for 2 years, respectively).

The descriptive results for poverty and fair/poor health could be misleading since the ethnic groups differed by and age and sex. To look for independent effects, models were fit adjusting for age groups and sex. **Table 2** compares unadjusted and adjusted regression models, with years in poverty as the outcome. Asian Indians and Japanese were less likely to be in poverty for either 1 or both years compared to NHPI, with odds that were half or less. Odds ratios were especially low for 2 years of poverty. Asian Indians and Japanese were approximately a third less likely than NHPI to remain in poverty for 2 consecutive years. Filipinos had lower odds than NHIPI for two years in poverty. The odds ratios for Chinese relative to NHPI were closest to 1, suggesting fairly similar risks of poverty for Chinese and NHPI. The odds ratios for Vietnamese and Other Asians were greater than 1, but not statistically significant.

In unadjusted models, only Asian Indians showed a statistically significant difference from NHPI for being in poor or fair health (**Table 3**). Adjustment for age and sex uncovered other ethnic differences for health status. In the adjusted models, the Chinese, Asian Indians, Filipinos, and Japanese all had lower odds of fair or poor health than NHPIs. The Chinese only showed differences with having 1 year of poor health, whereas the Asian Indians, Filipinos, and Japanese showed differences for 1 of the years and both years. Koreans, Vietnamese, and Other Asians did not differ significantly in health from NHPI.

Being in poverty for 1 or both years was significantly related to being in fair/poor health in the second year, after adjusting for age and sex (**Table 4**). The increased odds of fair/poor health for someone with 2 years of poverty was more than 3 times as large as the odds for someone not in poverty either year. After adjusting for NHPI and Asian ethnic groups in addition to age and sex the odd ratios decreased to 1.93 (95% CI=1.93, 2.61) for 1 year of poverty and 2.67 (95% CI=1.83, 3.90) for 2 years of poverty.

Table 1. Distributions of Age and Sex Among Native Hawaiians and Pacific Islanders and disaggregated Asian subgroups, CPS 2010-2019

| Ethnicity | N | Age Group in Years | | | | Sex | |
|---|---|---|---|---|---|---|---|
| | | 18 to 24 | 25 to 39 | 40 to 64 | 65 plus | Male | Female |
| Chinese | 1174 | 8.7% | 29.1% | 42.4% | 19.8% | 54.0% | 46.0% |
| Asian Indian | 972 | 4.5% | 44.4% | 42.2% | 8.8% | 73.3% | 26.7% |
| Filipino | 857 | 3.0% | 23.4% | 52.6% | 21.0% | 47.0% | 53.0% |
| Japanese | 623 | 2.1% | 20.4% | 46.2% | 31.4% | 55.0% | 45.0% |
| Korean | 432 | 5.1% | 32.2% | 47.1% | 15.6% | 53.4% | 46.6% |
| Vietnamese | 462 | 7.2% | 27.2% | 49.8% | 15.8% | 60.6% | 39.4% |
| Other Asian | 792 | 8.4% | 38.0% | 43.0% | 10.5% | 59.6% | 40.4% |
| NHPI | 643 | 4.6% | 43.7% | 41.7% | 10.0% | 56.4% | 43.6% |

CPS = Current Population Survey and NHPI =Native Hawaiians and Pacific Islanders. N's are unweighted; percentages are weighted percentages.

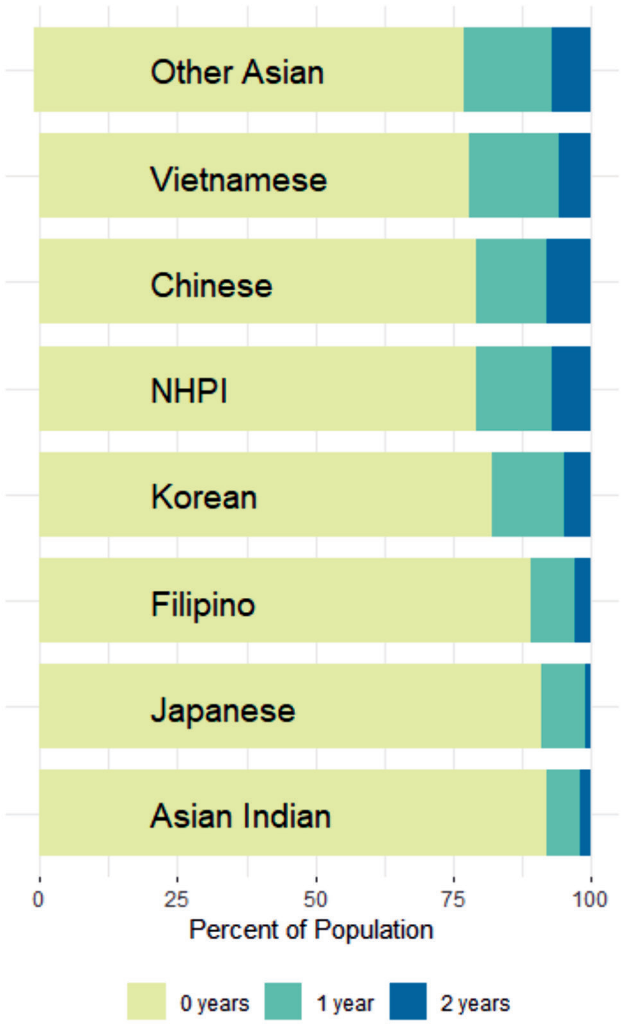

Figure 2. In Poverty 0 Years, 1 Year, or 2 Years by Native Hawaiian/Pacific Islander (NHPI) and Asian Ethnicities Current Population Survey (2010-2019)

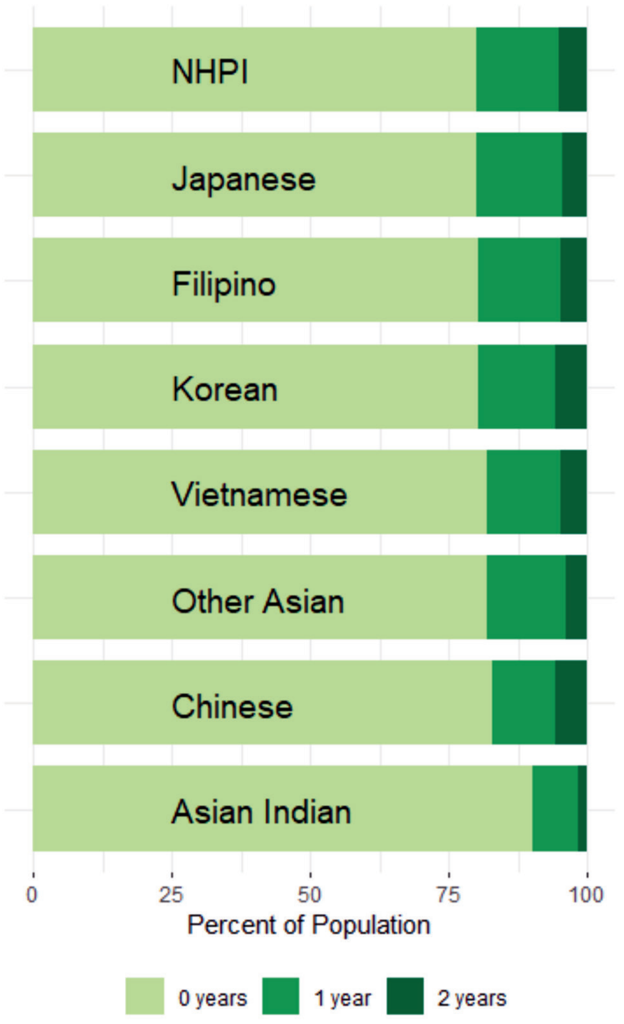

Figure 3. Native Hawaiian/Pacific Islander (NHPI) and Asian Ethnicities in Fair/Poor Health 0 Years, 1 year, or 2 years Current Population Survey (2010-2019)

Table 2. Odds Ratios Relative to Native Hawaiians and Pacific Islanders for Reporting Being in Poverty by Asian Ethnicities, CPS, 2010-2019

| Ethnicity | Years in poverty | N | Unadjusted Results | | | Age-, Sex-adjusted Results | | |
|---|---|---|---|---|---|---|---|---|
| | | | Odds Ratio | 95% CI | *P* value | Odds Ratio | 95% CI | *P* value |
| Chinese | 1 year | 151 | 0.97 | (0.65, 1.46) | .90 | 0.87 | (0.58, 1.33) | .53 |
| | 2 years | 84 | 1.08 | (0.64, 1.81) | .77 | 0.91 | (0.54, 1.53) | .71 |
| Asian Indian | 1 year | 64 | 0.41 | (0.26, 0.65) | < .001 | 0.45 | (0.28, 0.71) | .001 |
| | 2 years | 21 | 0.24 | (0.12, 0.46) | < .001 | 0.27 | (0.13, 0.53) | < .001 |
| Filipino | 1 year | 68 | 0.54 | (0.34, 0.86) | .01 | 0.50 | (0.31, 0.82) | .005 |
| | 2 years | 25 | 0.37 | (0.19, 0.73) | .004 | 0.33 | (0.16, 0.68) | .002 |
| Japanese | 1 year | 54 | 0.51 | (0.30, 0.85) | .01 | 0.47 | (0.27, 0.80) | .005 |
| | 2 years | 7 | 0.18 | (0.05, 0.58) | .004 | 0.16 | (0.05, 0.52) | .002 |
| Korean | 1 year | 50 | 0.92 | (0.55, 1.52) | .73 | 0.88 | (0.52, 1.48) | .63 |
| | 2 years | 21 | 0.71 | (0.34, 1.47) | .35 | 0.67 | (0.32, 1.41) | .29 |
| Vietnamese | 1 year | 61 | 1.21 | (0.72, 2.04) | .47 | 1.20 | (0.72, 1.99) | .49 |
| | 2 years | 33 | 0.91 | (0.51, 1.64) | .77 | 0.87 | (0.47, 1.63) | .67 |
| Other Asian | 1 year | 110 | 1.18 | (0.77, 1.81) | .45 | 1.14 | (0.74, 1.78) | .56 |
| | 2 years | 45 | 0.98 | (0.54, 1.78) | .96 | 0.93 | (0.51, 1.68) | .80 |

CPS = Current Population Survey and CI = Confidence Interval.
Participants were followed for 2years. Outcome categories were being in poverty 1 or 2 of the years relative to neither year (0 years). Odds ratios give the odds of Asian ethnicities relative to Native Hawaiians and Pacific Islanders for 1 or 2 years of poverty relative to being in poverty neither year. As example, among participants of the same age and sex Asian Indians have 0.41 the odds of poverty compared to Native Hawaiians in 1 of the 2 years and 0.24 the odds of being in poverty both years.

Table 3. Odds Ratios Relative to Native Hawaiians and Pacific Islanders for Reporting Being in Fair/Poor Health by Asian Ethnicities, CPS 2010-2019.

| Ethnicity | Years in Fair/ poor Health | N | Unadjusted Results | | | Age-, Sex-adjusted Results | | |
|---|---|---|---|---|---|---|---|---|
| | | | Odds Ratio | 95% CI | *P* value | Odds Ratio | 95% CI | *P* value |
| Chinese | 1 year | 148 | 0.74 | (0.52, 1.04) | .08 | 0.56 | (0.39, 0.81) | .002 |
| | 2 years | 68 | 1.09 | (0.53, 2.22) | .82 | 0.69 | (0.32, 1.48) | .34 |
| Asian Indian | 1 year | 86 | 0.47 | (0.32, 0.68) | < .001 | 0.48 | (0.33, 0.71) | < 0.001 |
| | 2 years | 20 | 0.30 | (0.13, 0.67) | .003 | 0.31 | (0.13, 0.71) | .006 |
| Filipino | 1 year | 142 | 0.98 | (0.69, 1.40) | .91 | 0.67 | (0.46, 0.98) | .04 |
| | 2 years | 49 | 0.96 | (0.45, 2.04) | .91 | 0.52 | (0.23, 1.17) | .11 |
| Japanese | 1 year | 101 | 0.98 | (0.65, 1.48) | .92 | 0.59 | (0.38, 0.91) | .02 |
| | 2 years | 36 | 0.89 | (0.38, 2.07) | .78 | 0.38 | (0.16, 0.94) | .04 |
| Korean | 1 year | 64 | 0.90 | (0.59, 1.37) | .62 | 0.75 | (0.48, 1.16) | .29 |
| | 2 years | 32 | 1.17 | (0.53, 2.56) | .70 | 0.84 | (0.37, 1.93) | .68 |
| Vietnamese | 1 year | 73 | 0.86 | (0.57, 1.28) | .45 | 0.71 | (0.47, 1.08) | .11 |
| | 2 years | 24 | 0.99 | (0.44, 2.21) | .98 | 0.67 | (0.29, 1.54) | .34 |
| Other Asian | 1 year | 111 | 0.90 | (0.62, 1.31) | .58 | 0.88 | (0.60, 1.31) | .54 |
| | 2 years | 42 | 0.77 | (0.36, 1.64) | .50 | 0.73 | (0.33, 1.62) | .44 |

CPS = Current Population Survey and CI = Confidence Interval.
Participants were followed for 2 years. Outcome categories were being in fair or poor health 1 or 2 of the years relative to neither year (0 years). Odds ratios give the odds of fair/poor health of Asian Ethnicities relative to Native Hawaiians and Pacific Islanders. As example, among participants of the same age and sex Asian Indians have 0.47 the odds of being in fair/poor health compared to Native Hawaiians in 1 of the 2 years and 0.30 the odds of being in poverty both years.

Table 4. Relation of Living in Poverty with Fair/Poor Health in the Second Year, Adjusted for Age and Sex, CPS 2010-2019

| Variable | Category | Odds Ratio (95% confidence interval) | | | |
|---|---|---|---|---|---|
| | | Odds Ratio | Lower CI | Upper CI | *P* value |
| Sex | Male | 1 | | | |
| | Female | 1.35 | 1.15 | 1.59 | < .001 |
| Age | 28-24 years | 1 | | | |
| | 25-34 years | 1.83 | 0.92 | 3.67 | .09 |
| | 35-54 years | 5.55 | 2.84 | 10.85 | < .001 |
| | 65 years and older | 17.27 | 8.83 | 33.77 | < .001 |
| Poverty | In poverty 0 years | 1 | | | |
| | In poverty 1 year | 1.95 | 1.54 | 2.46 | < .001 |
| | In poverty both study years | 3.28 | 2.44 | 4.39 | < .001 |

CPS = Current Population Survey and CI = Confidence Interval.

## Discussion

The results showed with longitudinal data the percentage of Asian and NHPI who lived in poverty for 1 or 2 of the study years. The proportion in poverty for 1or both years differed greatly among Asian subgroups. Chinese had poverty rates similar to NHPI, which were considerably higher than those of Japanese and Asian Indians. Poverty rates for Filipinos fell in between the 2 groups. NHPI experienced high levels of poverty both for 1 of the 2 years observed, as well as sustained poverty across the 2 study years. For both Chinese and NHPI, poverty persisted over 2 years for over 7% of the population.

The unadjusted proportions reflect the levels of poverty and fair/poor health in the community. Asian ethnicities differed both in levels of poverty and in health status. Prevalence, however, may differ by the age distribution of the populations. Disparities are better measured after age/sex-adjustment. NHPI differed from most Asian ethnicities before and after age-sex adjustment. For fair/poor health, significant results comparing Korean and Japanese to NHPI were only apparent after age-sex adjustment. The results underscore why disaggregated data is critical to understand ethnic differences in poverty and health. These data are important for health planning, such as knowing how many health facilities are needed.

Previous studies have highlighted the heterogeneity in risks of Asian ethnicities. A 2017 study by the National Bureau of Economic Research examining race and income inequality reported the income distribution of among Asians is bimodal: Asian ethnicities were at both the top and bottom 10% of income.[27] A study of Asians in California reported heterogeneity in the health risks across Asian subgroups.[28] Vietnamese had the poorest self-reported health; Filipinos had the most disparities, and every Asian subgroup had at least 1 disparity that was masked by aggregation. A study of the neighborhoods of Chinese and Vietnamese immigrants reported they tend to live in ethnic enclaves; and that poverty was high whereas health literacy was low. Age and health adjustment in regression models helped uncover differences in health.[29] A study of older Chinese immigrants observed that the migrants reported difficulty in reading health information and low health literacy overall.[30] These results emphasize the importance of disaggregating NHPI and Asian ethnic subgroups.

### Limitations and Strengths

A primary limitation of this study is the aggregation of NHPI. Further disaggregation would have enhanced the specificity of the results for Asian and Pacific Islander subgroups. A second limitation of the study is that health is self-reported and not assessed clinically, although self-reported health has strong associations with health, ranging from functional status to cardiovascular disease to mortality.[31-35] Selection bias could occur for a variety of reasons: the head of the household might not provide equally accurate information on all household members; participation in the follow-up survey could be biased from self-selection; and information reported might be selective in some instances. Certain analyses are limited and might be extended in future analyses. Subgroups could be studied such as people living in different geographical regions and ethnic subgroups could be stratified by social determinants to study the strength of relationships between poverty and health.

The CPS is the national standard on levels of poverty, and using poverty data from the CPS as an outcome is a strength. The 2 years of follow-up is a strength, but more years would be better to examine how frequently people may experience spells of poverty as opposed to experiencing poverty long-term. The same consideration applies to understanding bouts of fair/poor health as opposed to more chronic health conditions.

## Conclusion

NHPI and 6 Asian ethnicities and an Other Asian category varied by both levels of poverty and self-reported health. Persistent poverty had a greater effect on health than a single year of poverty. Shifts in and out of poverty might occur for people living close to the poverty lines, or due to acute events such as a job loss. Future studies should consider the duration of poverty when examining social determinants of health. Of the Asian ethnicities, Asian Indians, Filipinos, and Japanese were significantly less likely to be in poverty than NHPI whereas Chinese, Vietnamese, and Koreans were not. The results emphasize the substantial differences among NPHI and disaggregated Asian ethncities and stress the importance of having disaggregated ethnic results for research, health planning, and policy.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Impact of More Detailed Measures of Disease Severity on Racial Disparities in Cardiac Surgery Mortality among Native Hawaiians and Pacific Islanders

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## Abstract

*Studies that examine racial disparities in health outcomes often include analyses that account or adjust for baseline differences in co-morbid conditions. Often, these conditions are defined as dichotomous (Yes/No) variables, and few analyses include clinical and/or laboratory data that could allow for more nuanced estimates of disease severity. However, disease severity – not just prevalence – can differ substantially by race and is an underappreciated mechanism for health disparities. Thus, relying on dichotomous disease indicators may not fully describe health disparities. This study explores the effect of substituting continuous clinical and/or laboratory data for dichotomous disease indicators on racial disparities, using data from the Queen's Medical Center's (QMC) cardiac surgery database (a subset of the national Society of Thoracic Surgeon's cardiothoracic surgery database) as an example case. Two logistic regression models predicting in-hospital mortality were constructed: (I) a baseline model including race and dichotomous (Yes/No) indicators of disease (diabetes, heart failure, liver disease, kidney disease), and (II) a more detailed model with continuous laboratory values in place of the dichotomous indicators (eg, including Hemoglobin A1c level rather than just diabetes yes/no). When only dichotomous disease indicators were used in the model, Native Hawaiian and other Pacific Islander (NHPI) race was significantly associated with in-hospital mortality (OR: 1.57[1.29,2.47], P=.04). Yet when the more specific laboratory values were included, NHPI race was no longer associated with in-hospital mortality (OR: 1.67[0.92,2.28], P=.28). Thus, researchers should be thoughtful in their choice of independent variables and understand the potential impact of how clinical measures are operationalized in their research.*

## Keywords

*Dichotomous Indicators, Risk Modeling, Prediction, Disparities, Statistical Methods*

## Abbreviations

*ANOVA = analysis of variance*
*BMI = body mass index*
*HbA1c = hemoglobin A1c*
*LVEF = left ventricular ejection fraction*
*NHPI = Native Hawaiian and Pacific Islander*
*OR = odds ratio*
*QMC = Queen's Medical Center*
*STS = Society of Thoracic Surgeons*

## Introduction

Nearly 40 years since the US Department of Health and Human Services' landmark report highlighting racial and ethnic health disparities,[1] Native Hawaiian and other Pacific Islanders (NHPI) continue to bear a disproportionate burden of disease and adverse health outcomes. Compared with the rest of Hawai'i's population, NHPI have higher rates of chronic diseases, including heart disease, stroke, cancer, diabetes, and obesity, as well as longer hospital stays, poorer quality of life, and shorter life expectancy.[2]

Disease severity is a recognized, but underappreciated factor in health disparities. While NHPI have more chronic disease, several studies have noted that NHPI also have more severe disease.[3-6] Yet studies on disparities often consider comorbidities as dichotomous variables.[7-10] For instance, patients are usually categorized as either having diabetes or not. Even when more specific factors such as hemoglobin A1c (HbA1c) levels are available, they are dichotomized into 2 groups (eg, >6.5% or <6.5%) for ease of comparison. This operationalization of comorbid conditions is common in administrative datasets, allows for results that are more easily translated to clinical practice, and lends itself to simpler statistical analysis. However, this practice comes at the cost of loss of detail and potentially reduces the accuracy and precision of findings.

As an example, consider the following 2 patients: (1) A 46-year-old man with body mass index (BMI) of 30 and HbA1c of 6.6%, and (2) a 36-year-old man with BMI of 45 and HbA1c of 12.4%. Clinically, these patients likely have significantly different care needs and risk for a variety of complications. In fact, the first patient may be more similar to a non-obese, non-diabetic patient than to the second patient. However, dichotomous classification would group these 2 patients together and draw inferences from their combined data.

While previous studies have described the additional power gained by using continuous rather than dichotomous variables, this concept has not been consistently applied in research on health disparities. Many studies on health disparities utilize multivariable regression analyses in their work. This allows researchers to observe disparities on a population level and then use multivariable regression models to control for or explore potential mechanisms by adding risk factors, socioeconomic measures, and other variables as model coefficients. If race is still significant in the model after potential confounders and risk factors are included, researchers understand that there are lingering pathways through which disparities influence the outcome in question.[11,12] Underpowered or underspecified models thus hinder the ability to explore these issues, and it may be important to include more than just dichotomous disease indicators.

The purpose of this study is to better understand the extent to which racial/ethnic disparities are related to disease severity. The team uses the Queen's Medical Center's (QMC) cardiac surgery database as an example case, illustrating the difference in in-hospital mortality when different markers of disease are used and then considering the effects – if any – that these results have on the conclusions.

## Methods

### Study Design

The study is a secondary analysis of data collected for clinical and research purposes. It aims to serve as an illustrative example, rather than a precise description of in-hospital mortality following cardiac surgery. Discussions on the clinical applications of these data can be found elsewhere.[6,13]

### Database

Data are from the cardiac surgery registry at QMC, which is a tertiary care, 500-bed, university-affiliated hospital in Honolulu, Hawai'i. This registry contains data on all cardiac surgeries performed from 2009 to 2020. Data were collected by trained nurse abstractors who performed detailed reviews of the medical record and assembled prospective patient-level data for each case using standard definitions and protocols outlined by the Society of Thoracic Surgeons (STS).[13]

Data on all cardiac surgeries performed from 2009-2020 in adults ≥18 years old were include in this study. Cases that were missing data on race were excluded, and the study population was limited to patients who were identified in our data as Asian, White, or NHPI (97.8% of the surgical population).

### Sample

A total of 5097 cardiothoracic surgeries were conducted between 2009 and 2020. Fourteen surgeries were missing data on race or were among patients not classified as Asian, White, or NHPI, and an additional 32 were missing at least 1 disease indicator variable. Thus, the study population included 5051 surgeries in 5011 patients.

Less than 1% of records were missing laboratory values such as HbA1c, Left Ventricular Ejection Fraction (LVEF) and serum creatinine, and 1.5% were missing serum albumin. Given this small number, missing lab values were imputed using multiple imputations with the available data serving as predictors.

### Dependent Variable

In-hospital mortality was extracted from the medical chart at the time of data entry into the registry, as per standard STS protocols. It is defined as death prior to discharge, however long the hospital stay.

### Independent Variables

Independent variables included 5 common co-morbid conditions that are highly related to related to cardiovascular mortality: diabetes, heart failure, liver disease, kidney disease, and obesity. Each condition was included in the cardiac database as a "Yes/No" variable, except for diabetes, which had 5 categories based on treatment type. Diabetes was transformed into a "Yes/No" variable by defining the presence of diabetes to include patients treated with diet and/or medical therapy. Age and sex were included as additional covariates.

Severity was operationalized using laboratory values for HbA1c for diabetes, serum albumin for liver disease, and serum creatinine for renal disease. LVEF was used for heart failure and BMI for obesity.

### Analytic Strategy

Chi-square analyses were used to identify differences in categorical variables between NHPI, Asian and White patients with follow up 2-by-2 analysis with White patients as reference if the 3-way results were significant. Continuous variables were analyzed with 3-way Analysis of Variance (ANOVA) with follow up Welch T-tests with White patients as reference if results were significant.

Two multivariable logistic regression models[14] predicting in-hospital mortality were constructed: (I) a baseline model including race, age, sex and dichotomous (Yes/No) indicators for the 5 co-morbid conditions (diabetes, heart failure, liver disease, kidney disease and obesity), and (II) a more detailed model with continuous laboratory values for diabetes (HbA1C), liver disease (albumin) and renal disease (creatinine), and measures of heart failure (LVEF) and obesity (BMI) in place of the dichotomous indicators. In both models, the primary measure of interest was the significance of the coefficient for NHPI race, with White race as a reference group. Sensitivity analyses were conducted to compare the results of models using the imputed data with models that used only patients with complete data. If there were no significant differences and unless otherwise specified, all results presented are from models built on imputed data.[15]

All analysis was conducted using R statistical software, version 4.0.5 (R Core team, Vienna, Austria). Results were considered statistically significant if the *P*-value was less than an $\alpha = .05$. Unless otherwise specified, model coefficients are presented as odds ratios [95% confidence intervals]. This study was approved the QMC Institutional Review Board.

## Results

The distribution of races in the study population is similar to the distribution of races in the state's general population,[16] with 50.1% Asians, 25.1% NHPI, 22.6% White. NHPI were significantly younger (mean age: 60.0 years for NHPI vs 65.9 for Asian and 65.8 for White patients) and more likely to be female (31.3% for NHPI vs 26.8% for Asian and 21.6% for White patients). They were also significantly more likely to receive coronary artery bypass surgeries (76.3%) and aortic valve replacements than White patients (67.4%, **Table 1**).

NHPIs had a higher prevalence than Whites of diabetes (61.5% vs 32.4%), heart failure (37.1% vs 26.4%), kidney disease (9.96% vs 0.94%) and obesity (58.6% vs 34.7%). These prevalences also were significantly greater than Asian patients (**Table 2**). Compared with White patients, NHPIs had more severe diabetes (HbA1C: 7.2% vs 6.6%, $P<.001$), heart failure (LVEF: 50% vs 52%, $P=.027$), liver disease (albumin: 3.9 mg/dL vs 4.1 mg/dL, $P<.001$), kidney disease (creatinine: 1.8 mg/dL vs 1.5 mg/dL, $P=.028$), and obesity (BMI: 31.6 vs 27.3, $P<.001$).

There were no differences in unadjusted in-hospital mortality by race (White: 2.31%, Asian: 2.40%, NHPI: 2.20%). When only dichotomous disease indicators were used in the model, NHPI race was significantly associated with an increased in-hospital mortality (OR: 1.57 [1.29, 2.47], $P=.04$) (**Table 3**). Ultimately, this trend disappeared when more specific continuous lab values were included, with NHPI race was no longer associated with in-hospital mortality (OR: 1.67 [0.92, 2.28], $P=.28$).

## Discussion

Studies that examine racial/ethnic disparities in health outcomes often rely on administrative data, which usually operationalize co-morbid conditions as dichotomous (yes/no) variables. These findings suggest that analyses that include more detailed measures of severity may produce different results than more generalized ones. In this study, NHPI who underwent cardiac surgery had significantly higher odds of in-hospital mortality when compared to White patients when dichotomous indicators of co-morbid conditions were used, but had similar odds of mortality when severity of co-morbid conditions was considered.

The value of augmenting administrative data with a parsimonious set of clinical laboratory data to enhance predictions of in-hospital mortality has been reported.[7,8] For example, Hanchate and colleagues found that adding laboratory data and vital signs to administrative data from the Veterans Health Administration, significantly improved hospital performance profiles on 30-day mortality, although it had limited effect on 30-day readmission and other hospital quality measures.[8] Similarly, an earlier study reported that augmenting statewide hospital administrative discharge data significantly improved the model prediction for inpatient mortality.[7] The current study extends these findings by demonstrating the impact of additional clinical data on estimates of racial/ethnic health disparities in Hawai‘i.

On its face value, the results make sense. While NHPI carry a greater burden of cardiovascular refactors, they also typically present with more advanced disease, including more severe diabetes,[3,4] obesity, and renal insuffiency.[5] These findings suggest that disparities in NHPI in-hospital mortality following cardiac surgery may be partly explained by the severity of co-morbid conditions rather than their presence as a diagnosis per se.

This work has 2 major implications. First, studies that examine NHPI health disparities may need to consider the implications of using co-morbidity diagnoses vs. measures of co-morbidity severity as potential confounders in regression models. Second, while measures of co-morbidity severity may better account for racial/ethnic health disparities – indeed, NHPI and Whites had similar in-hospital mortality once co-morbidity severity was examined– this does not imply that racial/ethnic disparities no longer exist. Indeed, the National Institute of Minority Health and Health Disparities health disparities framework nicely connects domains and levels of influence to factors that may influence racial/ethnic differences in health-related behaviors and risk factors for disease.[17]

This study is subject to several limitations. First, it was limited to patients who underwent cardiac surgery at a single hospital in Hawai‘i, and the results may not be generalizable to other institutions or to other health conditions. Second, the analytic approach assumed that the laboratory and clinical values were independent, linear, and normally distributed, which may not be valid. The authors chose this approach given the size of the study population and to aid in the interpretability of the study findings. Finally, the measures of co-morbidity severity may not have been ideal. Other measure of liver function (eg, aspartate transaminase, alanine transaminase), diabetes severity (eg, insulin resistance), renal function (eg, glomerular filtration rate), and heart failure (eg, left ventricular strain) were not available.

In conclusion, greater disease detail obtained using laboratory values can affect results when exploring racial disparities. While further research should expand these findings to other clinical scenarios and with better specified modeling, researchers should be cognizant of disease severity as a means through which disparities can affect health outcomes.

Table 1. Population Demographics of Cardiac Surgery Patients at the Queens Medical Center, 2009-2020

| | Total | Asian | Native Hawaiian or Pacific Islander | White | P-value |
|---|---|---|---|---|---|
| Total (n [%]) | 5051 | 2526 [50.1] | 1268 [25.1] | 1257 [22.6] | |
| Age (years + SD) | 64.4 ± 11.3 | 65.9 ± 11.3 | 60.0 ± 11.0 | 65.8 ± 10.3 | <.001 |
| Female (%) | 26.9 | 26.8 | 31.3 | 21.6 | <.001 |
| Mortality (%) | 3.0 | 3.1 | 3.3 | 2.6 | <.001 |
| **Procedure** | | | | | |
| Coronary Artery Bypass Graft (%) | 72.6 | 73.9 | 76.3 | 67.4 | <.001 |
| Aortic Valve Replacement (%) | 11.7 | 10.6 | 8.6 | 16.7 | <.001 |
| Other (%) | 15.7 | 15.5 | 15.1 | 15.9 | .141 |

SD=standard deviation. *P*-values were calculated using Welch t-tests for age, chi-squared for female sex, and Fisher Exact tests for mortality.

Table 2. Comorbid Disease Prevalence and Severity by Race among QMC Cardiac Surgery Patients, 2009-2020

| | White | Asian | NHPI |
|---|---|---|---|
| **Diabetes** | | | |
| Yes, % | 32.4 | **53.3** | **61.5** |
| *P*-value | | *P*=<.001 | *P*=<.001 |
| Hemoglobin A1c, mean ± SD | 6.31 ± 1.56 | **6.74 ± 1.49** | **7.20 ± 1.86** |
| *P*-value | | *P*=<.001 | *P*=<.001 |
| **Heart Failure** | | | |
| Yes, % | 26.4 | 26.8 | **37.1** |
| *P*-value | | *P*=.61 | *P*=<.001 |
| LVEF, mean ± SD | 51.5 ± 12.4 | 52.8 ± 12.5 | **50.5 ± 12.0** |
| *P*-value | | *P*=.072 | *P*=.027 |
| **Liver Disease** | | | |
| Yes, % | 5.21 | **3.82** | **3.69** |
| *P*-value | | *P*=<.001 | *P*=<.001 |
| Albumin, mean ± SD | 4.12 ± 0.33 | 4.10 ± 0.52 | **3.93 ± 0.50** |
| *P*-value | | *P*=.68 | *P*<.001 |
| **Renal Insufficiency** | | | |
| Yes, % | 0.94 | **8.03** | **9.96** |
| *P*-value | | *P*<.001 | *P*<.001 |
| Creatinine, mean ± SD | 1.06 ± 0.84 | 1.64 ± 2.11 | 1.81 ± 2.29 |
| *P*-value | | *P*<.001 | *P*=.028 |
| **Obesity** | | | |
| Yes, % | 34.7 | **22.6** | **58.6** |
| *P*-value | | *P*<.001 | *P*<.001 |
| Body Mass Index, mean ± SD | 28.0 ± 5.67 | 27.0 ± 5.11 | **31.6 ± 6.4** |
| *P*-value | | *P*=.12 | *P*<.001 |

LVEF = Left Ventricular Ejection Fraction; NHPI = Native Hawaiian and Pacific Islanders; QMC = Queens Medical center; SD = Standard Deviation. *P*-values were calculated using chi-squared tests for dichotomous indicators and t-tests for laboratory supplementation. In all cases, values for White patients were used as comparison groups. Bold text indicates a coefficient estimate that is significantly different than 0, at an alpha of .05.

Table 3. Comparison of In-Hospital Cardiac Surgery Mortality Logistic Regression Models Using Dichotomous Disease Indicators vs Supplementation with Laboratory Data

| | **Model Coefficient** | |
|---|---|---|
| | **Dichotomous Disease Indicators OR [95% CI], *P*-value** | **Continuous Laboratory Indicators OR [95% CI], *P*-value** |
| **Race** | | |
| NHPI | **1.57 [1.29, 2.47], *P*=.04** | 1.67 [0.92, 2.28], *P*=.28 |
| Asian | 0.55 [0.16, 1.54], *P*=.30 | 0.24 [0.01, 1.36], *P*=.19 |
| White | 1 | 1 |
| **Diabetes** | | |
| Diabetes | 1.84 [0.60, 0.5.16], *P*=.26 | |
| A1c | | 1.18 [0.91, 1.03], *P*=.17 |
| **Heart Failure** | | |
| Heart Failure | 1.91 [0.91, 3.97], *P*=.08 | |
| LVEF | | 0.99 [0.95, 1.03], *P*=.62 |
| **Liver Disease** | | |
| Liver Disease | 0.98 [0.96, 1.02], *P*=.17 | |
| Albumin | | **0.22 [0.09, 0.50], *P*=<.001** |
| **Kidney Disease** | | |
| Kidney Disease | **4.12 [1.65, 9.63], *P*=.001** | |
| Creatinine | | **1.19 [1.02, 1.36], P=.019** |
| **Obesity** | | |
| Obesity | **.35 [0.11, 0.95], *P*=.048** | |
| BMI | | **0.88 [0.77, 0.99], *P*=.037** |

NHPI = Native Hawaiian and Pacific Islanders; A1c = Hemoglobin A1c; LVEF = Left Ventricular Ejection Fraction; BMI = Body Mass Index.
Model coefficients are displayed as Odds Ratio [95% Confidence Interval], with *P*-values in parentheses below based on a logistic regression model coefficients with significance determined by a Welch t-test. "No disease" is the reference group for the conditions. In the continuous laboratory models, the lab value or BMI was included in the model instead of the dichotomous disease indicator. Bold text indicates a coefficient estimate that is significantly different than 0, at an alpha of .05.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Age and Sex Distributions of 31 Common Racial Groups in Hawai‘i: A Shiny Web Application

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## Abstract

*Hawai‘i is the most ethnically diverse state with the highest proportion of multiracial individuals in the United States. The Stepwise Proportional Weighting Algorithm (SPWA) was developed to bridge the categorization of multiracial Census data into single-race population estimates for common races in Hawai‘i. However, these estimates have not been publicly available. A Shiny web application, the Hawai‘i Single-Race Categorization Tool, was developed as a user friendly research tool to obtain the age and sex distributions of single-race estimates for common racial groups in Hawai‘i. The Categorization Tool implements the SPWA and presents the results in tabular and graphic formats, stratified by sex and age. It also allows the categorization of partial Native Hawaiians as Native Hawaiians in the population estimation. Using this tool, the current paper reports population estimates and distributions for 31 common racial groups using Hawai‘i Census 2010 data. Among the major Census races, Asian had the largest population (631 881; 46.5%) in Hawai‘i, followed by White (431 635; 31.7%) and Native Hawaiian and Other Pacific Islander (227 588; 16.7%). Among Census detailed races within Asian, Filipino had the largest population estimate (244 730; 18.0%), followed by Japanese (227 165; 16.7%) and Chinese (103 600; 7.6%). Native Hawaiian accounted for 12.3% of the Hawai‘i population (166 944). After recategorizing part-Native Hawaiians as Native Hawaiians, Native Hawaiian increased by 150.0%, with the greatest increase among the young. This publicly available tool would be valuable for race-related resource allocation, policy development, and health disparities research in Hawai‘i.*

## Keywords

*Hawai‘i, censuses, population estimation, racial group, Shiny App*

## Abbreviations

*AIAN = American Indian or Alaskan Native*
*NH = Native Hawaiian*
*NHOPI = Native Hawaiian or Other Pacific Islander*
*Shiny App = Shiny web application*
*SPWA = Stepwise Proportional Weighting Algorithm*
*SOR = Some Other Race*

## Introduction

In 1997, the Office of Management and Budget made revisions to the Census, allowing respondents to choose multiple racial categories.[1] This change in racial reporting has made the data from the 2000 and 2010 censuses incomparable to prior ones. Single-race population estimates are essential for race-related resource allocation and policy making, health statistics reporting, and disparities research.

The Stepwise Proportional Weighting Algorithm (SPWA) was developed as a multi-race to single-race bridging method to generate single-race population estimates using multi-race Census data.[2] The algorithm allocates proportions of the multiracial population to their respective single races to create populations of individuals who are only 1 race. The resulting estimates would allow the potential comparison of single-race data collected before 2000 to the multi-race data collected afterward.

Although single-race data can be retrieved from the Centers of Disease Control and Prevention's WONDER database, the estimates are only provided for the 6 Census major races.[3] Due to Hawai‘i's ethnically diverse population, it faces the unique challenge of obtaining single-race estimates for Census detailed races such as Native Hawaiian (NH), Filipino, or Japanese. Additionally, multi-race NHs are often classified as NH in vital and hospital records in Hawai‘i, which further complicates the population estimation for Hawai‘i. This paper uses the term *partial NH adjustment* to describe the reclassification of multi-race NH as NH.

To the authors' knowledge, there are no publicly available data on single-race population estimates for most of Hawai‘i‘s common racial groups. The purpose of this study is to estimate the age and sex distributions for 31 common racial groups in Hawai‘i. The *Hawai‘i Single-Race Population Categorization Tool,* a *Shiny* web application Version 1.7.4 (Posit.PBC, Boston, MA), was developed to implement the SPWA. This paper describes the capabilities of the *Categorization Tool,* including its user input interface and table and graph outputs for selected common racial groups with specific age and sex stratifications. The population estimation results of the 31 most common racial groups in Hawai‘i is presented, and the age and sex distributions of some of the major Hawai‘i racial groups are also discussed.

## Methods

### Data

This study used the 2010 State of Hawai‘i Census data, which included racial counts stratified by age and sex.[4] The structure of Census major and detailed race categories are listed in the first column of **Table 1**. This list of 31 common racial groups in Hawai‘i included the 6 major Census racial categories (Level-1): Asian, White, Native Hawaiian and Other Pacific Islander (NHOPI), Black, American Indian and Alaska Native (AIAN),

Table 1. Single-Race Population Estimates by Sex and Age Groups for Common Racial Groups in the State of Hawai‘i: Estimated from the 2010 Census Data using the Stepwise Proportional Weighting Algorithm

| | **Total** | **%[a]** | **Male** | **Female** | **Female %** | **0-18 years** | **%[b]** | **19-64 years** | **%[b]** | **≥65 years** | **%[b]** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level-1 racial groups** | | | | | | | | | | | |
| Asian | 631 881 | 46.5 | 298 836 | 333 045 | 52.7 | 131 105 | 20.7 | 381 053 | 60.3 | 119 724 | 18.9 |
| White | 431 635 | 31.7 | 229 010 | 202 624 | 46.9 | 88 708 | 20.6 | 287 636 | 66.6 | 55 290 | 12.8 |
| NHOPI[c] | 227 588 | 16.7 | 115 022 | 112 566 | 49.5 | 79 330 | 34.9 | 131 532 | 57.8 | 16 726 | 7.3 |
| Black[d] | 28 595 | 2.1 | 17 053 | 11 543 | 40.4 | 8996 | 31.5 | 18 562 | 64.9 | 1037 | 3.6 |
| Some Other Races | 24 195 | 1.8 | 12 974 | 11 221 | 46.4 | 6933 | 28.7 | 15 753 | 65.1 | 1508 | 6.2 |
| AIAN[e] | 16 407 | 1.2 | 8348 | 8059 | 49.1 | 5656 | 34.5 | 9899 | 60.3 | 853 | 5.2 |
| **Level-2 racial groups within Asian** | | | | | | | | | | | |
| Filipino | 244 730 | 18.0 | 118 795 | 125 935 | 51.5 | 62 341 | 25.5 | 150 443 | 61.5 | 31 946 | 13.1 |
| Japanese | 227 165 | 16.7 | 106 255 | 120 910 | 53.2 | 32 869 | 14.5 | 131 363 | 57.8 | 62 934 | 27.7 |
| Chinese | 103 600 | 7.6 | 49 474 | 54 126 | 52.2 | 24 285 | 23.4 | 61 968 | 59.8 | 17 347 | 16.7 |
| Korean | 32 276 | 2.4 | 13 241 | 19 035 | 59.0 | 6160 | 19.1 | 20 892 | 64.7 | 5223 | 16.2 |
| Vietnamese | 10 910 | <1.0 | 5052 | 5858 | 53.7 | 2659 | 24.4 | 7306 | 67.0 | 945 | 8.7 |
| Okinawan | 3465 | <1.0 | 1657 | 1808 | 52.2 | 687 | 19.8 | 2204 | 63.6 | 575 | 16.6 |
| Asian Indian | 3057 | <1.0 | 1585 | 1471 | 48.1 | 647 | 21.2 | 2127 | 69.6 | 283 | 9.3 |
| Thai | 2540 | <1.0 | 797 | 1743 | 68.6 | 489 | 19.3 | 1899 | 74.8 | 152 | 6.0 |
| Laotian | 2085 | <1.0 | 1002 | 1083 | 51.9 | 528 | 25.3 | 1401 | 67.2 | 156 | 7.5 |
| Indonesian | 596 | <1.0 | 247 | 350 | 58.7 | 123 | 20.6 | 401 | 67.3 | <100 | 12.2 |
| Cambodian | 541 | <1.0 | 249 | 292 | 54.0 | 138 | 25.5 | 383 | 70.8 | <100 | 3.7 |
| Burmese | 227 | <1.0 | 113 | 113 | 49.9 | <100 | 18.9 | 163 | 71.8 | <100 | 9.3 |
| Pakistani | 216 | <1.0 | 132 | <100 | 38.9 | <100 | 26.9 | 146 | 67.6 | <100 | 5.6 |
| Sri Lankan | 201 | <1.0 | 109 | <100 | 45.8 | <100 | 17.4 | 140 | 69.7 | <100 | 12.9 |
| Mongolian | 140 | <1.0 | <100 | <100 | 55.2 | <100 | 14.3 | 105 | 80.0 | <100 | 5.7 |
| Nepalese | 132 | <1.0 | <100 | <100 | 49.4 | <100 | 17.4 | 112 | 79.5 | <100 | 3.0 |
| **Level-2 racial groups within NHOPI** | | | | | | | | | | | |
| Polynesian | 200 183 | 14.7 | 101 569 | 98 614 | 49.3 | 68 084 | 34.0 | 116 105 | 58.0 | 15 993 | 8.0 |
| Micronesian[f] | 26 884 | 2.0 | 13 217 | 13 667 | 50.8 | 11 086 | 41.2 | 15 085 | 56.1 | 713 | 2.7 |
| Melanesian[g] | 521 | <1.0 | 236 | 285 | 54.7 | 159 | 30.5 | 342 | 65.6 | <100 | 3.8 |
| **Level-3 racial groups within Chinese** | | | | | | | | | | | |
| Chinese[h] | 102 613 | 7.5 | 49 059 | 53 554 | 52.2 | 24 131 | 23.5 | 61 280 | 59.7 | 17 201 | 16.8 |
| Taiwanese | 987 | <1.0 | 415 | 572 | 58.0 | 153 | 15.6 | 688 | 69.7 | 146 | 14.8 |
| **Level-3 racial groups within Polynesian** | | | | | | | | | | | |
| Native Hawaiian | 166 944 | 12.3 | 84 399 | 82 545 | 49.4 | 55 179 | 33.1 | 97 401 | 58.3 | 14 363 | 8.6 |
| Samoan | 25 965 | 1.9 | 13 395 | 12 570 | 48.4 | 10 006 | 38.5 | 14 716 | 56.7 | 1243 | 4.8 |
| Tongan | 6120 | <1.0 | 3244 | 2876 | 47.0 | 2439 | 39.9 | 3347 | 54.7 | 334 | 5.5 |
| Tahitian | 1154 | <1.0 | 532 | 623 | 54.0 | 460 | 39.9 | 641 | 55.5 | <100 | 4.7 |

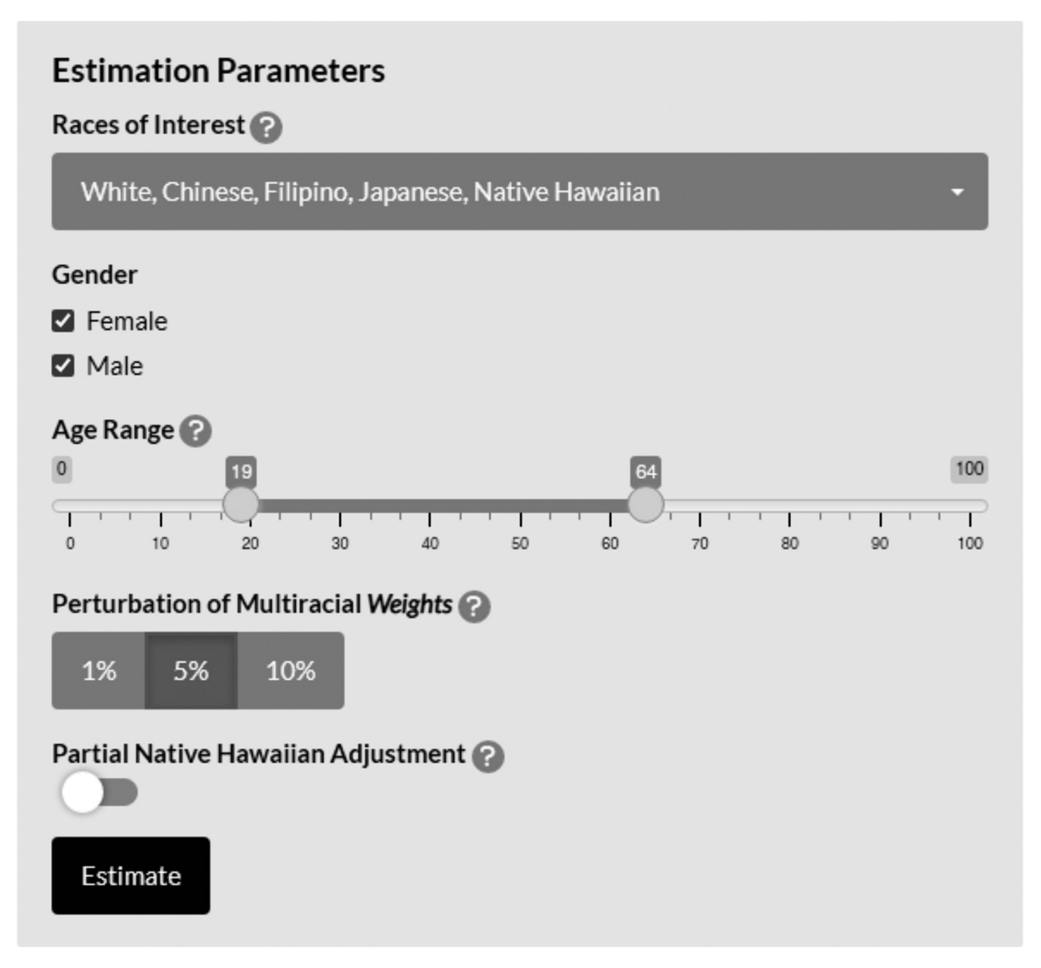
[a] Percentage of the total Hawai‘i Population (1 360 301). [b] Percentage of the total for the racial group. [c] Native Hawaiian and Other Pacific Islander. [d] Black and African American. [e] American Indian and Alaska Native. [f] Micronesian includes: Guamanian or Chamorro, Mariana Islander, Marshallese, Palauan, Carolinian, Kosraean, Pohnpeian, Saipanese, I-Kiribati, Chuukese, Yapese. [g] Melanesian includes: Fujian, Melanesian, Papua New Guinean, Solomon Islander, Ni-Vanuatu. [h] Chinese except Taiwanese.

and Some Other Race (SOR); 19 detailed Census race categories (Level-2): Filipino, Japanese, Chinese, Korean, Vietnamese, Okinawan, Asian Indian, Thai, Laotian, Indonesian, Cambodian, Burmese, Pakistani, Sri Lankan, Mongolian, Nepalese, Polynesian, Micronesian, and Melanesian; and 6 additional Census detailed races categories (Level-3): Chinese except Taiwanese, Taiwanese, Native Hawaiian, Samoan, Tongan, and Tahitian.

### Shiny Web Application (Shiny App): The Categorization Tool

The *Hawai'i Single-Race Categorization Tool* includes a conceptual infographics video, a race and demographics (age and sex) selection panel, graphical outputs, and downloadable summary data tables. Single-race population estimates and sensitivity intervals for all races were calculated for each of the age/sex groups (for example, males aged 0, males aged 1, …, females aged 99, females aged ≥100) based on the SPWA[2] and stored in the Shiny App. Single-race population estimates of all the age/sex groups were summed to obtain a total single-race population estimate. This process was performed both with and without grouping partial NHs as single-race NHs. The decimal estimates were rounded to the closest integers for reporting purposes. All calculations were conducted in R version 4.2.0.[5] The *Shiny* package[6] was used to create the web application. The *Tidyverse* packages[7] were incorporated to manipulate, shape, and visualize the data. For efficient data storage and fast initialization of the tool, the *Arrow* package[8] was used to compress and query the data. The *Hawai'i Single-Race Population Categorization Tool* is hosted on *shinyapps.io* (https://jabsom-dqhs.shinyapps.io/hawaii_single_race_categorization_tool/).

Users can specify the target demographics by adjusting the age range slider and sex checkboxes on the tool's parameter input panel (**Figure 1**). The user's selections determine what common racial groups to report and compare by any specific age and sex subgroups. The server of the Shiny App then aggregates the single-race estimates based on users' specifications. Help-dialogues explaining what each setting means are available throughout the page. Users can activate these help-dialogues by clicking on the encircled question mark buttons.



Estimation Parameters

Races of Interest: White, Chinese, Filipino, Japanese, Native Hawaiian

Gender
☑ Female
☑ Male

Age Range: 19 – 64

Perturbation of Multiracial *Weights*: 1% 5% 10%

Partial Native Hawaiian Adjustment

Figure 1. Input Panel of the Hawai'i Single-Race Population Categorization Tool

The graphic and table outputs of the *Categorization Tool* include a bar chart comparing the single-race estimates for each race selected in descending order and a downloadable table of the values displayed in the graph (**Figure 2**). Each bar represents a single-race estimate which is comprised of 2 counts - those who are that race alone, and an allocation of the multiracial population. Overlayed onto each bar is the respective sensitivity interval derived from the perturbation-based analysis.[2] The values in the graph can be downloaded as a comma-delimited file. The *Categorization Tool* also generates the age distributions of the selected racial groups. The graphic output panel includes line and stacked bar charts showing age distributions of each single-race estimates, with and without the partial NH adjustments. All graphics generated by the *Categorization Tool* can be downloaded in PNG format.

### Hawai‘i 31 Common Racial group Estimates and Age and Sex Distributions

The single-race estimates for the 31 common races were extracted from the *Categorization Tool*, then separated by sex and age groups (0-18 years, 19-64 years, and 65 years and older) with and without the partial NH adjustment. The proportions of the total population and the sex and age groups were computed for each race. The age distributions of the most common racial groups in Hawai‘i (Chinese, Japanese, Filipino, NH, and White) were generated using the *Categorization Tool* and compared among them.

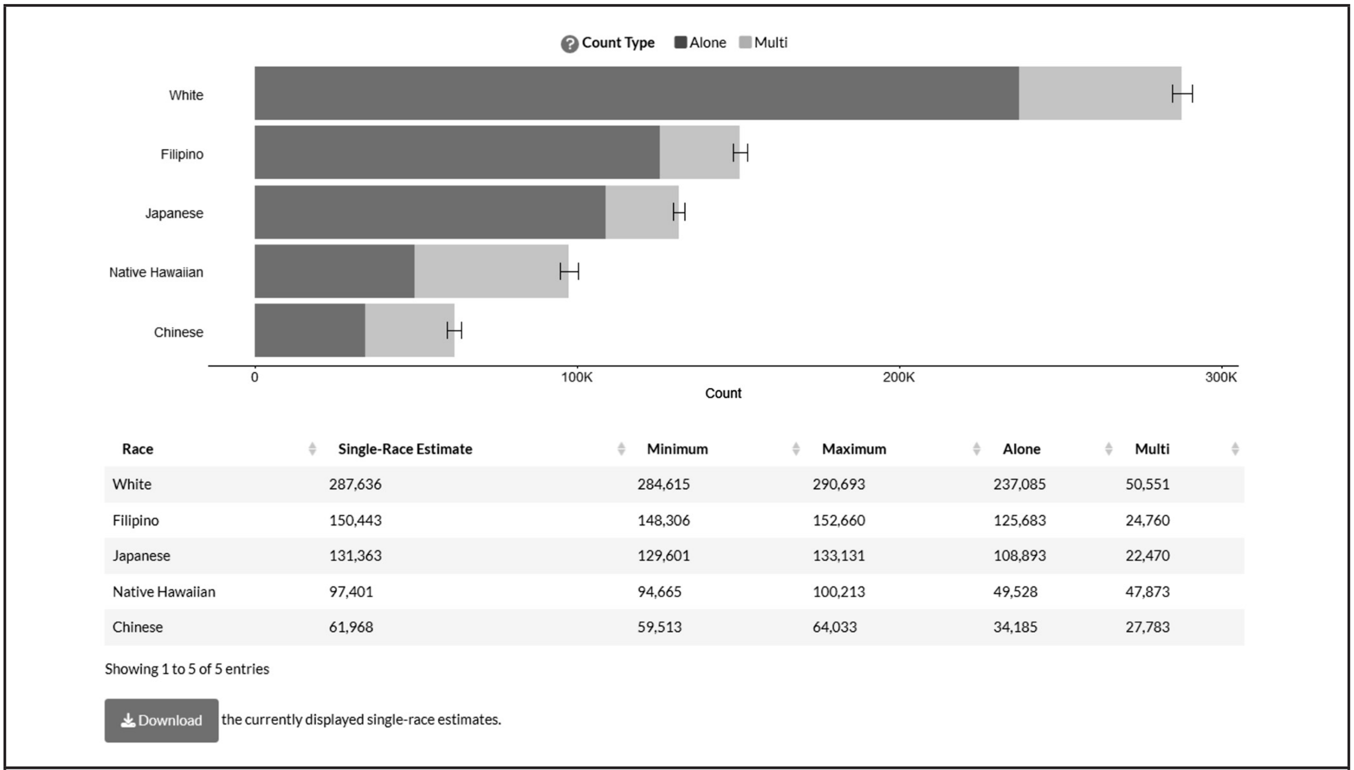
## Results

**Table 1** shows the population estimates for 31 common races in Hawai‘i. Among the Census major races (Level-1), Asian was the largest group, accounting for 46.5% of the total Hawai‘i population (1 360 301), followed by White, NHOPI, Black, SOR, and AIAN. The same rank order was observed in both sex groups and in the age 0-18 years and 19-64 years groups, but the fourth and fifth-ranked races (Black and SOR) reversed in the age 65 years and older group. In the detailed Asian racial groups (Level-2), Filipino had the largest population estimate, accounting for 18.0% of the total Hawai‘i population, followed by Japanese, Chinese, and Korean. The same rank order was found in both males and females, and in the age 0-18 years and 19-64 years groups. Among the age 65 years and older group, Japanese had the largest estimated population, accounting for 27.7% of individuals of this age group. Within NHOPI, Polynesians had the largest population estimate, accounting for 14.7% of the total Hawai‘i population and 88.0% of the NHOPI population. Among the detailed racial groups within Polynesian (Level-3), NH had the largest population estimate, accounting for 83.4% of Polynesian and 73.4% of NHOPI, respectively.

**Table 2** shows the partial NH adjusted population estimates for the same 31 common races. While the same rank order was observed for the Census major races (Level-1), the adjusted NHOPI estimate increased by 150.0% from its unadjusted estimate. Since the total population is fixed, the estimates for all the other Level-1 races decreased. The greatest reduction was found in AIANs (-37.1%), and the smallest reduction was found in Asians (-8.4%). The estimates for Whites, Blacks, and SOR decreased by 11.0%, 12.5%, and 14.9%, respectively. The same rank order was also found in both sex groups and in the age 19-64 years old group. In the 0-18 years age group, NHOPIs had the largest size, followed by Asians and Whites. All the NHOPI sex and age group estimates increased, ranging from 147.0% for those 65 years and older to 196.8% for the 0-18 years age group. Among the Asian detailed races (Level-2), the greatest reduction was found in Chinese (-16.6%), followed by Okinawans (-16.0%), Indonesians (-11.7%), and Asian Indians (-9.9%). Among the detailed NHOPI races, Polynesians increased to 157.6%, especially in the 0-18 year age group (171.7%). The estimates for Micronesians and Melanesians decreased by 5.4% and 18.0%, respectively. The NH population itself had its estimate increased by 173.7%. The other detailed racial groups, Samoans, Tongans, and Tahitians, decreased by 23.0%, 16.6%, and 60.8%, respectively.

**Figure 3** illustrates the detailed age distributions of the 5 most common races in Hawai‘i: Chinese, Japanese, Filipino, NH, and White. A pair of line charts presented on top show the unadjusted (left) and adjusted estimates (right). Each chart overlays the age distribution of each race allowing the comparison by race and partial NH adjustment status. The unadjusted estimates of White were higher than all the other races from age 0 to 73 years. Starting at age 74 years, however, Japanese showed the largest population estimate. For Whites, the working-age segment (19 to 65 years old) was larger than both the 0-18 years age group and the 65 years and older group. This working-age segment for Whites showed 3 peaks: 1 in young adults and 2 in middle-aged adults, with the highest peak found at around age 24. For Japanese, the middle-aged segment also appeared to be larger than the other age segments, with the highest estimate found at around age 55. The age distribution had a peak in middle-aged adults at around age 40 for Filipinos and at around age 52 for Chinese. For NH, the younger age segment appeared to be larger than the adult-age segments, with a peak at about age 3. The partial NH adjustment affected estimates for all age segments for every race, especially for the infant- and child-age segments. Larger increases in the NH population were observed at younger ages. Accordingly, the 4 other races had bigger decreases in their population at younger ages. There was no apparent change to the estimates of the elderly segment. The estimate for Filipinos decreased by up to 14.5%, which was relatively small compared to the other 3 races. The estimate decreased by up to 30.7% for Chinese, 24.0% for Japanese, and 23.6% for White. However, the adjusted estimates of White were still the highest, showing 3 peaks in the working-age segment, with the highest peak remaining at age 24. Japanese still had the largest population estimate starting at about 74 years of age.

A set of 4 stacked bar charts presented in the middle of **Figure 3** show the age distribution grouped by partial NH adjustment status and sex. Each chart stacks the age distribution by race so that the cumulative single-race estimates can be compared by NH adjustment status or sex. The stacked bar charts showed that the elderly Japanese population was mostly females. The other races appear to have a similar sex distribution across age. A line chart overlaying the partial NH adjusted and unadjusted single-race estimates is presented at the bottom of **Figure 3**. The separation between adjusted and unadjusted estimates was prominent in the individual race graphs.



| Race | Single-Race Estimate | Minimum | Maximum | Alone | Multi |
|---|---|---|---|---|---|
| White | 287,636 | 284,615 | 290,693 | 237,085 | 50,551 |
| Filipino | 150,443 | 148,306 | 152,660 | 125,683 | 24,760 |
| Japanese | 131,363 | 129,601 | 133,131 | 108,893 | 22,470 |
| Native Hawaiian | 97,401 | 94,665 | 100,213 | 49,528 | 47,873 |
| Chinese | 61,968 | 59,513 | 64,033 | 34,185 | 27,783 |

Showing 1 to 5 of 5 entries

Download the currently displayed single-race estimates.

Figure 2. Graphic and Tabular Outputs of the Hawai‘i Single-Race Population Categorization Tool for Selected Racial Groups

Note: The error bars in the plot indicate the range of the sensitivity interval. The table shows the minimum and maximum numbers of the interval. *Alone* represents the count of individuals of that race alone, and *Multi* represents the count allocated from the multiracial population to that race.

Table 2. Single-Race Population Estimates by Sex and Age Groups for Common Racial Groups in the State of Hawai‘i: Estimated from the 2010 Census Data using the Stepwise Proportional Weighting Algorithm after Adjusting for Multi-race Native Hawaiians

| | **Total** | **%[a]** | **Male** | **Female** | **Female %** | **0-18 years** | **%[b]** | **19-64 years** | **%[b]** | **≥65 years** | **%[b]** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level-1 racial groups** | | | | | | | | | | | |
| Asian | 578 670 | 42.5 | 272 309 | 306 362 | 52.9 | 108 857 | 18.8 | 353 243 | 61.0 | 116 571 | 20.1 |
| White | 384 300 | 28.3 | 205 381 | 178 919 | 46.6 | 68 909 | 17.9 | 262 881 | 68.4 | 52 510 | 13.7 |
| NHOPI[c] | 341 385 | 25.1 | 171 876 | 169 510 | 49.7 | 127 232 | 37.3 | 190 790 | 55.9 | 23 363 | 6.8 |
| Black[d] | 25 028 | 1.8 | 15 178 | 9850 | 39.4 | 7015 | 28.0 | 17 071 | 68.2 | 943 | 3.8 |
| Some Other Races | 20 599 | 1.5 | 11 173 | 9426 | 45.8 | 5528 | 26.8 | 13 870 | 67.3 | 1200 | 5.8 |
| AIAN[e] | 10 318 | <1.0 | 5326 | 4992 | 48.4 | 3187 | 30.9 | 6579 | 63.8 | 552 | 5.3 |
| **Level-2 racial groups within Asian** | | | | | | | | | | | |
| Filipino | 227 973 | 16.8 | 110 397 | 117 577 | 51.6 | 54 819 | 24.1 | 142 026 | 62.3 | 31 129 | 13.7 |
| Japanese | 212 422 | 15.6 | 98 784 | 113 638 | 53.5 | 26 467 | 12.5 | 123 738 | 58.3 | 62 216 | 29.3 |
| Chinese | 86 422 | 6.4 | 41 061 | 45 361 | 52.5 | 17 902 | 20.7 | 52 554 | 60.8 | 15 966 | 18.5 |
| Korean | 29 420 | 2.2 | 11 802 | 17 618 | 59.9 | 4946 | 16.8 | 19 404 | 66.0 | 5070 | 17.2 |
| Vietnamese | 10 509 | <1.0 | 4858 | 5651 | 53.8 | 2467 | 23.5 | 7113 | 67.7 | 928 | 8.8 |
| Okinawan | 2909 | <1.0 | 1389 | 1520 | 52.3 | 470 | 16.2 | 1890 | 65.0 | 549 | 18.9 |
| Asian Indian | 2755 | <1.0 | 1441 | 1314 | 47.7 | 542 | 19.7 | 1956 | 71.0 | 257 | 9.3 |
| Thai | 2350 | <1.0 | 705 | 1645 | 70.0 | 386 | 16.4 | 1814 | 77.2 | 149 | 6.3 |
| Laotian | 1998 | <1.0 | 962 | 1037 | 51.9 | 474 | 23.7 | 1371 | 68.6 | 153 | 7.7 |
| Indonesian | 526 | <1.0 | 213 | 313 | 59.5 | <100 | 18.1 | 367 | 69.8 | <100 | 12.4 |
| Cambodian | 514 | <1.0 | 237 | 277 | 53.9 | 124 | 24.1 | 370 | 72.0 | <100 | 3.7 |
| Burmese | 217 | <1.0 | 110 | 108 | 49.6 | <100 | 18.4 | 157 | 72.4 | <100 | 9.2 |
| Pakistani | 201 | <1.0 | 123 | <100 | 38.6 | <100 | 25.4 | 138 | 68.7 | <100 | 6.0 |
| Sri Lankan | 195 | <1.0 | 106 | <100 | 46.1 | <100 | 16.4 | 137 | 70.3 | <100 | 13.3 |
| Nepalese | 130 | <1.0 | <100 | <100 | 49.3 | <100 | 16.9 | 103 | 79.2 | <100 | 3.1 |
| Mongolian | 129 | <1.0 | <100 | <100 | 56.0 | <100 | 13.2 | 105 | 81.4 | <100 | 5.4 |
| **Level-2 racial groups within NHOPI** | | | | | | | | | | | |
| Polynesian | 315 530 | 23.2 | 159 186 | 156 345 | 49.5 | 116 916 | 37.1 | 175 971 | 55.8 | 22 644 | 7.2 |
| Micronesian[f] | 25 423 | 1.9 | 12 497 | 12 926 | 50.8 | 10 211 | 40.2 | 14 517 | 57.1 | 696 | 2.7 |
| Melanesian[g] | 427 | <1.0 | 191 | 236 | 55.3 | 106 | 24.8 | 303 | 71.0 | <100 | 4.2 |
| **Level-3 racial groups within Chinese** | | | | | | | | | | | |
| Chinese[h] | 85 466 | 6.3 | 40 660 | 44 807 | 52.4 | 17 760 | 20.8 | 51 883 | 60.7 | 15 824 | 18.5 |
| Taiwanese | 956 | <1.0 | 402 | 554 | 57.9 | 143 | 15.0 | 671 | 70.2 | 143 | 15.0 |
| **Level-3 racial groups within Polynesian** | | | | | | | | | | | |
| Native Hawaiian | 289 970 | 21.3 | 145 849 | 144 121 | 49.7 | 108 569 | 37.4 | 160 282 | 55.3 | 21 119 | 7.3 |
| Samoan | 20 006 | 1.5 | 10 394 | 9612 | 48.0 | 6469 | 32.3 | 12 372 | 61.8 | 1164 | 5.8 |
| Tongan | 5102 | <1.0 | 2744 | 2359 | 46.2 | 1774 | 34.8 | 3005 | 58.9 | 323 | 6.3 |
| Tahitian | 452 | <1.0 | 199 | 253 | 56.0 | 103 | 22.8 | 311 | 68.8 | <100 | 8.4 |

[a] Percentage of the total Hawai‘i Population (1 360 301). [b] Percentage of the total for the racial group. [c] Native Hawaiian and Other Pacific Islander. [d] Black and African American. [e] American Indian and Alaska Native. [f] Micronesian includes: Guamanian or Chamorro, Mariana Islander, Marshallese, Palauan, Carolinian, Kosraean, Pohnpeian, Saipanese, I-Kiribati, Chuukese, Yapese. [g] Melanesian includes: Fujian, Melanesian, Papua New Guinean, Solomon Islander, Ni-Vanuatu. [h] Chinese except Taiwanese.

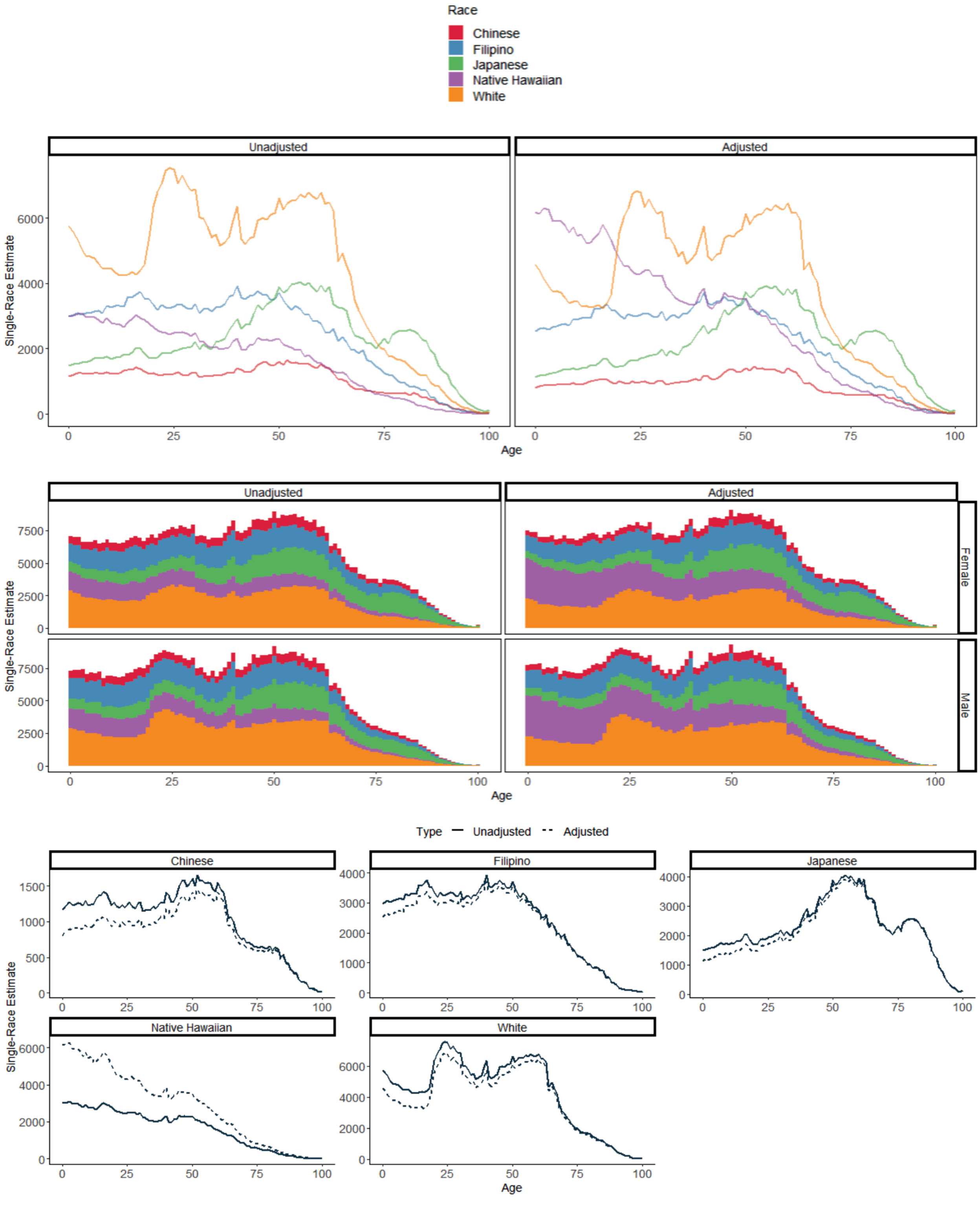


Figure 3. Age Distributions of Selected Racial Groups in Hawai‘i, with and without the Partial Native Hawaiian (NH) Adjustment

## Discussion

The graphs in the Shiny App *Categorization Tool* allowed comparisons of the single-race estimates to be made by age and sex. Notably, Japanese had the highest estimated population after the age of 74 years, which were mostly composed of females, and NH had greater population increases at younger ages after the partial NH adjustment. Using the partial NH adjustment, the NH estimate highlighted the NH representation in the state, but the estimates of all other races were reduced as the total population of Hawai‘i must remain fixed. In addition to the visuals, single-race estimates for sex and major age subgroups were generated from the *Categorization Tool* for 31 common races in Hawai‘i.

The partial NH adjustment resulted in more extensive changes in the population estimates for the younger ages. NHOPI is one of the fasting growing racial groups in the US, and NHOPI in Hawai‘i represents about 30% of all NHOPI in the US.[9] Our results show that the largest age segments in the NH population are infants and children, and many of them are multiracial individuals. This can be seen by the largest increase in the population estimate after the partial NH adjustment. Given that many studies have reported health disparities in the NH and NHOPI communities,[10-12] the health characteristics of these racial groups could shift in the future due to the increased percentage of multiracial individuals. Therefore, proper determination of the population size and tracking the growth of the racial/ethnic groups experiencing health disparities are important from a public health perspective.

Out of privacy concerns, the Census Bureau sets up a reporting threshold of 100 and any counts lower than 100 are reported as missing values. Many smaller racial groups exist in Hawai‘i. Unfortunately, the current study can only include 31 common racial groups. For each racial group, the SPWA estimation required both counts of individuals who reported that race alone and of those who reported that race and some other race(s). Five Asian detailed races did not meet this criterion and were excluded from this study. Excluding the 5 races could result in overestimation for the other 16 Level-2 races under Asian. However, since population sizes for those races were remarkably smaller than Filipino, Japanese, and Chinese, the impact on the 16 races was considered minor. Lastly, Census race data is self-reported. As a result, misclassification and under-reporting errors (eg, multiracial individuals not reporting all races) could result in biases in the estimates. The race categories used in the 2010 Census questionnaire only reflect a social definition of race recognized in the US and are not an attempt to define race biologically, anthropologically, or genetically. [9] Also, 2010 Census questionnaire surveyed race and Hispanic origin (ethinicity) as 2 separate questions. In the current analysis, we focused on only the 2010 Census data on race categorization.

The *Hawai‘i Single-Race Population Categorization Tool* provides the most comprehensive Hawai‘i population estimates to date. The *Categorization Tool* is publicly available to anyone with internet access. It is user-friendly, allowing the users to specify the targeted race and relevant demographics, and generates downloadable estimates and visuals. The perturbation analysis results allow the user to gauge the sensitivity of the population estimates. The 2020 decennial Census data for detailed races were unavailable at the time of this work. The categorization tool will be updated when the data becomes available to provide the most recent population estimates in Hawai‘i. Also, the categorization tool will be continuously improved through engagement of the NHOPI communities and based on user feedback to better serve the reporting needs. The Shiny App *Categorization Tool* is designed to be a useful and effective tool for public health practitioners and for health service and health disparities researchers in Hawai‘i.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Stepwise Proportional Weighting Algorithm for Single-Race Population Estimation Using Hawai‘i Census Data

Masako Matsunaga PhD; Kyle M. Ishikawa MS; Chathura Siriwardhana PhD; Hyeong Jun Ahn PhD; John J. Chen PhD

## Abstract

*Many health and health disparities studies require population prevalence information of various race groups, but the estimation of single-race population sizes using the US Census data has been challenging. For each Census race group, Census only provides the counts of those reported being single race ("race alone") and those reported of that specific race regardless of whether the individuals were multiracial or not ("race alone or in (any) combination"). The issue of how to classify Census multiracial individuals is especially important for the state of Hawai‘i due to its large multiracial population. The current study developed the Stepwise Proportional Weighting Algorithm (SPWA) for single-race population estimation using US Census data for major race groups in the Census and their nested detailed races. Additionally, given that "partial Native Hawaiian" has often been treated as "Native Hawaiian" in health disparities studies in Hawai‘i, the algorithm can also adjust for the unique partial Native Hawaiian race categorization. This paper describes the estimation process with the SPWA and demonstrates its ability to estimate single-races for the 5 most common race groups in Hawai‘i. This new methodology addresses an important concern regarding how to classify multiracial individuals to strengthen health and health disparities research in Hawai‘i.*

## Keywords

*population estimates, algorithm, Censuses, Hawaii, racial group, Native Hawaiians, Public Health*

## Abbreviations

*AIAN = American Indian and Alaskan Native*
*API = Asian and Pacific Islander*
*NCHS = National Center for Health Statistics*
*NH = Native Hawaiian*
*NHOPI = Native Hawaiian or Pacific Islander*
*POL = Polynesian*
*SEER = Surveillance, Epidemiology, and End Results Program*
*SOR = Some Other Race*
*SPWA = Stepwise Proportional Weighting Algorithm*

## Introduction

Hawai‘i has the highest percentage of multiracial residents among the 50 states in the United States (US). According to Hawai‘i Census data, individuals who self-identified with more than 1 race accounted for 21.4% of the population in 2000 and 23.6% of the population in 2010, which is substantially higher than the national averages (2.4% and 2.9%, respectively).[1]

In both the 2000 and 2010 Censuses, the US Census Bureau collected and tabulated race and ethnicity data based on the *Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity Office of Management and Budget*, issued in 1997. [2] The revisions increased federal major race categories from 4 [White, Black or African American (Black), American Indian and Alaska Native (AIAN), and Asian and Pacific Islander (API)] to 5 [White, Black, AIAN, Asian, and Native Hawaiian or Other Pacific Islander (NHOPI)]. In addition, it allowed the Census Bureau to use a sixth category – Some Other Race (SOR). The revisions also required federal data collection programs to allow respondents to select more than 1 race category when responding to a query on their racial identity.[3]

Since 2000, the US Census Bureau started to report counts of "*race alone*" and "*race alone or in (any) combination*" for the major races and their nested detailed races in compliance with the revised 1997 standards.[4] The updated reporting guidelines created an analytical challenge for determining and reporting race-specific statistics, such as disease prevalence by race group.[2] To meet this challenge, the regression bridging method was developed to derive single-race population estimates for the 4 major races,[5,6] which has been widely used in surveillance systems, such as the National Center for Health Statistics (NCHS) National Vital Statistics System[7] and the Surveillance, Epidemiology, and End Results Program (SEER) of the National Cancer Institute.[8] Due to concerns about the undercounted Native Hawaiian population in past Censuses, the Native Hawaiian estimates reported by SEER were adjusted by increasing API count and decreasing the White count.[8] However, SEER only provides estimates for the 6 major Census races and the methodology of estimation requires additional data external to the Census.

Several studies have determined single-race population estimates for the most common races in Hawai‘i,[9-13] such as White, Filipino, Japanese, Chinese, and Native Hawaiian (NH). However, there has not been a suitable method available for the population estimation for all common races in Hawai‘i. In addition, vital records and health surveys in Hawai‘i often categorize partial Native Hawaiians as NH. Thus, estimates for other race populations would need to be adjusted accordingly for this increased NH population estimate. A previous study proposed a proportional weighting approach allowing the single-race population estimates for the 5 most common races in Hawai‘i.[13] It determined weights for allocating multiracial individuals to individual single-race categories and obtained the single-race estimates by summing the count of single-race individuals and a proportion of the count of multiracial individuals. However, this approach did not take into consideration the nested structure of the Census races. As a result, population estimates for many of the detailed race groups in Hawai‘i could not be properly determined. The current study aims to expand the approach in a stepwise manner to account for the nested Census data structure (Stepwise Proportional Weighting Algorithm (SPWA)), with and without the adjustment for the count of partial NH. This paper describes the SPWA's estimation steps and demonstrates its utility with the estimation for the 5 most common racial groups in Hawai‘i. Lastly, the limitations and strengths of the SPWA are discussed.

## Methods and Results

### Hawai‘i Census Data

The current study utilized race data for Hawai‘i from the most recent decennial Census at the time of analysis (2010 Census).[14] **Figure 1** illustrates the nested structure of Census race data. The 6 Census major races (White, Black, AIAN, Asian, NHOPI, and SOR) were denoted as Level-1 races, using index *i*. The Census' detailed races under AIAN, Asian, and NHOPI were denoted as Level-2 races, using index *j*. The nested relationship between an *i-th* Level-1 race and a *j-th* Level-2 race was expressed using parentheses as *i(j)*. Detailed races under Level-2 races were denoted as Level-3 races, using index *k*. The nested relation of a *k-th* race of its upper-level races was expressed as *i(j(k))*. This system of indices and notations to denote nested races were used throughout. For instance, NH, a Level-3 race under Level-2 Polynesian (*POL*), which was under Level-1 NHOPI, was denoted as *NHOPI(POL(NH))*.

Census data provided both counts of "*race alone*" and "*race alone or in (any) combination*" for each race unless the actual count was less than 100 in which case a missing value was reported. The data also included the counts of "*Two or More*

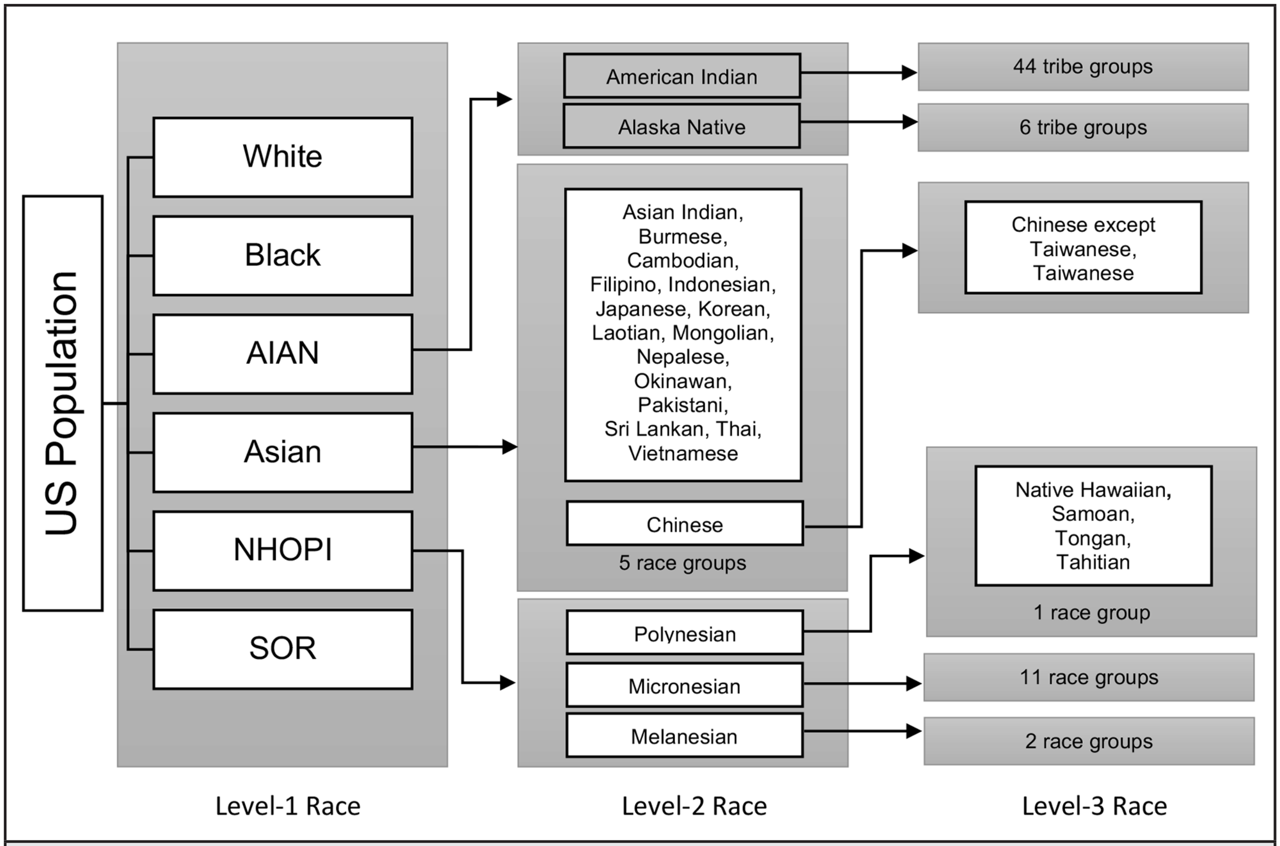

Figure 1. US 2010 Census Population Structure, Highlighting Race Groups for Single-Race Population Estimation for Hawai‘i[a]

AIAN = American Indian and Alaska Native. NHOPI = Native Hawaiian and Other Pacific Islander. SOR = Some Other Races.

[a] Race groups in the white boxes were estimated. Estimates for other race groups in the dark shading were not obtained due to the lack of data required for the estimation.

*Races*," which were the numbers of multiracial individuals associated with the major races.[4] In this paper, the counts of "*race alone*" and "*race alone or in (any) combination*" were referred to as *alone* counts and *combination* counts, respectively. The "*Two or More Races*" count was referred to as the *multiracial* count for Level-1 races. After excluding races with missing alone counts, the Hawai'i Census data included *alone* and *combination* counts for 31 common races, which are shown in the white boxes of **Figure 1**.

### Proportional Weighting Approach

The proportional weighting approach uses *alone, combination*, and *multiracial* counts to obtain single-race population estimates for the 5 most common races in Hawai'i (White, Filipino, Japanese, Chinese, and NH).[13] For a given race *i*, the *difference* count, denoted as $T_i^{2+}$, is the difference between the *alone* count ($T_i^1$) and the *combination* count ($T_i^2$) (Equation 1), representing the count of multiracial individuals associated with race *i*. The total *multiracial* count for all races, denoted as $M$, is the total population count minus the sum of the total alone count (Equation 2). The *weight* ($w_i$) for race *i* is obtained by dividing $T_i^{2+}$ by the sum of all the *difference* counts (Equation 3). The *single-race estimate* for race *i* ($T_i$) is calculated by adding a fraction of the *multiracial* count ($M$), as determined by $w_i$, to the *alone* count of race *i* (Equation 4).

$$T_i^{2+} = T_i^2 - T_i^1 \qquad (1)$$

$$M = T - \sum_{i=1}^{I} T_i \qquad (2)$$

$$w_i = \frac{T_i^{2+}}{\sum_{i=1}^{I} T_i^{2+}} \qquad (3)$$

$$T_i = T_i^1 + (M \times w_i) \quad (4)$$

where $T_i^1$ is the *alone* count,

$T_i^2$ is the *combination* count,

$T_i^{2+}$ is the *difference* count,

$T$ is the total population count,

$w_i$ is the *weight* for multiracial individuals,

$M$ is the *multiracial* count,

and $T_i$ is the single-race population estimate for race *i.*

### The Stepwise Proportional Weighting Algorithm (SPWA)

*Estimation without Adjustment for Multiracial Native Hawaiians*

To account for the nested structure of the Census race categories, the SPWA estimated single-race population size in a stepwise manner from Level-1 to Level-3 races (**Figure 1**). Equations 1-4 were used for the estimation of Level-1 races. The denominator for the *weight* was the sum of the *difference* counts for Level-1 races. The *multiracial* count ($M$) for Level-1 races was the "*Two or More Races*" count. For Level-2 races (*i(j)*) estimation, the algorithm was applied similarly (Equations 5-8). The *multiracial* count ($M_i$) was derived from the single-race estimates of the Level-1 races (Equation 6). For instance, the *multiracial* count for Level-2 races under *Asian* ($M_{Asian}$) was obtained by subtracting the sum of these races' alone counts from the single-race estimate of Asian. The denominator for the weight was the sum of the *difference* counts of these Level-2 races (Equation 7).

$$T_{i(j)}^{2+} = T_{i(j)}^2 - T_{i(j)}^1 \qquad (5)$$

$$M_i = T_i - \sum_{j=1}^{J} T_{i(j)} \qquad (6)$$

$$w_{i(j)} = \frac{T_{i(j)}^{2+}}{\sum_{j=1}^{J} T_{i(j)}^{2+}} \qquad (7)$$

$$T_{i(j)} = T_{i(j)}^1 + \left(M_i \times w_{i(j)}\right) \quad (8)$$

where $T_{i(j)}^1$ is the *alone* count,

$T_{i(j)}^2$ is the *combination* count,

$T_{i(j)}^{2+}$ is the *difference* count,

$w_{i(j)}$ is the *weight* for multiracial individuals,

$M_i$ is the *multiracial* count,

and $T_{i(j)}$ is the single-race population estimate for a race *i(j).*

The Level-3 races under Polynesian and Chinese were estimated with similar steps.

### *Estimation with Adjustment for Multiracial Native Hawaiians*

Under the NH adjustment, all partial NH were treated as NH, ie, using the *combination* count for NH as its adjusted estimate, which included both single-race NH and multiracial NH. As a result, estimates of the other races affected by this NH adjustment needed to be modified accordingly. First, the following adjustment elements at the 3 race levels were determined sequentially:

$$NH_{level3} = T^{2+}_{NHOPI(POL(NH))},$$

$$NH_{level2} = NH_{level3} - \left(T^{1}_{NHOPI(POL)} - \sum_{k=1}^{K} T^{1}_{NHOPI(POL(k))}\right),$$

$$NH_{level1} = NH_{level2} - \left(T^{1}_{NHOPI} - \sum_{j=1}^{J} T^{1}_{NHOPI(j)}\right),$$

where $NH_{level3}$ is the *multiracial* NHs not included in the NH *alone* count,

$NH_{level2}$ is the *multiracial* NHs not included in the Polynesian *alone* count,

$NH_{level1}$ is the *multiracial* NHs not included in the NHOPI *alone* count.

Next, the *alone* and *difference* counts for NHOPI and Polynesian were adjusted. For the Level-1 races, the following equations were used.

$$T_i^{1\,adj} = \begin{cases} T_i^1 + NH_{level1} & \text{if } i = NHOPI \\ T_i^1 & \text{otherwise} \end{cases}$$

$$T_i^{2+\,adj} = \begin{cases} T_i^{2+} - NH_{level1} & \text{if } i = NHOPI \\ T_i^{2+} & \text{otherwise} \end{cases}$$

$$M^{adj} = T - \sum_{i=1}^{I} T_i^{1\,adj} - NH_{level1}$$

$$T_i^{adj} = T_i^{1\,adj} + M^{adj} \times w_i^{adj}$$

where $T_i^{1\,adj}$ is the adjusted alone count for a Level-1 race,

$T_i^{2+\,adj}$ is the adjusted difference count for a Level-1 race,

$M^{adj}$ is the adjusted *multiracial* count for Level-1 races,

$w_i^{adj}$ is the adjusted *weight* calculated with the adjusted *difference* counts,

and $T_i^{adj}$ is the adjusted single-race estimate for race *i.*

The Level-2 and -3 race estimates could be adjusted similarly.

### *Sensitivity Analysis of the SPWA Estimates*

The sensitivity of the SPWA estimates was assessed following a Monte Carlo simulation, by perturbing the calculated weights in the estimation.[15] For Level-1 race *i,* a random weight was generated uniformly from a range with lower and upper limits defined by a perturbation limit (*a*%), $[w_i(1 - a), w_i(1 + a)]$, where $w_i$ is the original weight for race *i*. This sampled weight is denoted as $w^p_{i,a,s}$, where *s* is the *s-th* iteration, with , where n is the number of simulations. For a given *s*, due to the randomness of the perturbation, the summation of the sampled weights for the Level-1 races was likely not equal to 1. Therefore, these sampled weights were scaled at each iteration in order to constrain the summation to be 1, with the scaled weights denoted as $w'_{i,a,s}$. Next, $w'_{i,a,s}$ was used to calculate a perturbated Level-1 single-race estimate, $T_{i,a,s}$, as $T_{i,a,s} = T_i^1 + (M \times w'_{i,a,s})$. Accordingly, these perturbated single-race estimates for Level-1 races were then used to determine the single-race estimates for Level-2 and Level-3 races.

A custom value of 1000 was used as the number of simulations for the sensitivity analysis. The minimum and maximum values of the 1000 simulated estimates for each race was reported as the sensitivity interval for the estimate. The current study used custom values of 1% and 5% perturbation limits for the sensitivity analysis.

### **Illustration of the SPWA Single-race Population Estimates**

The SPWA was utilized to derive the population estimates of the 5 most common race groups in Hawai‘i: White, Filipino, Japanese, Chinese and NH, with and without partial NH adjustment. All calculations were conducted with R version 4.2.0.[16]

**Table 1** presents unadjusted and adjusted estimates and the sensitivity analysis results for these races. White had the largest estimate without adjustment, accounting for 31.7% of the Hawai‘i population (n = 1 360 301). Filipino was the second largest race group (18.0%), followed by Japanese (16.7%), NH (12.3%), and Chinese (7.6%). With the partial NH adjustment, NH estimate increased in rank from fourth to second among the 5 most common races, accounting for 21.3% of the total Hawai‘i population. White remained the largest race group, however, its percentage decreased to 28.3%. At the same time, the percentage for Filipino, Japanese, and Chinese decreased to 16.8%, 15.6%, and 6.4%, respectively.

**Figure 2** shows the distributions of unadjusted and adjusted estimates generated with 1% and 5% weight perturbation limits. The distributions were found to be symmetric. Not surprisingly, the 5% sensitivity intervals were wider than those of the 1%, but both intervals were relatively narrow compared with the population estimates, indicating the stability of these single-race estimates. For example, the intervals for unadjusted White ranged from 430 485 to 432 754 for the 1% weight perturbation limit and from 425 960 to 437 377 for the 5% weight perturbation limit.

Table 1. Single-Race Population Estimates using the Stepwise Proportional Weighting Algorithm (SPWA) with and without Adjustment for Multiracial Native Hawaiians: Hawai‘i 2010 Census

| | SPWA Estimate (%[a]) | 1%[b] Sensitivity Interval | 5%[b] Sensitivity Interval |
|---|---|---|---|
| **Without Adjustment** | | | |
| White | 431 635 (31.7) | 430 485, 432 754 | 425 960, 437 377 |
| Filipino | 244 730 (18.0) | 243 936, 245 466 | 240 664, 248 936 |
| Japanese | 227 165 (16.7) | 226 528, 227 793 | 223 896, 230 467 |
| Native Hawaiian | 166 944 (12.3) | 165 953, 167 961 | 161 967, 172 145 |
| Chinese | 103 600 (7.6) | 102 750, 104 324 | 99 212, 107 288 |
| **With Adjustment** | | | |
| White | 384 300 (28.3) | 383 790, 384 790 | 381 818, 386 780 |
| Native Hawaiian | 289 970 (21.3) | - c | - c |
| Filipino | 227 973 (16.8) | 227 514, 228 382 | 225 782, 229 986 |
| Japanese | 212 422 (15.6) | 212 012, 212 839 | 210 366, 214 387 |
| Chinese | 86 422 (6.4) | 86 000, 86 835 | 84 121, 88 638 |

[a] Percentage of the total Hawai‘i 2010 Census population (n=1 360 301). [b] Percentage weight perturbation limit.
[c] With adjustment, all multiracial Native Hawaiians were treated as Native Hawaiians.

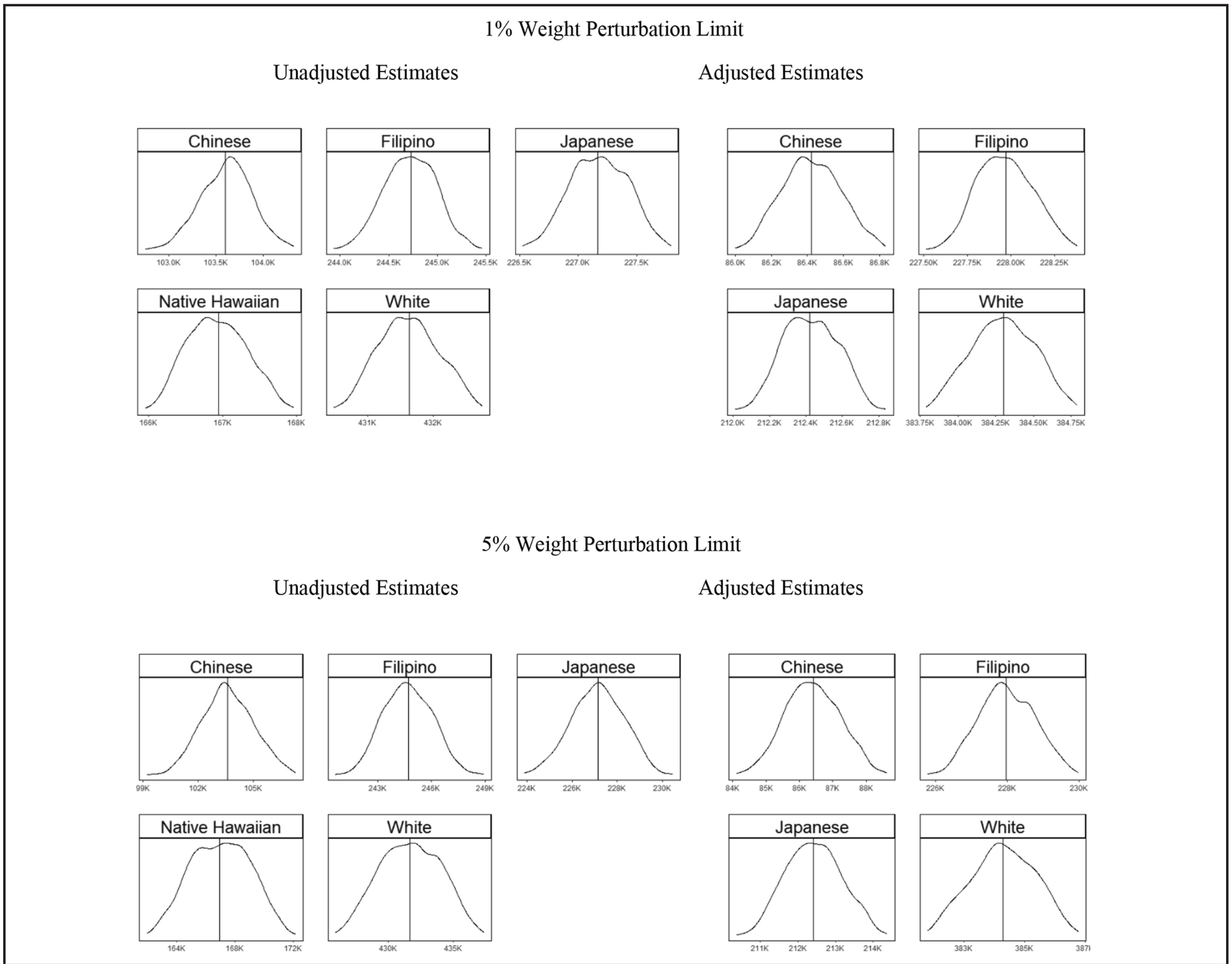

Figure 2. Stepwise Proportional Weighting Algorithm (SPWA) Sensitivity Analysis: Distribution of 1,000 Simulations of Unadjusted and Adjusted Single-race Estimates with 1% and 5% Perturbation Limits for the Most Common Races in Hawai‘i

Notes: 1. With adjustment, all partial Native Hawaiians were treated as Native Hawaiians. 2. The vertical line in each plot indicates the SPWA single-race estimate.

## Discussion

Single-race population sizes are essential parameters for health statistics, public health policy-making, and health disparities research, such as assessing ethnic-specific disease prevalence or developing new public health initiatives. The SPWA proposed in the current study allows for the systematic bridging of multiracial Census data into single-race population estimates. The algorithm takes into consideration the nested structure of the Census data and applies the proportional weighting approach in a stepwise manner, which allows for the estimation of all major and detailed Census race groups. The classification of partial NH as NH, a common practice in Hawai‘i, can be easily accommodated in the SPWA by introducing a multiracial NH adjustment. The sensitivity analysis suggests that the SPWA single-race estimates are quite stable given the perturbation limits used in the simulations.

For the 5 most common race groups in Hawai‘i, the single-race estimates show substantial increases from the *alone* counts. This is not surprising given the high percentage of multiracial residents in Hawai‘i, but the increased rates varied significantly among the race groups. For example, White increased by 28.2% (unadjusted = 431 635) from its *alone* count (n = 336 599). Among the 5 races, the largest increase was found for NH (108.0%, unadjusted count: 166 944, *alone* count: 80 337), whereas the smallest increase was found for Japanese (unadjusted count: 197 497, *alone* count: 166 944). NCHS also provides population estimates[7] based on the regression bridging method, which accounts for person- and county-level factors.[5,6] Based on the estimates using the 2010 Hawai‘i Census, White accounted for 30.1% of the Hawai‘i population, which increased by 21.9% from the *alone* count. Compared to the estimates in this study, the NCHS estimate for White has a slightly smaller increase from the *alone* count.

This study found that the impact of the multiracial NH adjustment varied across the race groups. Among the 5 most common race groups, a dramatic increase was found for NH, while substantial reductions were found for Chinese and smaller reductions were observed for White, Filipino, and Japanese. These observations seem to imply that more multiracial Chinese in Hawai‘i also self-identified as NH. SEER also included Hawai‘i adjustments in their estimates.[8] SEER estimates, based on the 2010 Census, were 24.7% for White.[8] The Hawai‘i Health Survey also categorized partial Hawaiians preferentially as Hawaiians. Their 2011 estimates showed that White accounted for 19.7% of the Hawai‘i population.[17] The Hawai‘i proportions for White based on the SEER and Hawai‘i Health Survey estimates were smaller than the NCHS's estimates (30.1%). The proportion for White based on adjusted estimates in this analysis was also smaller (28.3%) than the NCHS's estimate. The discrepancy among these estimation methods could be more apparent when comparing single-race counts rather than percentages. Therefore, researchers should be aware of the method used to generate single-race population estimates and how multiracial individuals, such as partial NH, were classified. This is critical to the appropriate interpretation of the analyses.

There were several limitations to the current study. The SPWA was developed to take into consideration the nested structure of the Census race data and applied the proportional weighting approach in a stepwise manner. Although the SPWA will likely reduce bias in the determination of the weights for multiracial individuals, it could still result in some overestimation due to missing data. Since population sizes for many Asian races were remarkably smaller than Filipino, Japanese, and Chinese, the impact on the estimation of these other races was considered minor. Another limitation was that the estimation could not consider the actual genetic compositions of each multiracial individual. For example, a multiracial individual with 3 races could be genetically comprised of 50% race *a*, 25% of race *b*, and 25% of race *c*. However, there was no way to identify the true race profile of each multiracial individual (eg, the number of races reported, parents' races). Even though the proportionality assumption may not always reflect the reality, it seems a sensible assumption overall. For this reason, the SPWA assigned equal race proportions for each multiracial individual. For example, one-third were assigned to each race if 3 races were reported. Another limitation is that the race data are self-reported. Individuals may not know their full ancestry or may only report it partially. The race categories included in the 2010 Census questionnaire generally reflect a social definition of race recognized in the US and are not an attempt to define race biologically, anthropologically, or genetically.[4] Also, 2010 Census surveyed race and Hispanic origin as 2 separate questions. In the current study, we focused on only the 2010 Census race categorization data.

Strengths of the SPWA include: (1) relatively straightforward calculations so complex statistical models are not needed; (2) external data are not required for the estimation; (3) single-race estimates can be determined iteratively for various races; (4) can be easily adapted to the adjustment for multiracial NH; (5) race estimates are, in general, relatively stable under the perturbations to the weights assigned in the estimation process; and (6) the approach could easily be applied to any future Census data to update these single-race estimates. The presenting estimates were computed using the 2010 decennial Census. The estimates will be updated when the 2020 Hawai‘i Census data become available.

Potential applications of the SPWA single-race population estimates are broad, including the determination of reference counts for race-based resource allocation, the justification for public policy decision-making, the denominator determinations of health services analysis, and the compiling and reporting of public health and other vital statistics. The SPWA fills an important methodology need for public health and health disparities research in Hawai‘i.

## Conflict of interest

None of the authors identify a conflict of interest.

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# Inventory of Survey Databases for Native Hawaiian, Pacific Islander, and Filipino Health Disparities Research

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## Abstract

*The aim of this scoping review was to assist researchers who want to use survey data, either in academic or community settings, to identify and comprehend health disparities affecting Native Hawaiian (NH), Pacific Islander (PI), and/or Filipino populations, as these are groups with known and numerous health disparities. The scoping review methodology was used to identify survey datasets that disaggregate data for NH, PI, or Filipinos. Healthdata.gov was searched, as there is not an official index of databases. The website was established by the United States (US) Department and Health and Human Services to increase accessibility of health data for entrepreneurs, researchers, and policy makers, with the ultimate goal of improving health outcomes. Using the search term 'survey,' 332 datasets were retrieved, many of which were duplicates from different years. Datasets were included that met the following criteria: (1) related to health; (2) disaggregated NH, PI, and/or Filipino subgroups; (3) administered in the US; (4) publicly available; (5) individual-level data; (6) self-reported information; and (7) contained data from 2010 or later. Fifteen survey datasets met the inclusion criteria. Two additional survey datasets were identified by colleagues. For each dataset, the dataset name, data source, years of the data availability, availability of disaggregated NH, PI, and/or Filipino data, data on health outcomes and social determinants of health, and website information were documented. This inventory of datasets should be of use to researchers who want to advance understanding of health disparities experienced by NH, PI, and Filipino populations in the US.*

## Keywords

*Data source, Native Hawaiian, Pacific Islander, Filipino, Health outcomes, Survey data*

## Abbreviations

*AA=Asian American*
*ACS=American Community Survey*
*AHRQ=Agency for Healthcare Research and Quality*
*ATUS=American Time Use Survey*
*BRFSS=Behavioral Risk Factor Surveillance System*
*CDC=Centers for Disease Control and Prevention*
*CMS=Centers for Medicare and Medicaid Services*
*CHIS=California Health Interview Survey*
*CHL=Children's Healthy Living*
*CPS=Current Population Survey*
*FDA=Food and Drug Administration*
*HINTS=Health Information National Trends Survey*
*MCBS=Medicare Current Beneficiary Survey*
*MEPS=Medical Expenditure Panel Survey*
*NESARC=National Epidemiologic Survey on Alcohol and Related Conditions*
*NH=Native Hawaiian*
*PI=Pacific Islander*
*SEER=Surveillance, Epidemiology and End Results*
*SDOH=Social Determinants of Health*

## Introduction

Numerous health disparities have been discovered for Native Hawaiian (NH), Pacific Islander (PI), and Filipino populations through the analysis of survey data.[1] Survey datasets offer numerous strengths, including a patient-centered perspective[2] and information on social determinates of health (SDOH), including income, education, and neighborhood conditions, that play a significant role in shaping health disparities. Addressing SDOH can lead to more effective interventions.[3,4] In addition, many of these surveys have been administered over decades, enabling tracking of changes over time.

Unfortunately, Asians Americans (AA) and NHPI are often grouped together under the single AAPI category or as 'other race.'[5-8] The AA and NHPI labels cover more than 50 distinct ethnic groups with unique languages, cultures, and histories, underscoring the importance of disaggregating AA and NHPI data.[9-11] The objective of this scoping review is to provide descriptions of publicly available survey datasets that allow disaggregation of NH, PI, and Filipinos to support health disparities research.

## Methodology

This scoping review employed the framework described by Peters et al.[12] For the search strategy, datasets on the US Department of Health and Human Services Health Data website (https://healthdata.gov) were reviewed using the search term 'survey' and retrieved 332 datasets. Many were the same dataset in different years (see **Figure 1**). Inclusion criteria were: (1) related to health; (2) disaggregated NH, PI, and/or Filipino subgroups; (3) administered in the US; (4) publicly available; (5) individual-level data; (6) self-reported information; and (7) data from 2010 or later. Two other datasets were included that were known to the investigative team from prior work.

For each dataset, **Table 1** lists the name of the survey, the disaggregated groups, the first year the survey was administered (2010 or later), the latest year of available data, and the survey sponsor. Subsequent tables describe the health variables and SDOH. The 5 domains for health variables included: (1) self-reported physical health; (2) self-reported mental health; (3) self-reported general health; (4) health behaviors (eg, physical activity, healthy eating, substance use); and (5) self-reported health conditions (eg, chronic diseases, mental health conditions). The 5 domains chosen for the SDOH were: (1) economic stability; (2) education access and quality; (3) health care access and quality; (4) social and community context); and (5) neighborhood and built environment. These are the domains used by Healthy People 2030 in grouping measures for health equity monitoring.[13] The survey datasets were summarized in terms of their level of disaggregation, their health measures, and their measures of social determinants of health.

## Results

### Summary of Survey Datasets

The search strategy yielded 15 survey datasets (**Figure 1**). Of these, 10 distinguish NH as a separate group, 9 distinguish PI, 10 distinguish Filipino separately, and 4 combine NH and PI but separate them from AA (**Table 1**). All datasets, except for the California Health Interview Survey, were sponsored by the federal government. The most frequently collected health variables were health behaviors (n=11), health conditions (n=11), and mental health (n=11), while physical health was the least common (n=7, **Table 2**). For SDOH, the most frequently collected variables were education (n=15) and health care access (n=11), while the least frequently collected were those related to neighborhood and built environments (n=4, **Table 3**).

### Survey Dataset Descriptions

***American Community Survey (ACS).*** Administered by the Census Bureau, ACS is a national survey that collects data on social, economic, housing, disability, and demographic characteristics of communities. Surveys are mailed to approximately 3.5 million addresses annually. The dataset disaggregates NHs, PIs, and Filipinos (**Table 1**). PI codes include Native Hawaiian, Samoan, Tongan, Guamanian/Chamorro, other Polynesian, other Micronesian, and other Melanesian groups; however, most PI groups have small sample sizes. Another limitation is the availability of few health variables (disability and self-reported health, **Table 2**). In contrast, there is a wide array of social determinants of health, including measures for economic stability, educational attainment, and health care access (**Table 3**). Data are available at https://usa.ipums.org/usa/acs.shtml.

***American Time Use Survey (ATUS).*** Administered by the Bureau of Labor, ATUS involves personal or telephone interviews with approximately 10 000 randomly selected individuals who are recruited from households that have completed interviews for the Current Population Survey (CPS, described below). ATUS separates AA, NH, and PI (**Table 1**). AA subgroups include Asian Indian, Chinese, Japanese, Filipino, Korean, and Vietnamese. However, the number of participants from ethnic minorities can be small in a given year. ATUS has an eating and health module that asks about nutrition, general health, and body mass index (**Table 2**). For health-related behaviors, participants are asked about their activities in the past 24 hours, which are then grouped into specific activities such as sleeping, biking, and sports/exercise/recreation. The survey also includes metabolic equivalents (METs) for each activity. SDOH include economic stability and educational attainment (**Table 3**). Data are available at https://www.bls.gov/tus/.

***Behavioral Risk Factor Surveillance System (BRFSS).*** The BRFSS, conducted by Centers for Disease Control and Prevention (CDC) in coordination with states and territories, is the nation's largest annual health-related telephone survey. Each year, more than 400 000 adults are interviewed about health-related risk behaviors and preventive health practices associated with chronic diseases, injuries, and preventable infectious diseases. National BRFSS reports do not disaggregate AA and/or NHPI. For Hawai‘i, racial/ethnic groups include NH, PI, and Filipino. PI can be further broken down into Guamanian or Chamorro/CHamoru, Samoan, and Other Pacific Islander (**Table 1**). AA can be also further broken down into Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Asian. Regarding health variables, chronic conditions covered by the survey include arthritis, asthma, cancer, diabetes, heart disease, high blood pressure and cholesterol (**Table 2**). SDOH from every domain are also available (**Table 3**). Hawai‘i data are available at www.hhdw.org. National data are available at https://www.cdc.gov/brfss/.

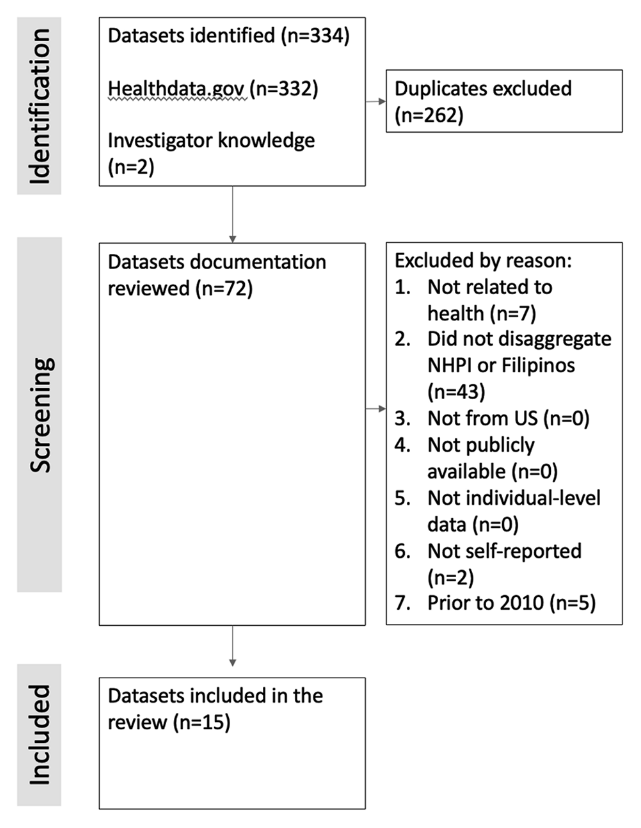

Figure 1. Flow Diagram for Inclusion in the Scoping Review of Survey Datasets for Native Hawaiian, Pacific Islander, and Filipino Health Disparities Research

Table 1. Descriptions of Survey Datasets for Native Hawaiian, Pacific Islander, and Filipino Health Disparities Research Including Name, Disaggregated Groups, Years Available, and Survey Sponsor

| | Dataset | Native Hawaiian (NH) | Pacific Islander (PI) | Filipino | NHPI (combined) | First Year Available (since 2010) | Most Recent Year | Sponsor |
|---|---|---|---|---|---|---|---|---|
| 1 | American Community Survey (ACS) | X | X[a] | X | | 2010 | 2020 | Census Bureau |
| 2 | American Time Use Survey (ATUS) | X | X | X | | 2010 | 2022 | Bureau of Labor |
| 3 | Behavioral Risk Factor Surveillance System (BRFSS) | X[b] | X[a,b] | X[b] | | 2010 | 2021 | Centers for Disease Control and Prevention |
| 4 | California Health Interview Survey (CHIS) | X | X[a] | X | | 2010 | 2022 | California Public Agencies & Private Organizations |
| 5 | Children's' Healthy Living (CHL) | X | X[a] | X | X | 2018 | 2020 | US Department of Agriculture |
| 6 | Current Population Survey (CPS) | | | X | X | 2010 | 2022 | Bureau of Labor |
| 7 | Health Information National Trends Survey (HINTS) | X | X[a] | X | | 2010 | 2021 | National Cancer Institute |
| 8 | Medicare Current Beneficiary Survey Data (MCBS) | | | X | X | 2010 | 2020 | Centers for Medicare & Medicaid Services |
| 9 | Medical Expenditure Panel Survey (MEPS) | | | X | X[c] | 2010 | 2019 | Agency for Healthcare Research & Quality |
| 10 | National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) - III | | | | X | 2013 | 2013 | National Institute on Alcohol Abuse and Alcoholism |
| 11 | National Health Interview Survey (NHIS) | X | X | | | 2010 | 2022 | Centers for Disease Control and Prevention |
| 12 | National Survey on Drug Use and Health (NSDUH) | X | X | X | | 2010 | 2021 (Sampling methods changed in 2021) | Substance Abuse & Mental Health Services Administration |
| 13 | Pregnancy Risk Assessment Monitoring System (PRAMS) | X | | X | | 2010 | 2021 | Centers for Disease Control and Prevention |
| 14 | Youth Risk Behavioral Surveillance System (YRBSS) Data | X | X | X | | 2010 | 2021 | Centers for Disease Control and Prevention |
| 15 | National Youth Tobacco Survey (YTS) | | | | X | 2010 | 2019 | Centers for Disease Control and Prevention |

NHPI = Native Hawaiian and Pacific Islander. [a] Pacific Islander can be further disaggregated. [b] Only available in Hawai'i state data. [c] NHPI can be identified by data manipulation using multiple variables.

***California Health Interview Survey (CHIS).*** Conducted since 2001 by the University of California at Los Angeles in collaboration with the California Departments of Public Health and Health Care Services, CHIS is an annual web and telephone survey of approximately 20 000 Californians, including adults, adolescents, and children. Filipinos are identified as well as NHs, Samoans, American Samoans, Tongans, Fijians, and other PIs (**Table 1**). A strength of the dataset is the wide range of measures on general and mental health, health-related behaviors, and health conditions (**Table 2**). Variables from each of the five domains of SDOH are included (**Table 3**). Data are available at https://healthpolicy.ucla.edu/chis/Pages/default.aspx.

***Children's Healthy Living (CHL).*** Funded by the Department of Agriculture, the CHL study is the first attempt to investigate the dietary intakes of children residing in Alaska, American Samoa, Commonwealth of the Northern Mariana Islands, Freely Associated States (including the Federated States of Micronesia, Pohnpei, Yap, Kosrae, Republic of the Marshall Islands, Republic of Palau), Guam, and Hawai'i. Data were collected between 2012 and 2020. CHL initially began as a randomized trial of an environmental intervention and has continued as a follow-up study of young children in the trial. The survey method was a paper survey, with interviews conducted with caregivers of children aged 2-8 years old. CHL distinguishes NHPI from Asian categories (**Table 1**). Regarding health variables, the CHL includes information on health-related behaviors, such as nutrition, and health conditions including obesity (**Table 2**).

Table 2. Health Variables Included in Each Survey Dataset

| | Dataset | Self-reported health - Physical[a] | Self-reported health - Mental[b] | Self-reported health - General[c] | Health behaviors[d] | Health conditions[e] |
|---|---|---|---|---|---|---|
| 1 | American Community Survey (ACS) | No | No | Yes | No | Yes |
| 2 | American Time Use Survey (ATUS) | No | No | No | Yes | Yes |
| 3 | Behavioral Risk Factor Surveillance System (BRFSS) | Yes | Yes | Yes | Yes | Yes |
| 4 | California Health Interview Survey (CHIS) | No | Yes | Yes | Yes | Yes |
| 5 | Children's' Healthy Living (CHL) | No | No | No | Yes | Yes |
| 6 | Current Population Survey (CPS) | No | No | Yes | No | No |
| 7 | Health Information National Trends Survey (HINTS) | No | Yes | Yes | Yes | Yes |
| 8 | Medicare Current Beneficiary Survey Data (MCBS) | Yes | Yes | Yes | Yes | Yes |
| 9 | Medical Expenditure Panel Survey (MEPS) | Yes | Yes | Yes | Yes | Yes |
| 10 | National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) - III | Yes | Yes | No | Yes | Yes |
| 11 | National Health Interview Survey (NHIS) | Yes | Yes | Yes | No | Yes |
| 12 | National Survey on Drug Use and Health (NSDUH) | Yes | Yes | Yes | Yes | No |
| 13 | Pregnancy Risk Assessment Monitoring System (PRAMS) | Yes | Yes | Yes | Yes | No |
| 14 | Youth Risk Behavioral Surveillance System (YRBSS) Data | No | Yes | No | Yes | Yes |
| 15 | National Youth Tobacco Survey (YTS) | No | Yes | No | No | No |

[a] Self-reported health – Physical refers to a question like "How would you rate your physical health"

[b] Self-reported health – Mental refers to a question like "How would you rate your mental health"

[c] "Self-reported health – General refers to a question like "in general, would you say that your health is excellent, very good, good, fair, or poor."

[d] Health behaviors refer to the actions, attitudes, and habits related to health and wellbeing such as, physical activity, healthy eating, substance use, stress management, and preventive health care.

[e] Health conditions refer to any physical and mental condition such as infectious diseases, chronic diseases, mental health conditions, injuries, genetic conditions, and environmental conditions.

SDOH include economic stability, educational attainment, and community-built environment (**Table 3**). Data are available at https://www.chl-pacific.org/.

***Current Population Survey (CPS).*** CPS is a survey conducted by the Census Bureau, with data collected through personal or phone interviews. Data from 1952 to 2022 are available. Approximately 60 000 households are surveyed each month, providing data on employment and unemployment as well as workforce participation. Asian categories in the CPS include Asian Indian, Chinese, Japanese, Filipino, Korean, and Vietnamese, with other racial categories being White, Black, American Indian, Alaskan Native, and NHPI (**Table 1**). Health information is limited to self-reported general health (**Table 2**). A strength of the dataset is the large number of variables related to SDOH, including economic stability, educational attainment, and health care access (**Table 3**). Data are available at https://cps.ipums.org/cps/.

***Health Information National Trends Survey (HINTS).*** Sponsored by the National Cancer Institute and available since 2003, HINTS collects nationally representative data about the use of cancer-related information. In 2021, cancer survivors were oversampled for HINTS, drawing from a sample of 3 cancer registries from the Surveillance, Epidemiology and End Results (SEER) program. Researchers can link the 2021 HINTS to data elements from SEER to get a more comprehensive understanding of health, cancer diagnoses, treatment, and outcomes. HINTS ethnic categories include Filipino, NH, Guamanian or Chamorro/CHamoru, Samoan, and Other Pacific Islander, but multiple years may need to be combined because of small numbers of these ethnic groups in the dataset (**Table 1**). Health information includes mental and general health, health behaviors, and health conditions (**Table 2**). Information on SDOH is available for all domains except for neighborhood and built environment (**Table 3**). Data are available at https://hints.cancer.gov/.

Table 3. SDOH Included in each Survey Dataset

| | Dataset | Economic Stability[a] | Education Access & Quality[b] | Health care Access & Quality[c] | Social & Community Context[d] | Neighborhood & Built Environment[e] |
|---|---|---|---|---|---|---|
| 1 | American Community Survey (ACS) | Yes | Yes | Yes | No | No |
| 2 | American Time Use Survey (ATUS) | Yes | Yes | No | No | No |
| 3 | Behavioral Risk Factor Surveillance System (BRFSS) | Yes | Yes | Yes | Yes | Yes |
| 4 | California Health Interview Survey (CHIS) | Yes | Yes | Yes | Yes | Yes |
| 5 | Children's' Healthy Living (CHL) | No | Yes | No | Yes | No |
| 6 | Current Population Survey (CPS) | Yes | Yes | Yes | No | No |
| 7 | Health Information National Trends Survey (HINTS) | Yes | Yes | Yes | Yes | No |
| 8 | Medicare Current Beneficiary Survey Data (MCBS) | Yes | Yes | Yes | Yes | No |
| 9 | Medical Expenditure Panel Survey (MEPS) | Yes | Yes | Yes | No | No |
| 10 | National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) - III | Yes | Yes | Yes | Yes | No |
| 11 | National Health Interview Survey (NHIS) | Yes | Yes | Yes | No | Yes |
| 12 | National Survey on Drug Use and Health (NSDUH) | Yes | Yes | Yes | Yes | No |
| 13 | Pregnancy Risk Assessment Monitoring System (PRAMS) | Yes | Yes | Yes | Yes | No |
| 14 | Youth Risk Behavioral Surveillance System (YRBSS) Data | No | Yes | No | Yes | Yes |
| 15 | National Youth Tobacco Survey (YTS) | No | Yes | No | No | No |

[a] Economic stability refers to an individual or population's ability to access and maintain sufficient financial resources to meet their basic needs such as food and housing.
[b] Education access refers to the ability of individuals to obtain education, including primary, secondary, and higher education; while education quality refers to the level of excellence of the education being received.
[c] Health care access refers to the ability of individuals to obtain health care services, including preventive services, primary care, and specialized care when needed; while health quality refers to the level of excellence of the health care services being received.
[d] Social and community context refers to social and cultural factors that can impact an individual's health and wellbeing, including factors such as social support and racial discrimination.
[e] Neighborhood and built environment refers to the physical surroundings in which people live, work, and play. Some examples include housing quality, access to healthy food, availability of green spaces, air and water quality, access to transportation, and neighborhood safety.

***Medicare Current Beneficiary Survey (MCBS).*** MCBS is an ongoing survey by the Centers for Medicare and Medicaid with accessible data from 1991. It collects data from a nationally representative sample of the Medicare population to determine the sources of payment and expenditures for all services. While NH and PI are aggregated as NHPI, Filipinos are treated as a distinct group from other Asians (**Table 1**). Health outcomes include mental, physical, and general health, as well as health-related behaviors and health conditions (**Table 2**). SDOH include economic stability, educational attainment, health care access, and social and community context (**Table 3**). Data are available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS.

***Medical Expenditure Panel Survey (MEPS).*** Available since 1996, MEPS is a large-scale survey conducted by the Agency for Healthcare Research and Quality (AHRQ) that includes 3 components – household, provider, and insurance. MEPS follows a longitudinal panel for 2 years. A new panel of sample households are sampled each year from respondents to the National Health Interview Survey (NHIS), discussed below, to provide household data. The provider component surveys hospitals, physicians, and other medical facilities that provided care to sampled household members. The insurance survey collects data on health insurance plans, benefits, and annual contributions made by employers and employees. The dataset disaggregates Filipino, Chinese, Asian Indians from other Asian ethnic groups since 2012; however, NHPI are grouped together (**Table 1**). Due to the small NHPI sample size (<200/year), multiple years of data should be combined to study NHPI. Health variables include physical, mental, and general health, as well as health-related behaviors and health conditions (**Table 2**). SDOH include economic stability, educational attainment, and health care access (**Table 3**). Data are available at https://meps.ahrq.gov.

***National Epidemiologic Survey on Alcohol and Related Conditions (NESARC-III).*** The National Institute on Alcohol Abuse and Alcoholism sponsored NESARC to collect data on alcohol use from a nationally representative sample of adults in the US. The first 2 waves of the NESARC were conducted between 2001 and 2005. The latest survey data were collected between 2012 and 2013, with a sample size of over 36 000 respondents. NHPIs are combined but separated from AAs (**Table 1**). For health, NESARC collected information on alcohol and drug use and disorders, related risk factors, and associated physical and mental disabilities (**Table 2**). SDOH include economic stability, educational attainment, health care access, and social and community context (**Table 3**). Data are available at https://www.niaaa.nih.gov/research/nesarc-iii.

***National Health Interview Survey (NHIS).*** Established in 1963, NHIS is conducted by CDC to monitor trends in illness and disability and to track progress toward national health objectives. NHIS is a cross-sectional household interview survey conducted, gathering data from about 30 000 adult interviews and 9000 child interviews per year. Through 2018, AAs were separated into detailed categories including Filipino, but NHPI was not a separate racial/ethnic category. From 2019, NHIS has not reported detailed and disaggregated AA groups, and NHPI information is only available in the restricted data, meaning release of this data requires an application and approval (**Table 1**). Core health questions include chronic conditions, health-related behaviors, functioning, and disability (**Table 2**). SDOH include economic stability, educational attainment, and health care access (**Table 3**). Data are available at https://www.cdc.gov/nchs/nhis/index.htm.

In 2014, NHIS sponsored an oversampling of NHPI, in which about 3000 households containing 1 or more NHPI resident were surveyed using the 2014 NHIS instrument. For the NHPI NHIS, race/ethnic categories included NH, Guamanian or Chamorro/CHamoru, Samoan, Other Pacific Islander, and Filipino. Data are available at https://www.cdc.gov/nchs/nhis/nhpi.html.

***National Survey on Drug Use and Health (NSDUH).*** This survey has been administered by the Substance Abuse & Mental Health Services Administration since 1971. NH, PI, and Filipinos are separated from other groups (**Table 1**). Regarding health, the survey tracks specific substance use and mental illness measures and assesses substance use disorders and treatment for these disorders (**Table 2**). For health behaviors, the survey asks about use of alcohol, marijuana, cocaine, hallucinogens, heroin, inhalants, tobacco, pain relievers, tranquilizers, stimulants, and sedatives. SDOH include economic stability, educational attainment, health care access, and social and community context (**Table 3**). Data are available at https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health.

***Pregnancy Risk Assessment Monitoring System (PRAMS).*** PRAMS is a state-based surveillance project conducted by the CDC that collects data on maternal attitudes and experiences before, during, and shortly after pregnancy. Women who have recently given birth are randomly selected from the site's birth certificate registry to receive a survey by mail. PRAMS currently covers about 81% of all US live births, with annual sample sizes ranging from 1000 to 3000 pregnant persons per state. Racial and ethnic categories vary by state. Hawaiʻi PRAMS data is available since 2000 and data are disaggregated for Filipinos and NHs by maternal race (**Table 1**). For health and health-related behaviors, PRAMS includes information on self-reported health, breastfeeding, cigarette smoking and alcohol use, and physical abuse (**Table 2**). For social determinants of health, PRAMS includes variables describing economic stability, educational attainment, health care access (eg, prenatal care and Medicaid and WIC participation), and social and community context (**Table 3**). Data are available at (https://www.cdc.gov/prams/prams-data/researchers.htm#variables) and at the Hawaiʻi Health Data Warehouse (https://hhdw.org/data-sources/pregnancy-risk-assessment-monitoring-system/).

***Youth Risk Behavioral Surveillance System (YRBSS).*** Similar to the BRFSS described above, YRBSS collects data on health behaviors among youth. Since 1991, the national YRBSS is administered biennially by the CDC to high school students (grades 9-12) in public and private schools in the US, and to middle school students in some states, territories and local educational agencies. A representative sample is generated using a 3-stage cluster sample design, and the average annual sample size ranges between 12 000 to 18 000. Data are available at https://www.cdc.gov/healthyyouth/data/yrbs/data.htm.

For Hawaiʻi, YRBSS is administered through a collaboration between the CDC, the Hawaiʻi State Departments of Education and Health, and the University of Hawaiʻi, utilizing as dual modes of paper or online survey. Two different surveys are conducted, 1 for middle school students (grades 6-8) and another for high school students (grades 9-12), within public non-charter schools in Hawaiʻi. Since 2011, the annual average sample size has ranged between 5000 and 6000. YRBSS Hawaiʻi collects disaggregated racial categories that include Filipino, NH, and PI (**Table 1**). The survey collects data on health risk behaviors such as unhealthy dietary patterns, inadequate physical activity, tobacco, alcohol, and other drug use, sexual behaviors, and unintentional injuries and violence (**Table 2**). SDOH include educational attainment, social and community context, and neighborhood and built environment

(**Table 3**). Additionally, visits to doctors and dentists are also assessed. Data are available at https://hhdw.org/data-sources/youth-risk-behavior-survey/.

***Youth Tobacco Survey (YTS).*** The national YTS has been administered annually since 1999 through a joint collaboration between the CDC and the Food and Drug Administration (FDA). YTS was administered as a paper survey but and transitioned to an online format in 2019. The survey targets middle school and high school students in the 50 states and the District of Columbia, with a national sample size between 14 000 and 36 000. The national YTS collects aggregated race data (Asian, and NHPI), which can be accessed at https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/data/index.html.

In Hawaiʻi, YTS was administered to public school students (both middle and high school) as a module in the Hawaiʻi School Health Survey from 2003 to 2019, along with the YRBSS. The Hawaiʻi YTS was administered biennially and had disaggregated race categories such as NH, PI, and Filipino (**Table 1**). YTS collected comprehensive data on health-related behaviors, including tobacco use, minors' access to tobacco products, exposure to second-hand tobacco smoke, knowledge and attitudes about tobacco, smoking cessation, knowledge about media messages, and school curriculum (**Table 2**). For SDOH, the only variable collected was educational attainment (**Table 3**). Unfortunately, the CDC discontinued the state-based YTS after 2019. Data are available at https://hhdw.org/data-sources/youth-tobacco-survey/.

## Discussion

This inventory of publicly available survey datasets includes 15 databases of potential use by researchers interested in studying health disparities among NH, PI, and Filipino populations. Strengths of these datasets are that they include measures of health and SDOH, and many have available data since 2010, allowing for the examination of changes over time. The main limitation of these datasets is the relatively small sample size of NH, PI, and Filipino populations, which may require investigators to combine data from multiple years to study health disparities.

There are several limitations to this review. First, survey datasets were initially identified using a single federal website and the knowledge of the author team. As a result, there may be additional datasets that could be useful to researchers that are not captured in this review. Second, because many datasets were described in this manuscript, there was only space for brief discussions of each dataset. Investigators will need to go to the websites to find out more information.

## Conclusion

Despite these limitations, this review will hopefully be useful to investigators interested in examining health disparities affecting NH, PI, and Filipinos. Analysis of these datasets will enable identification of areas to target for future research, with the ultimate goal of achieving health equity for NH, PI, and Filipino populations.

## Conflict of Interest

None of the authors identify a conflict of interest.

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# Potential Errors in Health Disparities Research Resulting from Lack of Unique Patient Identifiers: Analysis of Diabetes-related Preventable Hospitalizations

Hyeong Jun Ahn PhD

## Abstract

*All-payer, population-level hospital discharge data have been used to identify health disparities across racial/ethnic and other demographic groups. However, researchers are often unable to identify unique patients in the data sets if a unique patient identifier is not provided. The lack of the unique patient identifier can result in biased estimates of research outcomes using discharge data. This could then mislead the researchers, public, or policy-makers who utilize such biased results. This study examined estimation bias of health disparities due to rehospitalizations considering diabetes-related preventable hospitalizations using 6 years of state-level data from Hawai'i Health Information Corporation. Different analyses methods showed different probabilities of having multiple visits by age, race/ethnicity and payer subgroups. Charge analysis results also showed that ignoring the multiple visits could result in significance error. For a patient with multiple hospitalizations, rehospitalizations are often dependent upon the discharge status of previous visits, and the independence assumption of the multiple visits may not be appropriate. Ignoring the multiple visits in population-level analyses could result in severe health disparities significance errors. In this hospitalization charge analysis, the Chinese group was not significantly different than the White group (relative risk ratio - RR: [95% CI]: 0.93 [0.80, 1.08]), while the difference was signficant (RR [95% CI]: 0.86 [0.77,0.96]) when the multiple visits were ignored.*

## Keywords

*Multiple visits, significance error, unique patient identifier, GEE, hospitalization analysis*

## Abbreviations

*AHRQ = Agency for Healthcare Research and Quality*
*AOR = adjusted odds ratio*
*ARR = adjusted relative risk ratio*
*DOD = Department of Defense*
*DRPH = diabetes-related potentially preventable hospitalizations*
*GEE = generalized estimating equation*
*HHIC = Hawai'i Health Information Corporation*
*ICD-9 = International Classification of Diseases – 9th revision – Clinical Modification*
*OR = unadjusted odds ratio*
*RR = unadjusted relative risk ratio*

## Introduction

Diabetes is one of the most common chronic diseases in the United States (US). About 34.2 million people or 10.5% of the US population had diabetes in 2020.[1] Diabetes is present in almost 1 in 5 (19.4%) of hospitalizations in the general US population,[2] and more than 20% of patients with diabetes experience hospitalization each year. About 8.3% of adults with diabetes had multiple hospitalizations in 1988.[3]

Many diabetes-related hospitalizations are considered avoidable with good outpatient care.[4] Inpatient stays for uncontrolled diabetes, short-term and long-term diabetes complications, and lower-extremity amputations are specifically classified by the Agency for Healthcare Research and Quality (AHRQ) as diabetes-related potentially preventable hospitalizations (DRPH).[5] Decreasing such preventable hospitalizations is expected to result in improved quality of care and reduced health care costs.[5-6]

Important patterns exist among patients with diabetes. The percentage of people who are aged 65 years or older with diabetes was over 6 times higher than that among people aged 20 to 44 years (25.9% vs. 4.1%).[7] Racial and ethnic differences also exist. For instance, Native Hawaiians have higher rates of diabetes compared to other groups. [8-13]

All-payer, population-level hospital discharge data have been used to identify health disparities across racial/ethnic groups. One limitation in many all-payer, population-level discharge datasets is that researchers are unable to identify unique patients in the datasets. For instance, the widely-used Nationwide Inpatient Sample data from Healthcare Cost and Utilization Data[14] does not identify unique individuals due to privacy concerns, and thus cannot account for multiple hospitalizations by the same individuals in the estimation of rates and disparities.[15] Only 20 out of 47 participating states (43%) reported variables to track sequential visits, within or across facilities and hospitals for a patient within the state in their 2019 state-level inpatient databases. Even for states that have invested considerable time and money to create such unique identifiers, these data have not currently been widely used in health service research, especially across multiple years.

The lack of a unique patient identifier can result in biased estimates of research outcomes using discharge data. This could then mislead researchers, the public, or policymakers. For instance, the hospitalization patterns of patients with single visits might be quite different from that of patients with multiple visits. Significantly higher odds of having multiple stays were found for Hispanics and non-Hispanic Blacks relative to non-Hispanic Whites ($P < .0001$), Medicare or Medicaid patients compared with privately insured ($P < .0001$), and patients in low-income areas ($P < .05$).[16] If similar issues are true across many commonly reported outcomes with discharge data, many existing analyses that do not account for these biases may misstate or misestimate health disparities.

Hawai'i state-level hospitalization data includes a unique patient identifier across multiple years. The goal of this study was to use 6 years of Hawai'i state-level population-level data to investigate the impact of not identifying unique patients related to the extent of racial/ethnic health disparities. The first goal of this study is to explore any errors in significance when multiple visits are not considered as well as patterns of multiple DRPHs. The second goal is to estimate the parameters using a generalized estimating equation (GEE). For more illustration, the charges of diabetes hospitalizations are explored as a practical example of significance error that could be seen due to the lack of unique patient identification in a health disparity investigation.

## Methods

Hawai'i Health Information Corporation (HHIC) inpatient data from 2007-2012 (n=640,824) was used, which includes detailed discharge information for all hospitalizations from all payers in Hawai'i. The HHIC data includes data on race/ethnicity of patients, insurer, age, gender, and International Classification of Diseases – 9th revision – Clinical Modification (ICD-9) codes. Long-term care and psychiatric hospital visits were excluded. The HHIC data has been used as the Hawai'i hospital data source for the major national inpatient database.[4]

DRPH were defined with AHRQ criteria using ICD-9 diagnosis and procedure codes including: (1) uncontrolled diabetes without mentioning of a short-term or long-term complication (ICD-9-CM principal diagnosis codes 250.02-250.03); (2) diabetes with short-term complications, eg, ketoacidosis, hyperosmolarity, coma (ICD-9-CM principal diagnosis codes 250.1-250.33); (3) diabetes with long-term complications, eg, renal, eye, neurological, circulatory, or complications not otherwise specified (ICD-9-CM principal diagnosis codes 250.4-250.93); and (4) lower-extremity diabetes-related amputations based on ICD-9 and procedure codes ICD-9-CM procedure codes for lower-extremity amputation in any field and diagnosis code for diabetes in any field.[4] If a trauma diagnosis code was in any field, the amputation was not considered a DRPH. As DRPH definitions generally exclude pregnancy, childbirth, and puerperium hospitalization, those by individuals under 18 years, and those transferring from another institution, these visits were excluded in the study as well. Additionally, 433 Tripler Army Medical Center (Tripler) visit records were excluded due to unknown race/ethnicity information. While most patients with Department of Defense (DOD) insurance are likely to visit Tripler, the DOD patients who were admitted to other hospitals might have Tripler hospitalizations that were excluded from this study. A total of 7 652 records from 4 964 patients were used for analysis focusing DRPH visits with the exclusion criteria.

The HHIC race/ethnicity variable was created from the race/ethnicity categories available consistently across all hospitals in Hawai'i. Only 1 primary race is reported across all hospitals, typically from patient self-report at intake. Mixed-race individuals are represented as only their primary race. Other variables, such as sex (male/female based on administrative data), age (grouped in categories 18-39; 40-64, 65+), payer (DOD, Medicare, Medicaid, Private, and Other), location of residence (living on O'ahu or another Hawaiian island) and substance use (Yes or No) were also included in our multivariable analyses. Hospital charges in dollars were included in the HHIC data.

Choosing 1 visit per person is essential for patient level analysis as 1 record per patient needs to be analyzed to avoid certain issues with multiple records. For example, for racial disparities, 1 race record for a patient needs to be selected. If a patient keeps changing their race over time, it will result in inconsistencies among the different race/ethnicity groups. Therefore, selecting 1 record per patient is important for patient level analysis. Three different options were examined (first, last, and random) to investigate any significant difference. To consider these options, visits by the same patient were sorted by discharge date with the first and last visits easily identified. A random number generator was used to select a single visit for those patients with multiple visits.

### Statistical Methods

Multivariable logistic regressions were used to compare the first, last and a random visit from individuals with multiple visits versus a single visit, adjusted for age, sex, race/ethnicity, payer type, location of residence and substance use. All hospitalizations ignoring repeated visits were also analyzed by the same multivariable logistic regression while GEE models were used to consider the unstructured correlation structure among repeated visits within each patient. Adjusted odds ratios (AOR) with 95% confidence intervals (CIs) were obtained from the logistic regression and GEE models.

Three different approaches were used for hospitalization charge analysis using charge information for: (1) all hospitalizations without considering repeated measures; (2) the first visit for a patient; (3) all hospitalizations for a patient considering repeated measures. Multivariable gamma regression models with log link were used to predict hospitalization charges by race/ethnicity adjusting for other factors such as age, sex, race/ethnicity, payer type and location of residence.[17] Adjusted relative risk ratios (ARRs) of charges with 95% CIs were estimated. Analyses were conducted using SAS version 9.3 (SAS Institute, Cary, North Carolina) and two-tailed *P*-value of less than .05 was regarded as statistically significant. Because HHIC data are de-identified, analysis does not involve human subjects so Institutional Review Board (IRB) review was not sought.

## Results

### Single Visit Analysis

Twenty-two percent of the DRPH patients (n=1084) had multiple visits while 3880 patients had single visit. In multivariable logistic analysis using the first visits, younger patients had more multiple hospitalizations than older age groups (65+ years) (AOR [95% CI]: 4.04 [3.07, 5.30] for 18-39 years; 2.18 [1.77, 2.67] for 40-64 years), and patients with Medicaid or Medicare insurance had more multiple hospitalizations than patients with private insurance (AOR [95% CI]: 1.47 [1.20, 1.80] for Medicaid; 1.59 [1.28, 1.98] for Medicare) (**Table 1**, second column). Native Hawaiians and other Pacific Islanders were not significantly different from Whites, while Asians were less likely to have multiple hospitalizations than Whites (AOR [95% CI]: 0.52 [0.34, 0.82] for Chinese; 0.68 [0.54, 0.87] for Japanese; 0.68 [0.52, 0.89] for Filipino; 0.59 [0.37, 0.93] for other Asian). Sex and substance use were not statistically significant in predicting DRPH multiple hospitalizations.

Multivariable adjusted last visit analysis results were similar to first visit analyses (**Table 1**, third column). Younger patients also had more multiple hospitalizations than older age groups (65+ years) (AOR [95% CI]: 4.28 [3.27, 5.59] for 18-39 years; 2.33 [1.91, 2.84] for 40-64 years), and patients with DOD insurance, Medicaid and Medicare had more multiple hospitalizations than private insurance (AOR [95% CI]: 3.53 [1.63, 7.67] for DOD; 3.40 [2.03-5.70] for Medicaid; 4.68 [2.76-7.93] for Medicare). Native Hawaiians were more likely to have multiple hospitalizations compared to Whites (AOR [95% CI]: 1.24 [1.02, 1.51]) while Chinese and Japanese were less likely to have multiple hospitalizations (AOR [95% CI]: 0.61 [0.39, 0.93] for Chinese; 0.72 [0.57-0.92] for Japanese). Filipino, other Pacific Islanders and other Asian were not significantly different from Whites. Sex was not significantly different for DRPH multiple hospitalizations, but substance use did differ significantly with those who had substance use more likely to have a multiple hospitalization (AOR [95% CI]: 1.42 [1.10, 1.85]).

In multivariable adjusted random visit analyses (**Table 1**, fourth column), younger patients had more multiple hospitalizations than older age groups (65+ years) (AOR [95% CI]: 4.13 [3.15, 5.41] for 18-39 years; 2.29 [1.87, 2.81] for 40-64 years), and patients with Medicaid and Medicare had more multiple hospitalizations than those with private insurance (AOR [95% CI]: 2.06 [1.36, 3.13] for Medicaid; 2.31 [1.49, 3.56] for Medicare). Native Hawaiians and other Pacific Islanders were not significantly different from Whites, while Asians had fewer multiple hospitalizations than Whites (AOR [95% CI]: 0.55 [0.36, 0.85] for Chinese; 0.68 [0.54, 0.86] for Japanese; 0.72 [0.55, 0.93] for Filipino; 0.60 [0.38, 0.95] for other Asian). Sex and substance use were not significantly different for DRPH multiple hospitalizations.

### All Hospitalizations Analysis

The analysis using all hospitalizations was conducted without consideration of repeated measures (**Table 1**, fifth column). Females were significantly more likely to have multiple hospitalizations than males (AOR [95% CI]: 1.15 [1.04, 1.27]). Other Pacific Islanders were significantly less likely to have multiple hospitalizations compared from Whites (AOR [95% CI]: 0.77 [0.63, 0.94]). Age and payer showed similar pattern with other analyses.

GEE model analysis results, which statistically incorporate multiple visits, provide the more accurate significance (**Table 1**, last column). The 2 notable differences with results from other analyses present were: (1) Chinese was not significantly different from Whites (AOR [95% CI]: 0.68 [0.33, 1.40]) and (2) substance use was significantly associated with multiple DRPH (AOR [95% CI]: 1.60 [1.25, 2.05]). Younger patients also had more multiple hospitalizations than older age groups (65+ years) (AOR [95% CI]: 6.95 [5.12, 9.44] for 18-39 years; 2.97 [2.38, 3.69] for 40-64 years), and patients with Medicaid and Medicare were more likely to have multiple hospitalizations compared to those with private insurance (AOR [95% CI]: 3.03 [2.08, 4.43] for Medicaid; 2.50 [1.67, 3.73] for Medicare). Native Hawaiians and other Pacific Islanders were not significantly different than Whites, while Japanese, Filipino and other Asians were less likely to have multiple hospitalizations than Whites (AOR [95% CI]: 0.64 [0.49, 0.84] for Japanese; 0.69 [0.51, 0.95] for Filipino; 0.64 [0.41, 0.99] for other Asian). Sex was not significantly different for DRPH multiple hospitalizations.

### Charge Analysis

Hospital charge analysis for preventable diabetes hospitalizations was used as a practical example to further illustrate potential errors in significance (**Figure 1**). Hospital charges for Chinese were significantly lower than those of Whites in hospitalization level analysis without knowing patient identification by assuming independence among multiple visits within a patient (ARR [95% CI]: 0.86 [0.77, 0.96] for Method 1). However, hospital charges for Chinese were not significantly different than those of Whites when the other 2 methods were used: Method 2: patient level analysis using first admissions (ARR [95% CI]: 0.92 [0.81, 1.05]) and Method 3: hospitalization level analysis with repeated measure consideration (ARR [95% CI] 0.93 [0.80, 1.08]).

Table 1. Adjusted Odds Ratios for Multiple Diabetes Potentially-Related Hospitalizations in Hawai‘i, 2007-2012

| | Patient level | | | All Hospitalizations without repeat measures[d] | All Hospitalizations with repeat measures[e] |
|---|---|---|---|---|---|
| | First Hospitalization[a] | Last Hospitalization[b] | Random Hospitalization[c] | | |
| | AOR [95% CI] | AOR [95% CI] | AOR [95% CI] | AOR [95% CI] | AOR [95% CI] |
| **Gender** | | | | | |
| Female | 1.03 [0.90, 1.19] | 1.02 [0.89, 1.18] | 1.01 [0.88, 1.17] | 1.15 [1.04, 1.27]* | 1.15 [0.96, 1.37] |
| Male | Reference | Reference | Reference | Reference | Reference |
| **Age** | | | | | |
| 18-39 | 4.04 [3.07, 5.30] * | 4.28 [3.27, 5.59] * | 4.13 [3.15, 5.41] * | 6.95 [5.74, 8.42] * | 6.95 [5.12, 9.44] * |
| 40-64 | 2.18 [1.77, 2.67] * | 2.33 [1.91, 2.84] * | 2.29 [1.87, 2.81] * | 2.97 [2.57, 3.43] * | 2.97 [2.38, 3.69] * |
| 65+ | Reference | Reference | Reference | Reference | Reference |
| **Race/Ethnicity** | | | | | |
| Chinese | 0.52 [0.34, 0.82] * | 0.61 [0.39, 0.93] * | 0.55 [0.36, 0.85] * | 0.68 [0.52, 0.89] * | 0.68 [0.33, 1.40] |
| Filipino | 0.68 [0.52, 0.89] * | 0.84 [0.64, 1.08] | 0.72 [0.55, 0.93] * | 0.69 [0.58, 0.83] * | 0.69 [0.51, 0.95] * |
| Hawaiian | 1.16 [0.95, 1.41] | 1.24 [1.02, 1.51] * | 1.15 [0.95, 1.40] | 1.09 [0.94, 1.25] | 1.09 [0.88, 1.35] |
| Japanese | 0.68 [0.54, 0.87] * | 0.72 [0.57, 0.92] * | 0.68 [0.54, 0.86] * | 0.64 [0.54, 0.76] * | 0.64 [0.49, 0.84] * |
| Other Asian | 0.59 [0.37, 0.93] * | 0.64 [0.40, 1.02] | 0.60 [0.38, 0.95] * | 0.64 [0.47, 0.86] * | 0.64 [0.41, 0.99] * |
| Other Pacific Islander | 0.93 [0.71, 1.23] | 1.28 [0.97, 1.67] | 1.02 [0.78, 1.33] | 0.77 [0.63, 0.93] * | 0.77 [0.56, 1.04] |
| Other race | 0.80 [0.61, 1.04] | 0.76 [0.58, 1.01] | 0.70 [0.53, 0.92] * | 0.78 [0.64, 0.94] * | 0.78 [0.58, 1.04] |
| White | Reference | Reference | Reference | Reference | Reference |
| **Payer** | | | | | |
| Department of Defense | 1.09 [0.57, 2.08] | 3.53 [1.63, 7.67] * | 1.77 [0.86, 3.64] | 1.62 [0.95, 2.78] | 1.62 [0.75, 3.49] |
| Medicaid/Quest | 1.47 [1.20, 1.80] * | 3.40 [2.03, 5.70] * | 2.06 [1.36, 3.13] * | 3.03 [2.28, 4.04] * | 3.03 [2.08, 4.43] * |
| Medicare | 1.59 [1.28, 1.98] * | 4.68 [2.76, 7.93] * | 2.31 [1.49, 3.56] * | 2.50 [1.86, 3.37] * | 2.50 [1.67, 3.74] * |
| Other | 0.97 [0.66, 1.42] | 2.17 [1.29, 3.66] * | 1.25 [0.82, 1.91] | 1.51 [1.13, 2.01] * | 1.51 [1.01, 2.24] * |
| Private | Reference | Reference | Reference | Reference | Reference |
| **Living O‘ahu** | | | | | |
| Yes | 0.99 [0.85, 1.16] | 0.95 [0.81, 1.11] | 0.99 [0.84, 1.15] | 0.94 [0.84, 1.05] | 0.94 [0.77, 1.14] |
| No | Reference | Reference | Reference | Reference | Reference |
| **Substance Use** | | | | | |
| Yes | 1.12 [0.85, 1.47] | 1.42 [1.10, 1.85] * | 1.01 [0.77, 1.34] | 1.60 [1.33, 1.92] * | 1.60 [1.25, 2.05] * |
| No | Reference | Reference | Reference | Reference | Reference |

* = significant results with *P* value <.05

[a] First Hospitalization: the first visit out of multiple hospitalizations per patient.

[b] Last Hospitalization: the last visit out of multiple hospitalizations per patient.

[c] Random Hospitalizations: a randomly selected visit out the multiple hospitalizations per patient.

[d] All Hospitalizations without repeat measures: all visits were used without identifying patients.

[e] All Hospitalizations with repeat measures: all multiple visits were used with patient identification.

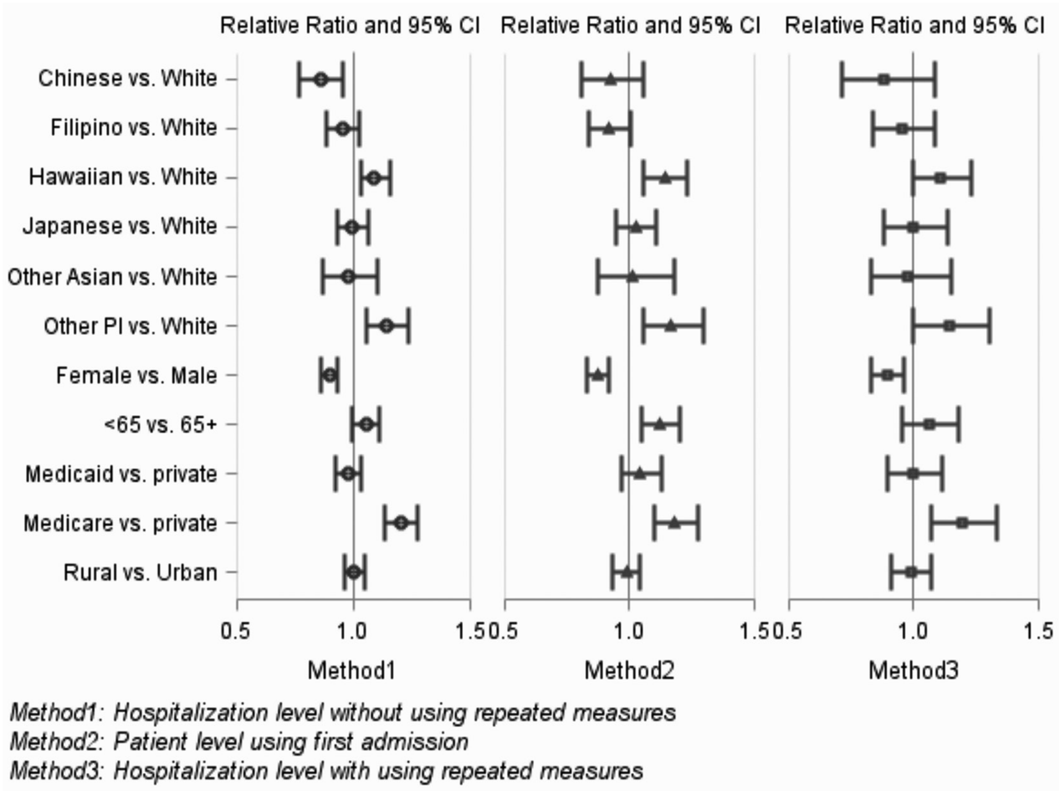

Figure 1. Adjusted Relative Ratio Estimation of Charges for Diabetes Potentially-Related Hospitalizations in Hawai'i, 2007-2012

## Discussion

Different analytic methods showed different probabilities of having multiple visits by age, race/ethnicity, and payer subgroups. It was common for younger patients to have more multiple hospitalizations than older age groups (65+ years). There were more multiple hospitalizations for patients with Medicaid and Medicare than with private insurance. However, some results were dramatically different among the 5 analyses. For example, in contrast with results from other analyses, in the analysis using the last visit, DRPH multiple hospitalizations showed significant differences between Hawaiians and Whites. In the analysis using repeated measures which generates statistically more accurate significance levels, Chinese DRPH multiple hospitalizations were not significantly different from Whites, while the other 4 analyses all showed that the Chinese had significantly fewer multiple hospitalizations than Whites. The analysis results of substance use using repeated measures also showed different patterns than those with first and random visit analyses. The selection of certain visits to represent patient-level hospitalizations is beyond this study scope as the study goal was to illustrate that significant differences exist between single visits and multiple visits for DRPH stays irrelevant of the selection of visits or repeated measures.

This study highlights the importance of patient identification in using hospitalization data. When patient identification is unknown, researchers have to assume independence among visits of the same patient. That is, if a patient was readmitted, the new admission wouldn't be connected with previous visits and the significance corresponding to "all hospitalizations without repeat measures" and "all hospitalizations with repeated measures" should be same. This independence assumption may be reasonable for analysis of some types of disease that do not usually result in repeated hospital visits, (eg, skin and subcutaneous tissue infections-related hospitalizations). For these diseases that are of mild to modest severity and treated relatively easily, significant differences in patient characteristics (eg, race/ethnicity, payer type) between single and multiple hospitalizations might not be seen. But if a patient is admitted with a disease that has severe comorbidities, the patient is more likely to be readmitted with same medical issue. In such cases, the repeated visits will need to be considered in the analysis. When the interval between visits is short, 30-day readmission is a popular outcome measure for hospitals to track. For readmissions over longer periods, many factors that are outside of hospitals' control, (eg, other complicating illnesses, patients' own behavior, or care provided to patients after discharge), could play a role. The message from this DRPH analysis is that rehospitalizations are often dependent on discharge status of previous visits for a patient, and independence assumption of the data may not be appropriate. If multiple visits were not appropriately accounted for, significance of health disparities would be severely affected, and the error could have impacts across racial/ethnic groups, comorbidity status, payer groups, and across the lifespan.

As an example of the potential error in significance, the hospital charge analysis showed that RR estimates could be dramatically different between the analyses with patient identification compared to those not taking patient identification into consideration. For Chinese, the RR of hospitalization charges is not significantly different from Whites when adjusted for multiple visits, but Chinese had significantly lower charges when multiple visits were not properly taken into consideration. Without the appropriate consideration of multiple visits, the results could mislead health policy makers, which could lead to misallocated effort in reducing health disparities that may not actually exist.

The current study has several limitations. Administrative data have known limitations and do not include many characteristics, including education, household income, English proficiency, and other factors that may help explain observed differences. The data studied is from a single state and is more than 10 years old. The limited years of data were accessed before the HHIC organization was dismantled and it was extremely difficult to update the data with recent years after reorganization. The results may not reflect national trends. While a strength of this study is the diversity of Asian American and Pacific Islander groups included, this may make the findings less directly applicable to national findings pertaining to other important racial/ethnic disparities, especially among African Americans and Latinos. While all individuals who live in Hawai‘i during the 6 year period are included, it is not known if individuals with hospitalizations in the state just recently entered the state or have since left the state. Also, such migration may vary by demographic groups. But the overall impact should be relatively small for Hawai‘i as the emigration and immigration of the state is not high. In the period 1995–2000, 125 160 people moved into the state and 201 293 moved out, for a net loss of 76 133.[18] The assignment of first and last visit by discharge date was also limited by the study period, and it may not capture the true first and last visit of a given patient. The potential error could be due to not only repeated measurements but also other reasons such as reported or unreported death and the fact that the GEE models also did not consider those events.

## Conclusions

Over 20% of the patients over the 6-year period had more than1 DRPH captured by the HHIC hospitalization data and over 8% of these patients had at least 3 hospitalizations. For a patient with multiple hospitalizations, rehospitalizations are often dependent upon the discharge status of previous visits and the independence assumption of the multiple visits may not be appropriate. Ignoring multiple visits in population-level analyses could result in severely distorting the significance of health disparities.

## Conflict of Interest

The author does not identify a conflict of interest.

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# The Pacific Innovations, Knowledge, and Opportunities (PIKO) Program: A Data Lifecycle Research Experience

Rylan Chong PhD; Laura Tipton PhD

## Abstract

*Pacific evidence-based clinical and translational research is greatly needed. However, there are research challenges that stem from the creation, accessibility, availability, usability, and compliance of data in the Pacific. As a result, there is a growing demand for a complementary approach to the traditional Western research process in clinical and translational research. The data lifecycle is one such approach with a history of use in various other disciplines. It was designed as a data management tool with a set of activities that guide researchers and organizations on the creation, management, usage, and distribution of data. This manuscript describes the data lifecycle and its use by the Biostatistics, Epidemiology, and Research Design core data science team in support of the Center for Pacific Innovations, Knowledge, and Opportunities program.*

## Keywords

*data lifecycle, health, evidence-based, clinical, translational, Native Hawaiian health, Pacific Islander health, Filipino health, data science, PIKO*

## Abbreviations and Acronyms

*API = application programming interface*
*BERD = Biostatistics, Epidemiology, and Research Design*
*CTR = clinical and translational research*
*NIH = National Institutes of Health*
*PIKO = Pacific Innovations, Knowledge, and Opportunities*

## Introduction

The Pacific Innovations, Knowledge, and Opportunities (PIKO) program is grant funded by the National Institute of General Medical Sciences (U54GM138062), and its primary aim is to improve the health of Native Hawaiians, Pacific Islanders, Filipinos, and people who are medically underserved in Hawai‘i.[1] This program is made up of 7 cores that function independently and collaboratively to provide support to PIKO researchers, defined as a researcher who is either going through the process of applying for PIKO pilot project funding support or has received PIKO funding support. PIKO researchers are often, but not exclusively, early-stage investigators , who are within 10 years of their terminal degree and have not had a substantial National Institutes of Health (NIH) independent research award. One of the cores that is integral to PIKO researchers' success is the Biostatistics, Epidemiology, and Research Design (BERD) core. The broad goals of this core are to support PIKO researchers through all stages of their study and for the PIKO researchers to develop competencies in Pacific evidence-based clinical and translational research (CTR). Core goals are met through consultation, training, and mentoring from each of the BERD components: biostatistics, epidemiology, research design, data science, psychometrics, mixed methods, economics, and database design.[1] In this column, the traditional Western research process is introduced as the context for BERD‘s innovation in integrating the data lifecycle research process. This is followed by a description of how PIKO researchers were exposed to data lifecycle competencies through the lens of the PIKO BERD core data science team.

## Traditional Western Research Process

The traditional Western research process, described in 7 steps in **Figure 1**, is an important process to extend the current body of knowledge in most scientific disciplines.[2] Individuals who are interested in research are primarily exposed to the research process in graduate school through a class project, grant funded project, a master's thesis, or a doctoral dissertation.[2] However, not all researchers' journeys are the same and not everyone goes through a graduate school research experience. Some researchers, including some PIKO pilot project awardees, are exposed to research after finishing their education during their career. For example, a community health practitioner who has no formal research experience could join PIKO to learn how to conduct research. Individuals who experienced the research process are expected to obtain the competencies illustrated in **Figure 1**.

Through the BERD core, the PIKO program provides support for PIKO researchers to help develop competencies on the traditional Western research process in 3 phases. The first phase is the design and submission of an abstract proposal, in which a researcher is exposed to the Activities 1-3 of the research process in Box 1 on the left-hand side of **Figure 1**. Next, researchers whose abstract proposals are selected to continue in the program are invited to submit a full proposal for funding, in which they revisit the same 3 activities in greater detail. In the third phase and Box 3 of the PIKO program, a funded full proposal is executed, and the PIKO researcher performs the remaining activities of the research process.

Performing CTR in the Pacific is greatly needed as there is an acknowledged lack of research in all areas of health for Native Hawaiians, Pacific Islanders, Filipinos, and people who are medically underserved in Hawai‘i.[3] However, several challenges stem from the data that contribute to the lack of CTR in the Pacific. These include: (1) small sample sizes; (2) limited availability, access, and usability of the data; (3) lack of awareness of the various types of data that can be collected and transformed; and (4) analytics that will produce useful and meaningful results. The data lifecycle process is a data science data management tool that addresses these challenges and is used in various disciplines, including as biology, environmental sciences, economics, cybersecurity, library sciences, business, political science, and social science.[4,5] The data lifecycle offers further insights into competencies that can address some of the data challenges of the Pacific.

## Data Lifecycle

Launching the data lifecycle begins with understanding the processes that make up this framework. Illustrated in **Figure 2**, the data lifecycle focuses on what happens to the data from the formation of the question through the end of the project. This process is used to guide the actions of the PIKO BERD core data science team.

As with the traditional Western research process, the 7 data lifecycle activities can be aligned with the PIKO program phases. The abstract proposal and full proposal mostly encompass planning, which is the first lifecycle activity. The remaining lifecycle activities (collect, process, analyze, preserve, share, and determine the course), all happen in the full proposal execution phase.

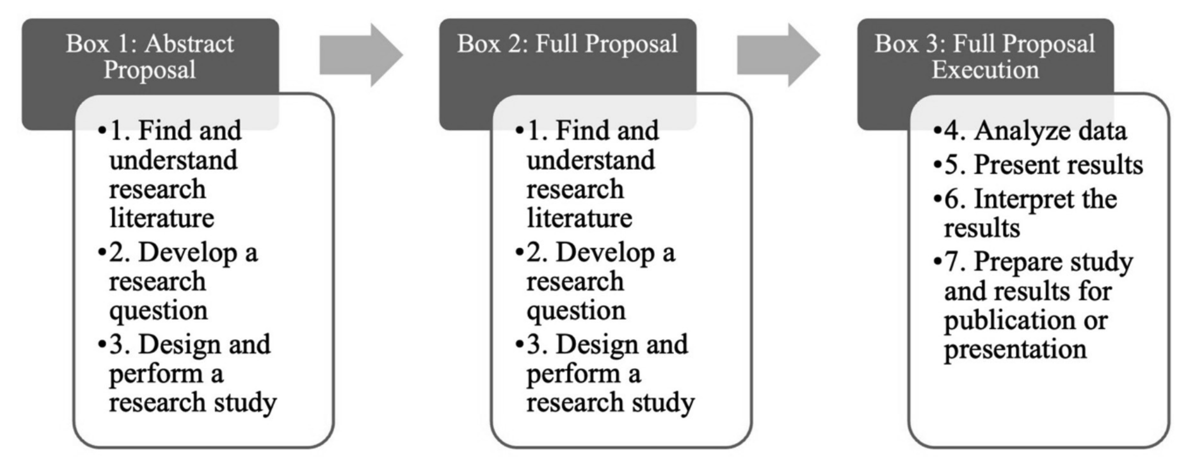

Figure 1. Three Phases of the PIKO Program and How they Align to the Traditional Western Research Process[2]

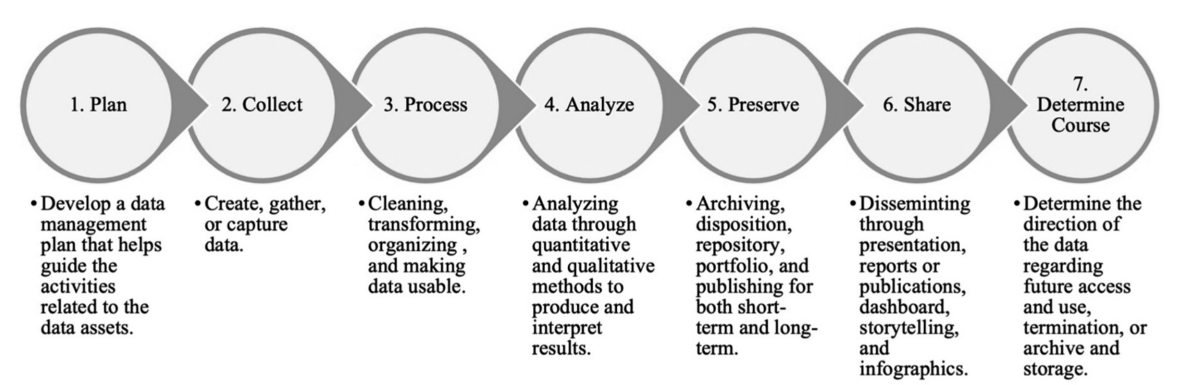

Figure 2. Data Lifecycle Activities[4–6]

## BERD Data Science Data Team Lifecycle Experience

This section provides details on how the data lifecycle process is utilized in the BERD core data science team with PIKO researchers. All stages of the data lifecycle are relevant. The primary role of the BERD data science team is to provide guidance and support while working with PIKO researchers.

Activity 1, "plan" occurs during the abstract proposal and the full proposal phases of the PIKO program. During these phases, a PIKO researcher develops a research plan that includes all components of a NIH proposal abstract, including data to be collected (Activity 2 of the data lifecycle) and how that data will be processed (Activity 3) and analyzed (Activity 4). Activities 5-7 of the data lifecycle, preservation, sharing, and determining the course of the data, are not described in the proposal. The data science team interacts with the PIKO researchers, usually after the abstract proposal phase, to discuss and provide recommendations on the reviewer comments or to provide any support that will benefit the researcher's project going forward. We found the most valuable tool to facilitate discussions with a researcher during the planning activity is a data management plan. Discussions can then cover project information that is not accurately described in the proposal: data types, formats, and sizes; related tools, software, and code to use with the data; collection activities and timeline; file formats and storage; processing of the data; and any standards and policies applied to the data.[7–9]

Once a PIKO researcher's plan is funded, PIKO researchers start their collection of structured, unstructured, and semi-structured data (Activity 2). Structured data is highly organized and has a tabular structure.[10] An example is survey data where values are stored in rows and columns. Conversely, unstructured data, such as images, documents and records, and videos, cannot be organized in rows and columns.[10] Finally, semi-structured data is a hybrid of structured and unstructured data. Examples of semi-structured data include social media Application Programming Interface (API) data, web scrapped internet articles, open-ended survey questions, and interviews and focus group narratives.[10] In the first few years of PIKO, there were some cases where PIKO researchers needed support to explore the more complex, or less traditional forms of data that could be collected to explain quantitative results, to address the lack of data for a particular question, or to investigate a question. Based on the case at hand, the data science team needed to be creative with their approach by suggesting to explore unstructured and semi-structured data and related tools to collect the data, which included documents and records, images, web scrapped internet articles, and social media API data.

After the data are collected, PIKO researchers begin Activity 3 of the data lifecycle and processed the data through three activities: cleaning, transforming, and organizing. Data cleaning includes removing, validating, modifying, aggregating, and subsetting the data. Transforming the data includes converting data from one format or structure to another. Data organization includes categorizing and classifying data to make it usable for the analysis activity.[4,6] The primary activity the data science team performed was to validate the PIKO researcher's data usefulness and to provide suggestions on transforming the data values from character to numeric for an easier analysis.

The analysis activity of the data lifecycle, Activity 4, is the area where the data science team and the PIKO researchers interact the most. The data science team currently offers 4 types of analysis support for researchers, including data exploration (eg, descriptive statistics, charts, figures); data modeling using machine learning techniques (eg, regression, naïve Bayes, decision tree); geospatial or mapping; and text mining (ie, exploring themes and patterns of text using coded algorithms). Data exploration has been the primary type of support offered by the data science team. The data science team provides mentoring and advice, performs 1-on-1 programming exercises, provides code, reviews the accuracy of code, and assists with programming statistics and figures. The other areas include data modeling using regression analysis and addressing inquiries about text mining methods for researchers who are performing qualitative studies.

The remaining Activities 5-7 of the data lifecycle are preserving, sharing, and determining the course of the data, which are primarily performed by PIKO researchers with their teams. Yet, the data science team supports these activities as well, including developing infographics and publications. Regarding infographics, the data science team provides guidance on applications and suggestions on how to create infographics that will communicate the information and results of a project to Pacific stakeholders. For manuscripts submitted for publication, the data science team performs some statistical analyses, confirms results, cleans data, provides recommendations for tables and figures to be used in the publication, suggests the additions of approaches and concepts in the methods section, and assists on responding to reviewers' comments.

## Data Lifecycle Competencies

Through working with the data science team and the data lifecycle, the goal is that PIKO researchers obtain 1 or more the following competencies:

- Able to understand and evaluate PIKO pilot project through a data management plan.
- Able to identify and understand unstructured and semi-structured data collection approaches.
- Able to identify and understand data usefulness and transformation.
- Able to identify and understand geographic information system (GIS) and/or text mining analysis methods.

- Able to evaluate data exploratory and data modeling analysis methods.
- Able to communicate information and results through infographics and publication.

While each of these competencies is valuable to PIKO researchers, 3 stand out from the rest through observation and working with PIKO researchers. First, the competency to use a data management plan as a framework to guide a PIKO project discussion is evident in the first phase and second phase of the PIKO program. Second, an understanding of collection approaches for unstructured and semi-structured data, how to make the data useful, how to transform the data, and how to analyze the data are competencies developed during the last phase of the PIKO program in the execution of their full proposal. Lastly, researchers who work with the data science team on infographics and publication learn to transfer and share results during the last phase of the PIKO program.

## Conclusion

The PIKO program was established to support culturally responsible and evidence-based clinical and translational research to improve the health of Native Hawaiians, Pacific Islanders, Filipinos, and other people who are medically underserved in Hawai‘i.[1] The BERD core is one of the 7 cores of this program and the only core to include a data science component that is meant to support PIKO researchers through all stages of both the traditional Western research process and the data lifecycle. After completing the PIKO program, a PIKO researcher is expected to publish his or her work and start the process of applying for a larger grant. Even if they do not publish their results or apply for a larger grant, the experience of working with the data lifecycle introduces new methods, tools, and resources to early-stage investigators that can support development of competencies in Pacific-related research.

## Conflict of Interest

None of the authors identify a conflict of interest.

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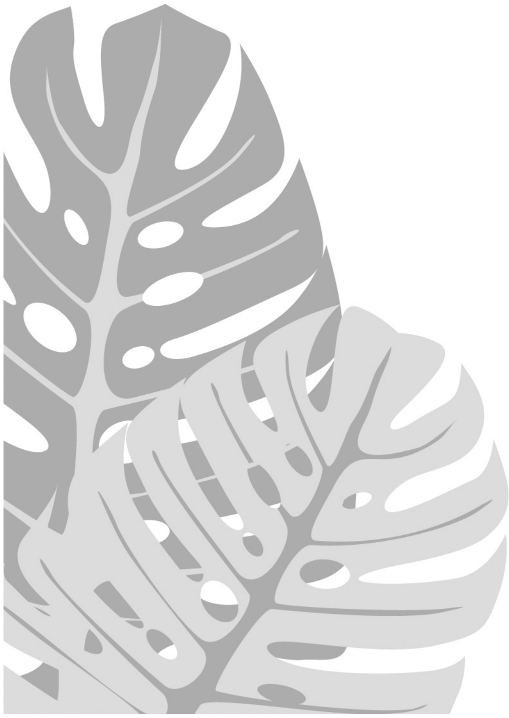
# Hawai‘i Journal of Health & Social Welfare Instructions for Authors of Research Articles

The Hawai‘i Journal of Health & Social Welfare (HJH&SW) publishes original research, reviews, balanced viewpoints (ie, point/ counterpoint articles), editorials, and other categories of articles. Topics of interest include medicine, nursing, public health, social work, dental hygiene, and pharmacology, with a focus on the unique, multicultural and environmental aspects of the Hawaiian Islands and Pacific Rim region. Some frequently published types of articles are described herein. Authors interested in publishing other types of articles may contact the journal.

**Original articles** are usually research-related, quantitative or qualitative papers. Research articles are limited to 3000 words. Reviews summarize the literature, address current practice or issues within the medical or public health communities, and are intended to promote a discussion of different viewpoints. Reviews are limited to 3000 words.

**Case Reports** are original and interesting reports that contribute significantly to medical knowledge. They generally describe unreported or unusual side effects, unexpected or unusual presentations of a disease, diagnoses and/or management of new and emerging diseases, unexpected events during treatment, or observations that highlight the need for new practice standards in the management of certain disease conditions. Case reports are limited 1500 words.



**Viewpoints** presented opinionated pieces on a topic of current controversy. Viewpoint pieces should nevertheless independently meet the scientific rigor for a published article through the inclusion of appropriate citations, and the use of noninflammatory language. It is the journal’s policy to present balanced opinions (ie, each viewpoint article must be paired with a counter-point article). Therefore, authors who submit a viewpoint article without the corresponding counter-point article may be delayed until an appropriate author for the counter-point piece can be found, and the article written. Authors are encouraged to work with colleagues to submit point- counterpoint articles together.

**Editorials**: For details about submitting editorials, please see our page Instructions for Authors of Columns/Editorials at https://hawaiijournalhealth.org/docs/author-guidecolumns-hjhsw.pdf

For authors/editors interested in commissioning a HJH&SW supplement, please view additional guidelines at https://hawaiijournalhealth.org/docs/supplementguide-updated2020-hjhsw.pdf

# Guidelines for Publication of Hawai‘i Journal of Health & Social Welfare Supplements

The Hawai‘i Journal of Health & Social Welfare (HJH&SW) partners with organizations, university divisions, and other research units to produce topic-specific issues of the journal known as supplements. Supplements must have educational value, be useful to HJH&SW readers, and contain data not previously published elsewhere. Each supplement must have a sponsor(s) who will work with the HJH&SW staff to coordinate all steps of the process. Please contact the editors at hjhsw@hawaii.edu for more information if you would like to pursue creating a supplement.

The following are general guidelines for publication of supplements:

1. Organizations, university divisions, and other research units considering publication of a sponsored supplement should consult with the HJH&SW editorial staff to make certain the educational objectives and value of the supplement are optimized during the planning process.

2. Supplements should treat broad topics in an impartial and unbiased manner. They must have educational value, be useful to HJH&SW readership, and contain data not previously published elsewhere.

3. Supplements must have a sponsor who will act as the guest editor of the supplement. The sponsor will be responsible for every step of the publication process including development of the theme/concept, peer review, editing, preliminary copy editing (ie, proof reading and first round of copy editing), and marketing of the publication. HJH&SW staff will only be involved in layout, final copy editing and reviewing final proofs. It is important that the sponsor is aware of all steps to publication. The sponsor will:
   a. Be the point of contact with HJH&SW for all issues pertaining to the supplement.
   b. Solicit and curate articles for the supplement.
   c. Establish and oversee a peer review process that ensures the accuracy and validity of the articles.
   d. Ensure that all articles adhere to the guidelines set forth in journal’s Instructions to Authors page (https://hawaiijournalhealth.org/authors.htm), especially the instructions for manuscript preparation and the statistical guidelines.
   e. Obtain a signed Copyright Transfer Agreement for each article from all authors.
   f. Comply with all federal, state, and local laws, rules, and regulations that may be applicable in connection with the publication, including ensuring that no protected health information appears in any article.
   g. Work with the editorial staff to create and adhere to a timeline for the publication of the supplement.
   h. Communicate any issues or desired changes to the HJH&SW staff in a timely manner.

4. Upon commissioning a supplement, the sponsor will be asked to establish a timeline for the issue which the sponsor and the HJH&SW editor(s) will sign. The following activities will be agreed upon with journal publication to take place no later than 24 months after signing. Extensions past the 24 months will be subject to additional fees based on journal publication rates at that time:
   - Final date to submit a list of all articles, with working titles and authors
   - Final date for submitting Word documents for copy editing
   - Final date for submitting Word documents for layout
   - Final date to request changes to page proofs (Please note that changes to page proofs will be made only to fix any errors that were introduced during layout. Other editing changes will incur an additional fee of $50 per page.)

5. The cost of publication of a HJH&SW supplement is $6,000 for an 8-article edition with an introduction from the sponsor or guest editor. Additional articles can be purchased for $500 each with a maximum of 12 articles per supplement. This cost covers one round of copy editing (up to 8 hours), layout, online publication with an accompanying press release, provision of electronic files, and indexing in PubMed Central, SCOPUS, and Embase. The layout editor will email an invoice for 50% of the supplement to the designated editor for payment upon signature of the contract. The remaining will be due at the time of publication. Checks may be made out to University Health Partners.

6. The sponsor may decide to include advertisements in the supplement in order to defray costs. Please consult with the HJH&SW advertising representative Michael Roth at 808-595-4124 or email rothcomm@gmail.com for assistance.

7. Supplement issues are posted on the HJH&SW website (https://hawaiijournalhealth.org) as a full-text PDF (both of the whole supplement as well as each article). An announcement of its availability will be made via a press release and through the HJH&SW email distribution list. Full-text versions of the articles will also be available on PubMed Central.

8. It is the responsibility of the sponsor to manage all editorial, marketing, sales, and distribution functions. If you need assistance, please contact the journal production editor. We may be able to help for an additional fee.

9. The editorial board reserves the right of final review and approval of all supplement contents. The HJH&SW will maintain the copyright of all journal contents.

Revised 3/21/23

# Hawai‘i Journal of Health & Social Welfare Style Guide for the Use of Native Hawaiian Words and Diacritical Markings

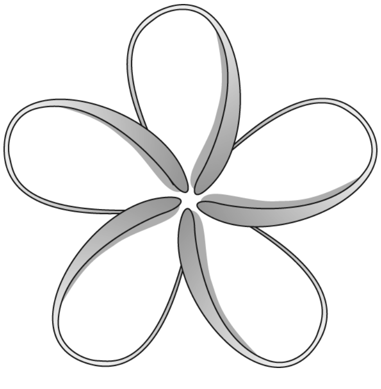
The HJH&SW encourages authors to use the appropriate diacritical markings (the ‘okina and the kahakō) for all Hawaiian words. We recommend verifying words with the Hawaiian Language Dictionary (http://www.wehewehe.org/) or with the University of Hawai‘i Hawaiian Language Online (http://www.hawaii.edu/site/info/diacritics.php).

Authors should also note that Hawaiian refers to people of Native Hawaiian descent. People who live in Hawai‘i are referred to as Hawai‘i residents.

Hawaiian words that are not proper nouns (such as *keiki* and *kūpuna*) should be written in italics throughout the manuscript, and a definition should be provided in parentheses the first time the word is used in the manuscript.

Examples of Hawaiian words that may appear in the HJH&SW:

**‘āina**
**ali‘i**
**Hawai‘i**
**kūpuna**
**Kaua‘i**
**Lāna‘i**
**Mānoa**
**Māori**
**Moloka‘i**
**O‘ahu**
**‘ohana**
**Wai‘anae**



# Hawai‘i Journal of Health & Social Welfare

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**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, Office of Public Health Studies, the Thompson School of Social Work & Public Health, the Nancy Atmospera-Walch School of Nursing, 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. ©Copyright 2023 by University Health Partners of Hawai‘i (UHP Hawai‘i).

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.

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