



Research article

Neighborhood level facilitators and barriers to hypertension management: A Native Hawaiian perspective

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ABSTRACT

Native Hawaiians have a disproportionately high prevalence of hypertension, which is an important and modifiable risk factor for cardiovascular disease (CVD). To reduce CVD among Native Hawaiians, we must better understand facilitators and barriers to hypertension management (i.e., diet, physical activity, stress reduction) unique to Native Hawaiians. Despite evidence of neighborhood-level facilitators and barriers to hypertension management in other populations, there is limited research in Native Hawaiians. Participants from a randomized controlled trial ($n = 40$) were recruited for 5 focus groups. All participants were self-reported Native Hawaiians and had uncontrolled hypertension. Discussions elicited experiences and perceptions of neighborhood-level stressors as they relate to participants' hypertension management efforts. Audio recordings were transcribed and analyzed using ATLAS.ti for emergent themes. Five themes were identified: neighborhood description, community resources, neighborhood change, safety, and social connectedness. Novel barriers to hypertension control included loss of culture and loss of respect for elders, change in community feel, and over-development. Facilitators included social cohesion and collective power. These data provide a deeper understanding of how Native Hawaiians experience neighborhood factors and how those factors impact their efforts to improve their diets, physical activity, and stress management. The findings help to inform the development of multilevel CVD prevention programs. Further research is needed to explore the subtheme of social and emotional stress related to neighborhood change and CVD health risk due to cultural and historic trauma references.

1. Introduction

Cardiovascular disease (CVD) is the leading cause of death in the US [1]. Hypertension is a major and modifiable risk factor for CVD [2,3,4]. Hypertension is implicated in 50% of ischemic strokes and increases the risk for hemorrhagic stroke, chronic heart disease, kidney failure, and blindness [5]. Native Hawaiians, the indigenous people of Hawai'i, suffer from a disproportionate burden of CVD

Abbreviations: Native Hawaiian, NH; Cardiovascular disease, CVD; Hypertension, HTN; Body Mass Index, BMI.

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resulting from hypertension. Under the previous American Heart Association (AHA) guidelines, which defined hypertension as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg, the prevalence of hypertension has been estimated at 48% in Native Hawaiians, 38% in Japanese, 30% in Filipinos, and 23% in non-Hispanic Whites [6,7,8]. These rates will likely rise under the revised AHA guidelines, which define hypertension as systolic blood pressure of ≥ 130 mmHg or diastolic blood pressure of ≥ 80 mmHg. Native Hawaiians are 3–4 times more likely to have coronary heart disease and stroke than Whites and they experience these conditions an average of 10 years earlier [9,10]. Among Native Hawaiians, mortality rates from coronary heart disease and stroke are 68% and 20% higher, respectively, than in the state population as a whole [11].

Native Hawaiians have a higher prevalence of behavioral and physiological risk factors for hypertension. The Racial and Ethnic Approaches to Community Health Across the U.S. Risk Factor Survey found that fewer Native Hawaiians met the recommended physical activity guidelines and they report less leisure-time physical activity than the state as a whole [8,12]. In Hawai'i, a greater percentage of Native Hawaiians report currently smoking and binge drinking while fewer report physical activity, compared to Whites [8]. Some of these disparities worsened over time. From 2005 to 2015, the proportion of Native Hawaiians who reported binge drinking rose by 7.2% (vs. 2.4% for all residents of the state), while the proportion of those who met physical activity guidelines dropped by 7.3% (vs. 4.3% for all residents) [8,13]. Native Hawaiians experience greater physiological risk factors for hypertension as well. In fact, 75% of Native Hawaiians have a BMI ≥ 30 compared to 55% of non-Hispanic Whites, and 10% have type 2 diabetes mellitus, compared to 5% of non-Hispanic Whites [8].

However, these behavioral and physiological risk factors do not occur in a vacuum. Rather, they are influenced by the environment in which they occur. Research outside of Hawai'i has shown that neighborhood-level factors (e.g., safety and availability of walking paths and useable sidewalks, availability of healthy foods, safety, and social cohesion) influence hypertension risk [14,15,16,17,18,19,20,21]. For instance, the locations of recreation facilities and neighborhood walkability have been found to influence physical activity [22,23]. Another study found that neighborhood social cohesion is associated with less cigarette use and healthier eating [24]. A study in older adults with hypertension found that individuals who perceive more social cohesion in their neighborhoods engage in more hypertension management [25]. However, there has been limited neighborhood-level factors research among Native Hawaiians [26]. One study found that communities with a high density of Native Hawaiians have more fast food outlets and fewer exercise facilities than communities with fewer Native Hawaiian residents [27]. These neighborhood-level factors may be impacting the effectiveness of hypertension management and CVD risk reduction interventions. For instance, an intervention that encourages daily walking may be less effective in areas with poor walkability.

An important step in examining the relationship between neighborhood-level factors and hypertension among self-identified Native Hawaiians is to understand how they perceive their neighborhoods and how they believe their neighborhoods influence their ability to manage their hypertension. Identifying important and modifiable neighborhood factors in Native Hawaiian communities that affect their hypertension management and CVD risk can enhance the effectiveness of behavioral-based interventions for this high-risk population.

1.1. Purpose

The purpose of this study was to identify Native Hawaiian perspectives and beliefs regarding the influence of neighborhood-level

Table 1
Focus group discussion guide.

Areas of Interest	Focus Group Questions
Description of neighborhoods	1. How would you describe your neighborhood? <ul style="list-style-type: none"> • Probe for different characteristics
Neighborhood dimensions	2. How would you geographically define your neighborhood? 3. Describe your neighborhood's [dimension]. <ul style="list-style-type: none"> • Walkability • Availability of healthy foods • Safety • Social cohesion • Aesthetic quality • Violence • Activities with neighbors
Neighborhood impact on hypertension management	4. What other dimensions should be included? Why? 5. How do these dimensions affect your hypertension management/CVD risk reduction efforts? (e.g., physical activity, eating)? <ul style="list-style-type: none"> • Walkability • Availability of healthy foods • Safety • Social cohesion • Aesthetic quality • Violence • Activities with neighbors

factors on their efforts in hypertension management (i.e., improving diet, increasing physical activity, and reducing stress).

2. Methods

2.1. Participants

A sub-sample of participants ($n = 40$) was recruited from a randomized controlled trial funded by the National Institutes of Health. The parent study tested the impact of a hula-based cultural dance intervention on systolic blood pressure in 263 self-identified Native Hawaiians with uncontrolled hypertension (i.e., physician-diagnosed hypertension and a systolic blood pressure ≥ 140 mmHg at the time of study enrollment) [14]. The current investigation was part of a supplemental study to the parent study to identify facilitators and barriers to hypertension management. The current study included five focus groups with 2–12 participants per group. Participants consisted of a convenience sample recruited by our community partners, which represent and serve three communities on the island of O'ahu (two urban, one rural), one on the island of Maui (rural), and one on Hawai'i Island (rural). The Office of Research Compliance Human Studies Program at the University of Hawai'i at Mānoa reviewed and approved the human subjects protocol for this project (Protocol no: 2017-00014). Written informed consent was obtained from all individual participants included in the study prior to their participation.

2.2. Procedures

Focus group discussions elicited participant experiences and perceptions of neighborhood-level stressors as they relate to their efforts in managing their hypertension and reducing their CVD risk (e.g., engaging in physical activity and decreasing sodium intake). The neighborhood-level stressors discussed were based on the Neighborhood Level Stressors Scale and included: walkability, availability of healthy foods, safety, social cohesion, aesthetic quality, violence, and activities with neighbors [15]. Table 1 presents the focus group guide used to conduct the discussions. Audio recordings were transcribed and analyzed using ATLAS.ti for emergent themes.

2.3. Analysis

First, two researchers read through the transcripts to familiarize themselves with the data. Second, open coding was performed. The two researchers independently analyzed the focus group transcripts and noted each idea expressed in response to the focus group questions. Third, the researchers independently grouped the codes under higher-order concepts to create codebooks with themes. The researchers then met to discuss and resolve any differences in codes or themes, creating a single codebook. Codes were removed if they only appeared in one focus group. Fourth, the two researchers used this single codebook to independently recode the transcripts. Finally, the researchers met to resolve coding discrepancies via discussion.

3. Results

Five focus groups ($n = 40$) were conducted: two in urban O'ahu, one in rural O'ahu, one in rural Maui, and one in rural Hawai'i Island. Specific demographic characteristics of the focus group participants are unavailable. Overall, 38 participants were female and 2 were male. All participants were self-identified Native Hawaiian and had physician-diagnosed hypertension with continued indications of systolic blood pressure greater than 140 mmHg, despite medication. Participants were at least 21 years of age with no

Table 2
Emergent themes and subthemes.

Theme	Subtheme
Neighborhood description	Definition of neighborhood
Community resources	Physical and social/emotional description
Safety	Access to health food/physical activity
Social connectedness	Programs and interventions
Change	Criminal activity
	Pedestrian safety
	Driver safety
	Perceived safety or threat
	Activities with neighbors
	Social cohesion
	Community power
	Physical change
	Development
	Access to land
	Social/emotional change
	Change in community feel
	Loss of respect for elders
	Loss/return of culture

history of CVD. Finally, all participants had their physician's approval to participate in moderate physical activity to help manage their hypertension.

Table 2 presents the five major themes identified and their respective subthemes. The major themes included 1) neighborhood description, 2) community resources, 3) neighborhood change, 4) safety, and 5) social connectedness. Each subtheme was viewed as either a facilitator of or a barrier to controlling hypertension and reducing CVD risk.

Neighborhood Description refers to how participants defined their neighborhoods, which included geography, physical characteristics, and feelings that their neighborhoods imbued in them. The geographic definition of neighborhood varied. Some participants in rural focus groups considered an entire town that is 4.4 square miles to be their neighborhood. Other participants who lived in housing developments considered those developments to be their neighborhoods, whether those developments were condominium buildings, townhouse complexes, or large rurally located housing developments. Others had a more practical geographic boundary. As one participant stated, "If I can walk to it in like half an hour, I would consider that part of my neighborhood, that's where I live." Generally, participants in rural neighborhoods tended to view their neighborhoods as larger geographically than participants from urban locations.

The descriptions of neighborhoods included both positive and negative characteristics for both urban and rural focus groups. Four of the five focus groups described their neighborhoods as beautiful and safe. Two out of the five focus groups, one urban and one rural, mentioned unattractive aspects. One participant who lives in a rural area stated, "So many abandoned cars, like some of them are right on the curb." Participants who lived in urban neighborhoods mentioned graffiti and litter. Participants also frequently mentioned the demographics of their neighborhoods. One participant reported, "The street that I live on, it's an older neighborhood so a lot of the people that live there had lived there for 20 plus years. So, it's just the older families that are there. Not too many kids, although a family just moved in maybe six months ago and they have little ones so now ... you're hearing children in the neighborhood." Finally, when describing their neighborhoods, participants mentioned how their neighborhoods made them feel. One participant described it as "a country-feel, you know. You know, you don't feel like, 'I need to talk a certain way to be understood,' you know."

Community Resources refers to various resources (e.g., access to healthy food, physical activity options, and community programs) that participants can access in and around their neighborhoods to help control their hypertension. The subthemes included the availability of healthy food/physical activity options and community-based programs and interventions. Access to healthy food or physical activity options differed across neighborhoods. Focus group participants from urban neighborhoods believed they had good access to healthy food via farmers markets and healthy options at nearby restaurants. Participants who lived in the most rural areas (two of the five focus groups) perceived their access to both healthy food and physical activity options as poorer than in urban/suburban areas. As one participant described, "The more out you live, the less you get and the more expensive it is."

Community programs that provide access to healthy food and physical activity options were perceived to help participants manage their hypertension. One participant described a program at a local farm, "You like vegetables, come down and put a couple of hours at the farm and then, you can have vegetables, so trade-off." In addition to discussing the need for and use of programs, participants expressed that they valued community-based programs. One participant stated, "The success of these community programs that they have here at this park is the accessibility. And they kind of keep it interesting. And we offer diverse programs. But it's also convenient [for] residents."

Safety refers to how safe participants felt in their neighborhoods. This sense of safety was directly and indirectly related to participants' efforts to better manage their hypertension. Directly it impacted their efforts to be physically active in their neighborhoods or access healthy foods in their neighborhoods. Indirectly, criminal activity and perceived threats were related to a general sense of safety, or lack thereof, in their neighborhoods which were experienced as stress and anxiety, and also influenced participants' willingness to be physically active in their neighborhoods. The subthemes that emerged included criminal activity, pedestrian safety, driver safety, and perceived safety/threat. Pedestrian safety was directly related to walking in their neighborhoods. Safety as a pedestrian was discussed as a major barrier to walking in their neighborhoods in four of the five focus groups. The nature of the concern, however, varied. Pedestrian safety and perceived criminal threats related to the illicit activities were discussed in both urban and rural focus groups. Focus groups from rural areas also mentioned loose dogs and a lack of sidewalks. One participant described multiple recent pedestrian fatalities in their neighborhood, "We lost three people ... four people died in the crosswalk this side." Another participant expressed concerns about loose dogs, "The little subdivision behind me used to feel safe but now they have animals that I've seen running up and down, I don't go." Participants in four of the five focus groups discussed criminal activity, including burglary and illicit drug sales. For instance, several participants mentioned "drug houses" in their neighborhoods: empty houses posed concerns for being a place where people used drugs, while occupied houses raised concerns for being a place where occupants were selling illegal substances. One participant shared "the mother [the participant's neighbor] was selling drugs and every night you see cars in the front."

Participants also discussed aspects of their neighborhood that made them feel more or less safe. This feeling of safety was related to how comfortable participants were being physically active in their neighborhoods and a general level of stress. For instance, participants from urban and rural focus groups discussed formal neighborhood watches, security at their condominium buildings, and neighbors who were home regularly and would keep an eye on people and property. One participant shared a story of when she was waiting for a friend outside of her condominium building and was approached by the doorman inquiring why she was there, "I was like, okay, obviously he asks people when they're stopped on the side of the road, that they're actually here for a reason, you know, so. Usually, I feel relatively safe in my building." Another described a neighbor who would frequently monitor who was using the pool and report non-residents to the authorities. This gave her an "assurance thing of knowing, you know, they are around." In contrast, some participants discussed generally feeling unsafe in their neighborhoods. Some participants provided specific examples, such as hearing fights at their neighbors' homes and "domestic issues going on there and they said it's late at night when all this swearing. And they

have called the cops for that.” Residents who feel unsafe in their neighborhoods reported needing to leave their neighborhoods to be physically active. One participant explained, “because you don’t feel safe in your own neighborhood, you actually have to go out and find it [physical activity opportunities].”

Social Connectedness encompasses the social characteristics of a neighborhood with the subthemes of activities with neighbors, social cohesion, and collective community power. Many participants, including those who mentioned safety concerns, discussed positive interactions with their neighbors. These interactions seemed to help participants feel more comfortable in their neighborhoods and reduce stress. Participants perceived some of their neighbors as helpful and caring. For instance, a participant described how some of her neighbors would take other neighbors’ garbage cans to the main street for the city curbside trash collection. She elaborated, “Every garbage day and they go out ... I mean, not for the whole neighborhood but they’ll do it for the ones closest and they’ll bring in everybody’s can.”

Three of the five focus groups discussed how neighborhoods and communities are related yet distinct concepts. When the researchers inquired about the distinction between neighborhood and community, participants expressed they viewed neighborhood in more physical or geographical terms, while community was viewed more in social terms (e.g., shared values). However, participants did convey the connection between the two. One participant responded, “One cannot do without the other.” Participants often used the term community, rather than neighborhood, when discussing positive social interactions. For instance, when discussing community, one participant stated, “Everybody knows everybody and they would people stop and help you, you get [sic] flat tire or something or you need to move that from your house or, people would come, community will get together.” Participants who were long-time residents of their neighborhoods mentioned feeling a great deal of social cohesion with their neighbors, saying, “It’s kind of like more of a family” and “concern for your neighbors, concern for your family.”

The final aspect of social connectedness was the collective power that some participants felt from their communities. This was discussed by the two of the rural focus groups. This was discussed exclusively as community power rather than neighborhood power. Some participants provided examples of past situations in which the community acted collectively to prevent unwanted development or change in their neighborhood. One participant explained, “I know they have tried to come into [our community] and bring things in and ... but we’ve all managed to stick together and make sure that it didn’t happen.” Other participants discussed the potential for collective community power. For example, one participant stated, “If we need the community, let’s say for example like if were to – they’re coming in to plow down our wharf as an example, I think the whole community will go down there and stop them, you know, they would just block the road or something as soon as they know the people coming in, like how they blocked the road up to Mauna Kea.”

Neighborhood Change was discussed in all five of the focus groups. It was mostly discussed negatively and included the subthemes of physical neighborhood change (i.e., development and access to land) and social/emotional change (i.e., feel of the community, loss of respect for elders, and loss of culture). Both urban and rural areas have seen significant development since participants first moved there. One participant shared “When my husband and I built our house 27 years ago ... There was only one house down the street from us and that’s the way we wanted it and now I’m surrounded.” Participants realized that some of the development has had negative outcomes, such as increased access to vehicular travel and fast food that impacted their physical activity and eating. When discussing how they used to have to walk long distances for work and grocery shopping, one participant said, “I’ll be very honest knowing that we had both some of the hardships, we’re at the point where we don’t want our children to have to do like we have been.” This statement was followed by the recognition that there were health advantages to the active travel from which their children do not benefit.

Two of the five focus groups discussed how the loss of access to land impacted their ability to manage their hypertension via gardening and traditional medicines. They attributed this to the privatization of land in the 1850s, the illegal overthrow of the Hawaiian Monarchy in 1893, and the subsequent financial and health implications [16,17]. One participant stated “If we had land, how rich we would be instead of everybody else getting rich off of us. Because if our people had lands, they would be the healthiest people on this earth. My grandfather lived to 96 ... all he ate was what he planted in his yard on the Big Island.” Another participant commented on the loss of land resulting in the loss of access to plants and herbs used in traditional healing, “Our problem today is we don’t have access to all these herbs and things ...” Building on this statement, another participant responded, “And now [we’ve lost] the knowledge.”

In addition to the physical changes participants have seen in their neighborhoods, all five of the focus groups discussed changes to the social and emotional aspects of their neighborhoods. Participants seem to experience this change as a stressor and was an overarching theme expressed in each focus group by multiple participants. Sometimes this was the result of new people moving to the neighborhood. One participant explained “We really have to realize that times has [sic] changed. So, you’ve got new people moving in, that seem or make it look differently.” Another participant stated, “New people come in and everyone has different expectations for the area that they’re moving into. And for some of us because we’ve enjoyed what we have as children, we know and that respect is always there and that trust is friends and families were very, very strong.” Many participants commented on the lack of respect for elders shown by today’s youth. One participant stated, “The way they talk to their parents and parents are talking to, it’s so disappointing.” The one positive change that was mentioned was the growing interest in the Hawaiian culture, language, and practices by today’s youth. One participant explained, “So right now, this generation, let’s say my grandchildren generation, they’re in the process of learning how to create and learning more Hawaiian things that eventually I think the generation to come if they get the knowledge, I think we can get the aloha spirit back.”

4. Discussion

A unique finding from these focus group discussions was the salience of historical losses. Participants discussed the youth’s loss of

respect for elders, loss of land, and loss of Hawaiian culture (i.e., social norms, food, and farming). The stress of these losses was evidenced by their unprompted and prolonged discussion in each of the focus groups. The loss of land, culture, and language are tied to the occupation of Hawai'i and the illegal overthrow of the monarchy government. Before Western contact in 1778, Native Hawaiians were healthy with a rich cultural tradition and a population of ~800,000. Afterward, Native Hawaiians were annihilated by novel infectious diseases; the population declined by 95% to less than 30,000 in 1920 [18]. Survivors were displaced from ancestral lands; forced to abandon their native language, customs, and beliefs; and marginalized through legislation and compulsory assimilation policies [19,20,21,22]. In 1893, the US supported the overthrow of the legal government of Hawai'i and eventually took possession of the entire archipelago [21].

This unfortunate history and these historical losses are parallel to that experienced by American Indians and Alaska Natives [23]. Thoughts of these historical losses have been associated with substance use and depression [24,25,26,27]. Access to, and ownership of, land is a major social determinant of health for Indigenous peoples [28]. Thus, continued cultural revitalization, including land access and ownership, should be considered an important aspect of health promotion programs and interventions that aim in part to reduce or manage stress in Native Hawaiian communities.

Our other results were in agreement with previous research. Participants focused on different characteristics of their neighborhoods when asked to describe them. This included how neighborhoods were defined, safety concerns, and the social/emotional characteristics ascribed to a given neighborhood. Previous research also found variation in neighborhood definition [29]. Most studies apply a single definition of neighborhood. However, it is important to understand and capture the diverse ways people experience their neighborhoods to better design interventions. Similar to tailoring for cultural relevancy, interventions can also be tailored to specific neighborhoods. Such tailoring would allow the intervention to build on strengths most salient to participants or address what may be lacking in the participants' perspective.

Participants in this study were found to value increased accessibility and familiarity that comes with health programs provided in their neighborhoods. Other research from Hawai'i supports the assertion that health education and promotion programs that involve the community help improve health outcomes [30]. Programs that utilize local language and culturally-relevant media have been shown to improve health outcomes among Native Hawaiians [31,32]. Adapting programs such that they are relevant to the target population is supported by the literature on community-based health promotion efforts [33]. Including the community in the design and implementation of health promotion interventions supports the success of these programs [34]. In addition, locating these interventions in community settings (e.g., community-based organizations, community centers, and schools) contributes to the success of health behavior change interventions [33,35,36].

Participants related their perceptions of safety to their ability and willingness to be physically active in their neighborhoods. Their perception of safety was influenced by criminal activity as well as pedestrian and driver safety. Participants were from a mix of lower and middle socioeconomic areas. According to the Healthy People 2030 initiative, crime and violence are key Social Determinants of Health within the neighborhood and built environment domain [37]. Racial and ethnic minorities with lower socioeconomic status are more likely to be exposed to crime and violence within their communities, compounding the potential for exacerbating disparities [38]. Exposure to crime and violence, whether individuals are victimized directly, witness violence or property crimes in their community, or hear about crime and violence from other residents living in a community, can have detrimental health effects [39].

Multiple studies have found a relationship between perception of neighborhood safety and physical activity [40,41,42]. For example, one study found that individuals who perceived their neighborhoods to be unsafe reported a reduction in physical activity, higher body mass index scores, had higher levels of obesity, and poorer self-rated physical and mental health [43]. Neighborhood pedestrian safety may be one of the more important factors in people's leisure walking and overall physical activity [44]. Perceptions of safety and crime have been associated with participation in neighborhood-based walking and physical activity [45,46,47]. While violent crime in Hawai'i continues to be low compared to communities of similar size across the US, Hawai'i experiences other safety concerns [48]. For instance, on the island of O'ahu alone, there are 793 miles of road that lack sidewalks and, in 2018, Hawai'i had the 6th highest per capita pedestrian fatality rate in the US (3 per 100,000 people) [49,50].

Participants discussed the social environment of their neighborhoods as being important to their health. The impact of new residents and no longer knowing one's neighbors was discussed often as a source of stress. Research has shown that social integration in neighborhoods benefits physical and mental health [51,52,53]. Length of residence is related to the development of relationships and trust with neighbors [54]. Thus, in areas with a greater turnover of residents, social integration may be lacking. Social cohesion, defined as the perception that neighbors help each other, get along, can be trusted, and share the same values, is associated with a 3% higher probability of being physically active and a 5% higher probability of consuming at least five daily fruit and vegetable servings, after controlling for other forms of support [55]. Social cohesion is also associated with faster sleep onset and longer sleep duration [56]. Social cohesion and activities with neighbors are both associated with greater physical activity and healthier eating [57]. Additionally, lowering stress and anxiety are also important aspects of hypertension management [58]. Together, this research supports the idea that the changes to the social and emotional aspects of their neighborhoods that participants described may be impacting their hypertension management.

A similar concept, collective efficacy, defined as the willingness of community members to look out for each other, is associated with weight change and fruit intake [59,60,61]. Thus, the collective power that participants described may be associated with hypertension management. Additionally, collective efficacy moderates the association between neighborhood disadvantage and CVD mortality and early mortality [59]. Concerns around gentrification are not limited to the financial exclusion of current residents, but extend to the social exclusion of those residents as well. Research in African American neighborhoods has found that gentrification can have negative impacts on older residents that choose to remain in their changing neighborhoods, such as disruption of social ties, decreased social cohesion, and increased isolation [62].

The implications of this study should be interpreted in light of its strengths and limitations. Participants were recruited from five different neighborhoods from three different islands. The neighborhoods were both rural and urban. Another strength, is that all the participants had participated in a hypertension management intervention which included an education component. Thus, it was likely that participants were knowledgeable about how to manage their hypertension and had been considering if not attempting these management behaviors. Therefore, they would have been aware of the barrier and facilitators present in their respective neighborhoods. Like all focus group data, there is the possibility of bias in the discussion (e.g., potential that some participants were not comfortable voicing dissenting ideas). To address this bias, the facilitator was trained in facilitation. Additionally, ground rules were stated at the beginning of each group discussion that stated everyone will be given the opportunity to share their thoughts and to not question, doubt, or judge others' ideas. This sample, like all self-selected samples, may not reflect the perspectives and experiences of all Native Hawaiians in Hawai'i.

5. Conclusions

These qualitative data deepen our understanding of how neighborhood factors are experienced by self-identified Native Hawaiians and should be considered in the development of multilevel interventions to improve cardiovascular health. Specifically, historical losses (i.e., loss of land and culture) are underlying issues for participants and influence how they perceive and experience their neighborhoods. It appears that consideration of these losses affects participants' efforts to manage their hypertension through both physiological stress and neighborhood infrastructure. Thus, interventions to address hypertension in Native Hawaiian communities should consider neighborhood-level components that strengthen cultural values while promoting healthy lifestyles. Potential neighborhood-level interventions include community-wide cooking demonstrations and tastings, community lo'i kalo (irrigated terrace taro), and fishponds. The activities would welcome all community members and be accompanied by lessons on the cultural significance of the practices. For instance, the cooking demonstrations could teach participants how to prepare a traditional Native Hawaiian dish while linking preparation and consumption of these foods to Native Hawaiian history and traditional beliefs. Participants could work in the lo'i kalo as well as learn the cultural significance of kalo and traditional cultivation practices.

Individual-level hypertension management interventions for Native Hawaiians have been found efficacious [63]. Our results suggest that Native Hawaiians have unique needs from their neighborhoods to better facilitate their efforts in controlling their blood pressure and CVD risk. Thus, the development and testing of a multilevel hypertension or CVD risk intervention for Native Hawaiians is warranted.

Author contribution statement

Claire Townsend Ing: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Mei Linn N. Park: Analyzed and interpreted the data; Wrote the paper.

J. Kahaulahilahi Vegas; Stacy Haumea: Performed the experiments; Wrote the paper.

Joseph Keawe'aimoku Kaholokula: Conceived and designed the experiments.

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Data availability statement

The authors do not have permission to share data

Declaration of interest's statement

The authors declare no competing interests.

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