AN INVESTIGATION OF HULA AS A CULTURALLY APPROPRIATE PHYSICAL ACTIVITY FOR HEALTH PROMOTION

A DISSERTATION TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAIʻI AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PUBLIC HEALTH

MAY 2015

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Keywords: Hula, physical activity, hypertension, Native Hawaiian and Pacific Islanders, culturally-appropriate intervention, health-related quality of life

Acknowledgements

This dissertation study was supported in part by Grant Number: P20 MD000173 from the National Institute on Minority Health and Health Disparities (NIMHD). The contents of this dissertation are solely the responsibility of the author and do not necessarily reflect the official views of the funding agency.

I would like to thank my community partners, Kula no no Poʻe Hawaiʻi, Kokua Kalihi Valley Comprehensive Family Services, and Hālau Mohala ʻIlima, for their participation in this research project. Without their help, this would not have been possible. I would also like to thank my committee members for their mentorship and guidance throughout this process. Special thanks go to my boss, Mele Look, for her physical, mental, and emotional support during this long journey. To my cohort and other DrPHers (Lehua, Hyunhee, Chris, Jennifer, May Rose, and Jackie) thank you for pushing me through this program. Lastly, I would like to thank my family and friends for their love and encouragement and my husband for his unconditional support and patience.

Abstract

Physical activity (PA) both prevents and treats many established cardiovascular disease (CVD) risk factors, including hypertension and obesity. CVD continues to be the leading cause of death in the United States (US), making it a major public health concern. Native Hawaiians and Pacific Islanders (NHPI) share an unequal burden of CVD compared to the general population. According to the Office of Minority Health, NHPI in Hawai‘i are 3 times more likely to have CVD and are 1.7 times more likely to die of heart disease than their White counterparts.

This dissertation explored hula, the indigenous dance of Native Hawaiians, as a physical activity (PA) in health interventions. This three-part dissertation aimed to: 1) evaluate physiological variables of hula to establish the dance as a moderate and/or vigorous physical activity, 2) ask NHPI that participated in a hula-based intervention for hypertension about their thoughts about the use of hula, and 3) determine if changes in blood pressure could predict changes in health-related quality of life after participation in a hula-based intervention for hypertension.

The study in Chapter two demonstrated that physiological variables of low and high intensity hula were able to reach moderate and vigorous intensity PA, respectively. The qualitative study in Chapter three asked participants of a hula-based, hypertension management intervention about their thoughts on the use of hula for a health intervention. Participants all agreed that hula appeared to be a suitable alternative PA for a health intervention. The study in Chapter four conducted a multiple regression to determine if change in systolic and diastolic blood pressure could predict changes in health-related quality of life (HRQOL). Only one subscale from the SF-12, Social Functioning, was shown to be significant. This study showed that improvement in hypertension does not appear to have an impact on HRQOL for NHPI that participated in a hula-based study.

Overall, this dissertation demonstrated that hula can be implemented as a valid alternative to traditional PA for health interventions as shown both quantitatively from several indicators and qualitatively from program participants.

Table of Contents

List of Tables

List of figures

Introduction

Physical activity has been well established as an important factor for health. Recommendations for physical activity from the Center for Disease Control (CDC) and the American College of Sports and Medicine (ACSM) for healthy adults (ages 18 – 64) are 150 minutes per week of moderate intensity physical activity or 75 minutes per week of vigorous intensity physical activity (Haskell et al., 2007). The CDC also has recommendations for the metabolic equivalent (MET) values for moderate physical activity, between 3.0-5.9 METs, and for vigorous physical activity, at 6.0 METs and higher. One MET is equal to the amount of energy we require at rest (Whaley, Brubaker, & Otto, 2006), so essentially moderate physical activity means we are expending three to six times more energy than we would at rest. Typically, METs are measured by the amount of oxygen required for the particular activity.

According to Healthy People 2020 (HP 2020) and the CDC, fewer than 80% of adults in the US meet the recommended levels of physical activity for both aerobic and muscle strength training, and currently only 43.5% of adults meet the recommended levels of 150 minutes of moderate-intensity physical activity a week (United States Department of Health and Human Services [HHS], Healthy People 2020, 2013). The goal for HP 2020 is to increase this to 47.9%, which represents a 10% increase in the number of adults that meet the physical activity recommendations (HHS, Healthy People 2020, 2013).

Physical activity both prevents and treats many established cardiovascular disease (CVD) risk factors, including hypertension and obesity (Thompson et al., 2003). Several studies have demonstrated that physical activity not only prevents weight gain, but is also considered a protective factor against chronic diseases such as diabetes, CVD, (Raum, Rothenbacher, Ziegler, & Brenner, 2007; Rennie, McCarthy, Yazdgerdi, Marmot, & Brunner, 2003; Wannamethee & Shaper, 2001), cancer (Kumanyika et al., 2008), and acute events like myocardial infarction and stroke (Batty, 2002). Excessive body weight is a major risk factor for most of these diseases, and with adequate physical activity a person can prevent becoming overweight. One review found that, among longitudinal studies that investigated the association between physical activity and body mass index (BMI) or body weight, there was a negative association between physical activity and weight gain, indicating that more physical activity predicted less weight gain (Wareham, van Sluijs, & Ekelund, 2005).

Cardiovascular disease and Native Hawaiians and Pacific Islanders

CVD continues to be the leading cause of death in the United States (US) (Minino, Murphy, Xu, & Kochanek, 2011), making it a major public health concern. In 2009, one out of every four US deaths was caused by CVD (Kochanek, Xu, Murphy, Minino, & Kung, 2011). It is projected that between 2010 and 2030, the overall prevalence of CVD will rise from 36.9% in 2008 (Roger et al., 2012) to 40.5% by 2030 (Heidenreich et al, 2011). In addition, the financial burden of this disease is expected to triple, from $272 billion in 2010 to more than $818 billion by 2030 (Heidenreich et al., 2011).

Native Hawaiians and Pacific Islanders (NHPI) share an unequal burden of CVD, diabetes, and obesity prevalence compared to the general population (Mau, Sinclair, Saito, Baumhofer, & Kaholokula, 2009). NHPI is federally defined as a person with origins from the indigenous people of Hawai‘i, Guam, Samoa, or other Pacific Islands. Pacific Islands include the islands of Polynesia, Micronesia, and Melanesia (Executive Office of the President, 1997). NHPI have a reported prevalence of CVD of 20.2%, compared to the White prevalence of 11.7% (Schiller, Lucas, Ward, & Peregoy, 2012). NHPI also have higher prevalence of the risk factors associated with CVD, including diabetes (23.7%), obesity (31.5% overweight and 43.5% obese), and hypertension (40.8%), as compared to Whites at 7.6%, 33.9% and 26.2%, and 23.9%, respectively (National Center for Health Statistics, 2005; Schiller et al., 2012). According to the Office of Minority Health, NHPI in Hawai‘i are 3 times more likely to have CVD and are 1.7 times more likely to die of heart disease than their White counterparts (Heart Disease and Native Hawaiians/Pacific Islanders, 2013). Overall, mortality rates for CVD in Native Hawaiians are among the highest nationally (Pobutsky, Bradbury, & Wong Tomiyasu, 2011).

One of the main risk factors of CVD is hypertension. Hypertension is clinically defined as having a systolic blood pressure greater than 140 mmHg, or a diastolic blood pressure greater than 90 mmHg (Gillespie, Kuklina, Briss, Blair, & Hong, 2011; Roger et al., 2012). Almost one third of Americans have hypertension (30.1%), and this condition was thought to be a contributing factor to over 348,000 deaths in 2008 (Gillespie et al., 2011; Roger et al., 2012). NHPI have a very high prevalence of hypertension at 40.8%, compared to the national average of 30.1% (Schiller et al., 2012). In Hawai‘i, 31.5% of NHPI reported that a physician had told them that they had hypertension, compared to 25.6% of Caucasians in 2009 (Hawaii Health Data, 2009). In Hawai‘i, Native Hawaiians and Japanese have the highest prevalence of hypertension

(nearly 40%), although Native Hawaiians are substantially younger at diagnosis, and Native Hawaiians report that they are significantly more restricted in their daily life by their health problems (Pobutsky et al., 2011). This highlights the need for programs addressing hypertension in Native Hawaiian and Pacific populations.

Health-related quality of life (HRQOL) and chronic disease

Chronic diseases are defined as conditions that lasts for at least a year, and that require continual medical attention and that may or may not affect a person's daily activities (US Department of Health and Human Services, 2010). These diseases, such as diabetes, cancer, arthritis, hypertension or asthma, can affect a person's overall health-related quality of life (HRQOL). HRQOL is defined as a person's overall perceptions about their individual and community environment and how those perceptions relate to their overall health status (Centers for Disease Control and Prevention [CDC], 2011a). HRQOL goes beyond quality of life, and assesses how a person's mental or physical state affects their health (CDC, 2011a). HRQOL commonly is measured through the Medical Outcomes Study Short Forms (SF-12 and SF-36) (Ware & Sherbourne, 1992; Ware, Kosinski, & Keller, 1996), the Sickness Impact Profile (Bergner, Bobbitt, Carter, & Gilson, 1981), and the Quality of Well-Being Scale (Kaplan, Ganiats, Sieber, & Anderson, 1998). HRQOL is of interest for physicians and researchers because it gives subjective views into how disease signs and symptoms can affect each person.

Various research studies have been conducted to determine if there is a difference in HRQOL in healthy individuals compared with individuals affected with one or more chronic conditions. A previous cross-sectional study compared the HRQOL between people with hypertension and people with other chronic diseases (Maatouk et al., 2012). This study found that people with hypertension scored lower in HRQOL as assessed by the SF-12. There has been one meta-analysis that synthesized various studied that looked at HRQOL and hypertension (Trevisol et al., 2011). The authors found that people with hypertension reported a lower HRQOL as measured by the SF-36 when compared to a normal population. Another study compared healthy people to people with diabetes, diabetes plus cardiovascular comorbidities, hypertension, and hypertension plus other cardiovascular comorbidities (Polijicanin, Ajdukovic, Sekerija, Pibernik-Okanivoci, Metelko, & Mavrinac, 2010). The authors found significant differences in HRQOL as measured by the SF-36, between the healthy people and all others in each category. In one study that assessed the HRQOL in people with Parkinson's disease, a

disease known for significantly decreasing a person's physical functioning, researchers found that people with the disease reported lower scores in HRQOL when compared to general scores from the population (Schrag et al., 2000)

Culturally appropriate interventions

Several reports note that minority populations in the US have higher prevalence of chronic diseases then their Caucasian counterparts (Flegal, Carroll, Ogden, & Curtin, 2010; Liao et al., 2011; Schiller et al., 2012). By 2060, the population of the US has been projected to be 43% White only, followed by 31% Hispanics, 15% African American, and 8.3% Asian, showing that no single race will be the majority (United States Census Bureau, 2012). With minority populations on the rise, there could be a need for a change in health care and health care delivery. One study has speculated that, with a changing population, there will be a change in health care needs (Haughton & Stang, 2012). The shifting population, along with the higher prevalence of chronic diseases and risk factors for minorities, calls for the need for interventions that resonate with these ethnic groups.

For health practitioners, culturally appropriate interventions have been thought to be more effective for the minority population they were developed for (such as African American, Asian, or Hispanic) than an intervention developed for a Caucasian population (Brach & Fraser, 2000). Brach and Fraser (2000) developed a conceptual framework outlining how nine cultural competency techniques could lead to improvements in health disparities (Figure 1.1). Combining some or all of these elements can aid a program in creating a culturally appropriate intervention. As Figure 1.1 outlines, if an intervention has the cultural appeal to the participant, through the use of bi-lingual community health workers, familiar food examples, or drawing on their cultural values during education, this could encourage better recruitment to and retention in the program, which could result in better outcomes (Brach & Fraser, 2000). In a recent Cochrane review (Attridge, Creamer, Ramsden, Cannings-John, & Hawthorne, 2014), researchers evaluated 33 culturally appropriate randomized control interventions for type 2 diabetes in minority populations. This review concluded that culturally appropriate health education for minority populations is better than usual care or practice in eliciting improvements in hemoglobin A1C, triglycerides, and diabetes knowledge.

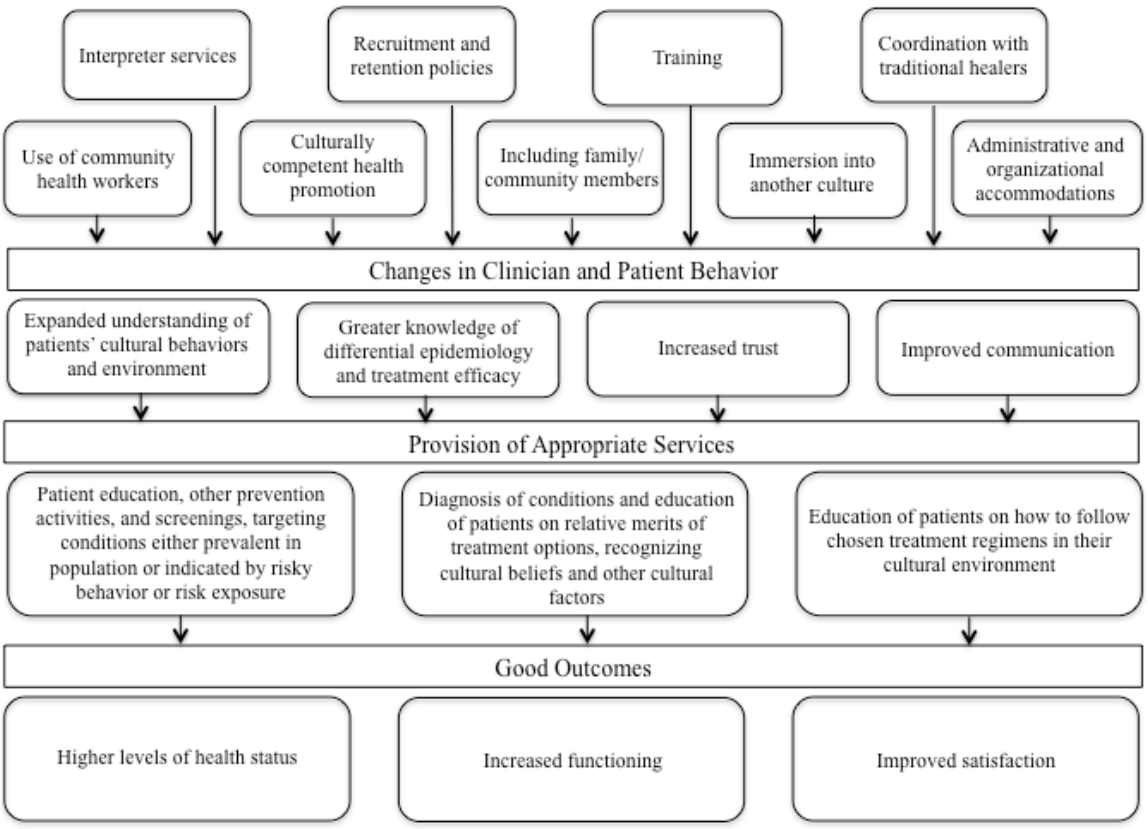

Figure 1.1 Conceptual framework of how nine culturally competent techniques can lead to improved health disparities, adapted from Brach & Fraser (2000).

In a review by Kreuter et al. (2002), authors describe specific components of an intervention that can be changed to make a program more "culturally appropriate." In the review, five different methods are outlined that can make an intervention more appealing to a specific culture. The five domains are peripheral, evidential, linguistic, constituent-involving, and sociocultural. Peripheral strategies involve making program materials appealing to the specific culture by utilizing pictures of people from the same culture, images, or declarative titles for the group. This is similar to "surface" relevance of an intervention as described by Resniow et al. (1999). Evidential strategies include bringing awareness of the issue for a certain group by presenting evidence that will convince the group to participate in that intervention. Linguistic strategies aim to provide program materials in language of the target group. Constituent-involving strategies attempt to draw on the experience of the cultural group, which could also include having a person of the culture involved as staff. The last strategy, sociocultural, makes the program or intervention address the health issue through the social and cultural values of the

target population. Resniow et al. (1999) would describe this level of cultural tailoring as the "deep structure" because these interventions build on a specific culture's beliefs, values, and behaviors. None of the methods mentioned above are mutually exclusive, but can work together to create a program or intervention that is culturally appealing. As a way to include more cultural components, a culturally relevant form of physical activity could be one effective method of drawing the interest of a particular group, which can facilitate better participation and adherence to the physical activity and intervention. By drawing the participant interest and increasing retention, this could also improve the intervention outcomes.

Hula: The traditional dance of Native Hawaiians

Hula is the traditional dance of Native Hawaiians, the indigenous people of the Hawaiian Islands (Kaeppler, 1993). It has had a wide range of appeal to all people and cultures in Hawai'i, as well as worldwide. Currently, hula is not only practiced by Native Hawaiians, but by anyone interested in the dance. In Hawai'i, there are more than 100 *Hula Hālau* (Hula schools), with almost every ethnicity represented among the students (Look, Kaholokula, Carvhalo, Seto, & de Silva, 2012). People across the state have learned to enjoy and appreciate this dance from the indigenous population. In addition, there are more than 1,000 Hula Hālau across the nation and in Japan, Mexico, and various European countries (Look et al., 2012), which further expands the reach of hula as a cultural practice.

Hula is rooted in the traditional Hawaiian values such as spirituality, religion, and health (Barrere, 1980; Emerson, 1909). Today, hula is mainly divided into two main forms: 1) *kāhiko* and 2) '*auana*. *Kāhiko* is the traditional form of hula and is typically accompanied with a traditional Native Hawaiian instrument, such as an *ipu* or *ipu heke* (gourd instrument) or a *pahu* (drum) and chanting in Native Hawaiian language. '*Auana* is the modern form of hula, which is accompanied by stringed instruments (guitar, ukulele, bass) and singing in English and/or Native Hawaiian language. In both forms of hula, it is expected that the dancer have an understanding of not only the literal translation of the words, but also of the hidden, poetic meaning of the words and song. It is through this complete understanding that an appropriate performance of hula can take place. The movements of hula, both hands and feet, enhance the performance of a song by giving the audience a visual tool to bring the story to life (Hopkins, 1982; Kaeppler, 1993; Kanaka'ole, 1997). The surface or literal meaning in both traditional and modern song will often utilize components of the natural world found in Hawai'i as symbolism, and also as a way to

spiritually connect the song back to the islands and people through nature or the land (Emerson, 1915; Kanahele, 1993; Pukui & Korn, 1973). This connection back to the land can be important for improving the psychological well-being of people, as it deepens their spiritual connection to their culture. Hula has the ability not only to improve physical fitness, mobility, flexibility, but psychological well-being through stress and anxiety reduction as well.

Rationale for utilizing Hula as Exercise Training Intervention

Hula could be a suitable physical activity for health-related interventions if delivered as a comprehensive program aimed at improving health and psychological well-being, which has been demonstrated in Tai Chi interventions (Lan et al., 1999; Yeh et al., 2004). The songs used in hula, for both kāhiko and ʻauana, have a wide range of tempos and can be fast or slow. The dances can vary in their intensity depending on the choreography of the dance and on the skill level of the dancer. Because hula can include slow, low-impact movements, and because the dance can be adjusted in intensity, hula may be a suitable physical activity for persons with decreased functional capacity to achieve their exercise training goals. It can also present as a low-impact exercise for people who have compromised exercise capacity because of years of sedentary behavior.

Hula Has Not Been Studied as a Health-Related Intervention

The physical benefits of hula seem to fit well into the theoretical framework of a tertiary prevention program, such as cardiac rehab program, as well as for primary and secondary prevention program to help individuals prevent or reduce CVD risk factors, such as hypertension. However, to the best of our knowledge, hula has not been systematically evaluated as a method for physical activity in a health intervention. Hula comes from a culture with a holistic health view and connection to the land, and because these beliefs are similar to other Pacific populations, hula could translate and connect to other Pacific Islanders.

Previous research

A five-year, National Institutes of Health (NIH) pilot study was conducted by the Department of Native Hawaiian Health (DNHH) at the John A Burns School of Medicine, University of Hawaiʻi. The "Hula Enabling Lifestyles Adaptation (HELA)" study evaluated the use of hula as the physical activity for a cardiac rehabilitation program. Participants that had recently experienced a cardiac event (myocardial infarction, heart surgery, heart failure) were recruited for the study. The intervention was 12 weeks in duration, three times a week for one

hour, and was held at Queen's Medical Center in Honolulu, Hawai'i. Classes were conducted by a *Kumu hula* (hula teacher and expert), and registered nurses to ensure the safety of participants that attended each class. The results from the intervention group were compared to a control group that did not participate in the hula class.

The HELA study was designed as a culturally appropriate approach, with principles of community-based participatory research (CBPR) employed in the design and implementation of the program. Kumu hula were interviewed about their thoughts about using hula in a clinical intervention for health. All agreed that hula would be appropriate, if implemented correctly by maintaining the culturally integrity of the dance (Look et al., 2012). A community partner, *Hālau Mōhala 'Ilima*, participated in the design and execution of the intervention, providing the Kumu hula to facilitate each of the groups.

As part of the HELA study, one of the first steps was to determine if hula achieved the metabolic equivalent (MET) levels that the CDC recognizes as acceptable levels of physical exertion for moderate or vigorous exercise. The variables collected from participants included energy expenditure (VO_2), heart rate (HR), respiratory exchange ratio (RER), caloric expenditure, and METs. The primary goal of this small study was to determine the MET levels for low and high intensity hula, as a way to compare hula dancing to other forms of activities with established MET values. For moderate physical activity, the CDC recommends MET values of 3.0-5.9 METs, and for vigorous physical activity the CDC recommends MET values of 6.0 and higher (Haskell et al., 2007; Pate et al., 1995). It was found that when hula is stratified into low and high intensity dancing, low intensity hula reaches 5.7 METs and high intensity hula reaches 7.7 METs. These MET values reach the levels of moderate and vigorous physical activity, respectively (Usagawa et al., 2013).

In an effort to disseminate the intervention from the HELA study out of the clinical setting and into the community, another pilot study was conducted. "Ola Hou i ka Hula" (Ola Hou) was a randomized control trial conducted at two community sites, Kula no na Po'e Hawai'i (Kula) and Kokua Kalihi Valley Comprehensive Health Center (KKV), for adults with hypertension. The sites were chosen because they served NHPI populations. Inclusion criteria for participants were a clinical diagnosis of hypertension, defined as a systolic blood pressure greater than 140 mmHg or 130 mmHg if they also had diabetes, and physically able to participate in a hula class. After participants were screened for hypertension, they were randomized into a

control group (usual care) and an intervention group that participated in a hula class and heart health education (general information about hypertension, medications, healthy diet, and physical activity). Each community site conducted its own screening and randomization. The hula class was 12 weeks in duration, two times a week, for one hour. In addition, a community health worker provided culturally appropriate heart health education for another three hours, delivered for 30 minutes either before or after the hula class, for six sessions. The community site decided on how the six hours of education would be divided up and delivered.

The primary outcome measures for Ola Hou were exercise capacity, utilizing a six-minute walk test, health-related quality of life (HRQOL), assessed by the 12-Item short-form health survey (SF-12), and heart disease risk factors, specifically systolic and diastolic blood pressure. Weight, stress management (Perceived stress scale survey), and perceived discrimination (Modified oppression survey) were also measured. All measurements and surveys were given at baseline and at three months. Preliminary clinical data were analyzed and found a significant reduction in systolic blood pressure in both groups, the intervention group and control group, when we aggregated the two sites.

Purpose of dissertation and conceptual framework

As the disparities in risk factors for chronic diseases like CVD continues to be prevalent in the NHPI population, the need for interventions that appeal to these populations is important. The initial steps to address this problem were to find a culturally appropriate and appealing program that meets guidelines and increases participation in physical activity. This dissertation aimed to evaluate if hula, an acceptable cultural practice among Native Hawaiians and many residents of Hawai‘i, had the potential to elicit health benefits through regular participation.

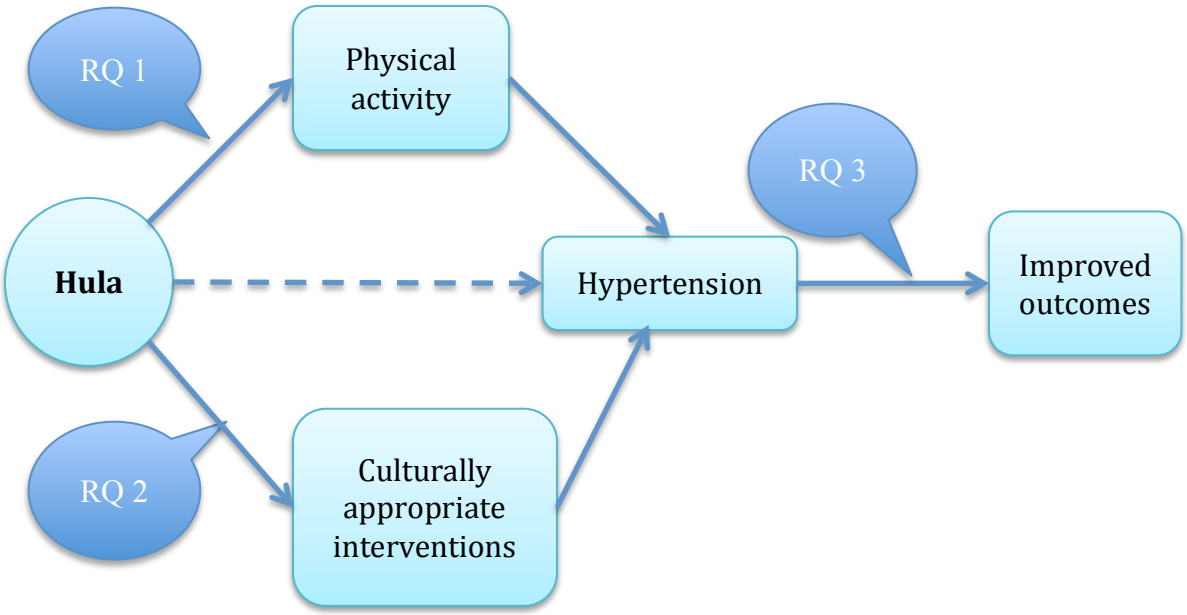

Figure 1.2 Dissertation conceptual framework (RQ = research question)

The conceptual framework of this dissertation (Figure 1.2) began with hula as the starting point. The purpose of the first study was to further evaluate hula as a physical activity that meets the recommended intensity of physical activity as noted by the CDC and ACSM (Haskell et al., 2007). The second study utilized qualitative methods to determine how participants of Ola Hou felt while participating in a culturally appropriate intervention that used hula and their overall experience of the intervention. The third study investigated if a reduction in hypertension in a NHPI population was related to improvements in health outcomes, specifically improved HRQOL scores. Each research question addressed different components of this conceptual framework.

The first study aimed to determine if hula reached the threshold of physical exertion to be considered moderate physical activity, vigorous physical activity, or both. These are the levels of exertion the CDC recommends adults to gain the physiological benefits of physical activity. To answer this research question, a secondary data analysis was conducted, using data collected to determine the METs of hula, to evaluate the energy expenditure of hula by 19 (10 female, 9 male) healthy adult dancers. MET levels, used to determine the intensity of an activity, were estimated in a previous study (Usagawa et al., 2013), so this study analyzed previously unanalyzed data on oxygen consumption (VO_2), heart rate (HR), percentage of maximum heart

rate (%HR_{max}), and caloric expenditure in these 19 hula dancers. The data provided a more comprehensive overview of how rigorous a hula dance can be. We also compared differences between the two forms, ʻauana and kahiko, and two intensities, low and high, of hula. The results from this study helped to provide more evidence of hula's appropriateness as a primary form of physical activity in health interventions and in daily life.

The second study asked NHPI what they thought about an intervention to reduce hypertension that used hula as its main physical activity. For this qualitative study, focus groups were conducted with participants from Ola Hou program. Hula is the traditional dance of Native Hawaiians, so we asked participants about their thoughts about the use of hula for health promotion and its cultural relevance. This study asked participants about how they felt about the intervention and their experience with the class. The results from this study determined the extent of appeal of a hula-based intervention for hypertension in Hawaiʻi.

The third and last study evaluated if an improvement in systolic blood pressure is related to improvement in HRQOL scores. For this secondary data analysis, the study used the previously unanalyzed data from the participants of the Ola Hou intervention to determine if a reduction in blood pressure was associated with improvements in HRQOL in a NHPI population. A hierarchical regression was conducted to determine if changes in systolic and diastolic blood pressure can predict improved HRQOL scores as measured by the SF-12.

Chapter 2. AN ANALYSIS OF THE PHYSIOLOGICAL VALUES OF HULA

Abstract

Cultural activities, such as cultural dance or food preparation, are not often measured for their value as a physical activity. The main purpose of this study was to examine physiological variables of exercise (e.g. HR, $\%HR_{max}$, VO_2, and caloric expenditure [CAL]) to quantify hula as a physical activity that meets moderate or vigorous intensity standards. A cross-sectional, quantitative secondary data analysis of previously collected data was conducted. Nineteen elite dancers (10 female, 9 male) participated in the previous data collection. A two-by-two analysis of variance (ANOVA) was done between gender and intensity for each variable to assess if there were differences between male and female dancers and between gender and type of hula within each intensity category. An analysis was also completed between the two forms of hula, ʻauana and kahiko. Results demonstrated that all of the indicators of physical activity except for VO_2 met or exceeded the values for moderate or vigorous activity. When analyzing the difference between hula type and intensity in HR, $\%HR_{max}$, and VO_2 the main effect of intensity was significant and the main effect of hula type was significant. Between gender and intensity, there were significant differences in all variables. Between gender and hula form, there were statistically significant differences in HR, $\%HR_{max}$. The main effect of gender was significant for VO_2 and for CAL, the main effect of hula type was not significant. When stratified by type of hula, all variables were different between intensity and gender. The only exception was VO_2 was not significantly different between genders for kahiko. Overall, hula appears to be a suitable alternative for traditional physical activity but the type of hula and intensity of the dances need to be taken into account to ensure the level of exertion is appropriate to achieve health benefits.

Introduction

In 2009, 53.2% of adults in Hawai‘i met the recommended levels of physical activity, with an additional 35.7% reporting activity levels that did not meet the current recommendations, and the remaining 11.1% reporting no activity (Hawaii Health Data Warehouse, 2011). Native Hawaiian adults reported a higher prevalence of physical activity than the state average at 59.2%, while other Pacific Islanders (Micronesian, Samoan, Tongan, and others) reported a lower prevalence of 46.9%. However, 30.1% and 42.0% of Native Hawaiians and Pacific Islanders (NHPI), respectively, did not meet the current recommended guidelines even though they were physically active (Hawaii Health Data Warehouse, 2011). If some cultural activities could be shown to be vigorous enough to be considered as moderate or vigorous physical activity, this could encourage more participation in these cultural practices, which could increase NHPI physical fitness and improve health outcomes.

Cultural activities, such as cultural dance or food preparation, are not often measured for their value as a physical activity. One of the most common methods for measuring the "rigor" of an activity is through the oxygen consumption (VO_2), which measures the rate of oxygen use by the body, and can aid in determining the intensity of a physical activity (Wilmore & Costill, 2004). Measuring VO_2 requires a piece of highly technological exercise physiology equipment, called an indirect calorimeter (da Rocha, Avles, & da Fonseca, 2006; Levine, 2005). This equipment is expensive and must be operated by trained professionals. Another commonly used method to express the intensity of an activity is through metabolic equivalents (METs), which is calculated from VO_2 by dividing by a factor of 3.5 (Ainsworth et al., 1993). One MET is about the amount of energy a person is expending at rest (Ainsworth et al., 1993). An activity that is equal to five METs is requiring five times the energy the person would be using at rest.

According to the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM), the recommended amount of physical activity adults should participate is 150 minutes of moderate intensity aerobic activity per week or 75 minutes of vigorous intensity aerobic activity per week. Moderate intensity and vigorous activity is described as an activity requiring 3.0 – 5.9 METs and greater than 6.0 METs, respectively (Haskell et al., 2007, Pate et al., 1995).

Ainsworth and colleagues complied the most comprehensive list of activities and their corresponding intensity levels, expressed in METs (Ainsworth et al., 1993; Ainsworth et al.,

2000, Ainsworth et al., 2011). The compendium is an extensive list of traditional activities like sports (i.e. basketball game with a MET of 8.0, soccer game with a MET of 10.0, or a baseball game with a MET of 5.0), running, swimming, biking, and different variations of each (i.e. running a ten-minute mile with a MET of 10.0 or running a seven-minute mile with MET of 14.0). The list also includes household and occupational activities; for example, light cleaning around the house requires 2.5 METs. The updated lists in 2000 and 2011 included some cultural activities, like religious activities performed in church and traditional Greek dancing, but most these were based on self-reported exertion levels or unpublished thesis dissertations, so the method could not be identified, or were not direct measurements of oxygen uptake. Therefore, these activities need to be investigated further to accurately compare the intensity of one form of exercise to another.

Hula, the traditional dance of Native Hawaiians (Pukui, 1942), is practiced across the state of Hawai‘i by male and female Native Hawaiians and others interested in the dance. While appearing graceful and effortless, hula dancers know there is a tangible physical aspect of performing a hula dance correctly. There are two main forms of hula. The older form, hula *kahiko,* is performed to traditional *oli* (chants) accompanied by a traditional percussion instrument (*ipu*, *ipu heke*, *pahu*). The contemporary hula *‘auana* is accompanied by songs in English or Hawaiian language and stringed instruments (guitar, bass, ukulele, piano). Both dance forms use the same low-impact aerobic, lower-body movements and foot patterns and similar upper body movements (Kaeppler, 1993).

In order for hula to be utilized in a more formal capacity for health programs or interventions, it needs to be quantified as an activity that meets the level of exertion that would satisfy the definitions for moderate and/or vigorous physical activity (Haskell et al., 2007). In addition, this would allow health professionals like physicians and trainers to encourage their patients to engage in more hula dancing to increase their total physical activity time during the week. Dancers could take additional classes or dance on their own at home. This activity could maintain its cultural components, while providing the benefits of a more traditional exercise regimen if executed properly. To our knowledge, only one study has looked at measuring the energy expenditure of hula (Usagawa et al., 2013). However, this study only evaluated the MET values, which are not commonly used by lay people to determine the intensity level of their activity. Other variables assessed, such as heart rate (HR), percentage of maximal heart rate

(%HR_{max}), VO_2, and caloric expenditure are more common for recreational exercisers and are more easily measured.

The purpose of this study was to examine if HR, % HR_{max}, VO_2, and caloric expenditure of hula further provides support that hula as a physical activity that meets the recommended intensity of aerobic exercise as noted by the CDC and American College of Sports Medicine (Haskell et al., 2007, Pate et al., 1995). In addition, the different types of hula, ʻauana and kahiko, were analyzed to determine if both forms reach the physiological threshold for moderate and vigorous intensity physical activity. Specific hypotheses were:

1) Low and high intensity hula will elicit values of HR, % HR_{max}, VO_2, and caloric expenditure that meet the requirements for moderate and vigorous intensity physical activity, respectively
2) Low and high intensity hula ʻauana will both elicit values of HR, % HR_{max}, VO_2, and caloric expenditureVO_2, HR, % heart rate maximum, and caloric expenditure that meet the requirements for moderate and vigorous intensity physical activity, respectively.
3) Low and high intensity hula kahiko will both elicit values of HR, % HR_{max}, VO_2, and caloric expenditure that meet the requirements for moderate and vigorous intensity physical activity, respectively.
4) Low and high intensity hula will elicit values of HR, % HR_{max}, VO_2, and caloric expenditure, that will not be significantly different between gender and form (ʻauana and kahiko).

Method

***Study Design*.** The current study was a cross-sectional, quantitative secondary data analysis of previously collected data to evaluate the metabolic equivalents (METs) of dancing hula (Usagawa et al., 2013). Approval from the University of Hawaiʻi Committee on Human Subjects was obtained for the original data collection procedure in 2011. Signed consent was obtained from all subjects, prior to data collection, and all study procedures were approved. The University of Hawaiʻi Committee on Human Subjects also approved the secondary data analysis on the previously collected data.

Participants. The participants in the previous and current study were 19 elite hula dancers, ten females and nine males. All were from a school of Native Hawaiian education and dance on the island of O‘ahu. All participants were adults (18-50 years) and were free of chronic diseases or conditions that could affect metabolism or daily physical activity for the past year. These participants were competitive dancers who performed in at least one formal hula competition within the last 2 years, and had been regularly attending hula classes at least once a week for the last six months. All subjects had extensive hula training (2-19 years) and were able to properly perform kahiko and ‘auana styles of hula continuously for at least 20 minutes. Elite dancers were chosen to standardize the dancing ability of participants, and this method of participant selection was replicated by previous studies that evaluated the physical exertion of other forms of dance (Blanksby & Reidy, 1988; Di Blasio, De Sanctis, Gallina, & Ripari, 2009; Jette & Inglis, 1975).

Measures

Demographics. The demographic variables collected from the participants were gender, date of birth, self-reported ethnicity, years dancing hula, and years competitively dancing hula (Table 2.5). Height was self-reported in feet and inches (converted to inches), and weight was obtained to the nearest 0.1 pound using a digital scale (Tanita® Model BWB-800A Professional Digital Scale, Tanita, Tokyo, Japan). Body mass index (BMI) was calculated from height and weight: BMI = weight (lb)/[height (in)]^2·703 (CDC, 2014).

Independent variables. The dancers performed two sets of hula, one ‘auana set and one kahiko set. Within each set, they first performed low intensity dances and then followed with high intensity dances. Participants were randomized to dance set 1 or dance set 2 (Table 2.1).

Table 2.1.

Dance sets performed by participants

	Dances				
Dance set 1	Low intensity ‘auana	High intensity ‘auana	Rest	Low intensity kahiko	High intensity kahiko
Dance set 2	Low intensity kahiko	High intensity kahiko	Rest	Low intensity ‘auana	High intensity ‘auana

Dependent variables. The variables analyzed for this study were HR, % HR_{max}, VO_2, and caloric expenditure (CAL). These are typical measures of exercise intensity (Wilmore & Costill, 2004) used in determining if an activity is strenuous enough to be considered an effective form of physical activity. The values of each data point were extracted from the 5th minute of dancing for each of the four conditions. This point was chosen to ensure that the dancer achieved a steady state of energy expenditure. Table 2.2 displays some of the variables and their normal ranges during exercise by a normal, non-elite athlete, 25-40 year old male. It also shows the maximal ranges that can be achieved during exercise (Wilmore & Costill, 2004).

Table 2.2.

Typical measures of energy expenditure

Variable	Measurement unit	Normal ranges during exercise	Maximal ranges
VO_2	$ml \cdot O_2 \cdot kg^{-1} \cdot min^{-1}$	10.5—35.0	40.0—50.0+
Heart rate	Beats/minute	85-180	185+
% of heart rate maximum	% of HR_{max}	40-90%	100%
Respiratory exchange ratio	Ratio of CO_2/O_2	0.78-1.0	>1.1

(Wilmore & Costill, 2004)

VO_2. Oxygen consumption, or VO_2, is a typical and widely used measure of energy expenditure. VO_2 is an indicator of physical fitness. The higher value a person can obtain indicates a higher level of physical fitness and aerobic capacity (Wilmore & Costill, 2004). Table 2.3 shows the values of VO_2 that a person needs to achieve to reach moderate or vigorous intensity exercise.

Table 2.3.

VO_2, % of maximum heart rate (%HR_{max}), and caloric expenditure for activities at various intensities

Intensity	Male VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)*	Female VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)*	%HR_{max}**	Caloric expenditure (kcal/min)**
Moderate	22.5 – 33.75	20 – 30	50 – 70%	3.5 – 7.0
Vigorous	33.3 – 37.8	29.6 – 33.6	70 – 85%	> 7.0

*Wilmore & Costill, 2004; **Centers for Disease Control and Prevention, 2011b

Heart rate and % of heart rate maximum. Heart rate, typically measured in number of beats per minute, is an easy method to determine physical exertion during exercise. A lower heart rate during a specific exercise is thought to correlate to a higher level of fitness (Warburton, Nicol, & Bredin, 2006). Percentage of heart rate maximum is usually estimated by subtracting a person's age from the number 220 (American Heart Association, 2012). However, recently a more accurate equation to estimate a person's maximum heart rate was developed (Gellish, Goslin, Olson, McDonald, Russi, & Modgil, 2007) and further validated in college-aged students (Cleary, Hetzler, Wages, Lentz, Stickley, & Kimura, 2011). This was the equation used to predict heart rate maximum of participants, calculated from their age: $191.5 - 0.007 \cdot age^2$. Table 2.3 shows the percentages of heart rate maximum that reach moderate or vigorous intensity exercise.

Caloric expenditure. Caloric expenditure during physical activity is usually measured in kilocalories per hour, and is dependent on a person's body mass. Previous reviews have recommended that people engage in physical activity that expend about 1,000 calories per week, with an average of 150 to 400 calories per day (American College of Sports Medicine [ACSM], 2000; Warburton et al., 2006) for health-related benefits. The type and intensity of physical activity does not matter, and the authors recommend that people start off at low intensity and slowly increase to high intensity exercise, once tolerance has increased (Warburton et al., 2006). Table 2.4 shows various caloric expenditure values for some common physical activities.

Table 2.4.

Caloric expenditure during one minute for various physical activities

Activity	Men (kcal/min) (70 kg or 154 lb body mass)	Women (kcal/min) (55 kg or 121 lb body mass)	Relative to body mass ($kcal \cdot kg^{-1} \cdot min^{-1}$)
Moderate activity			
Walking 5.6 km/h or 3.5 mph (17 min/mi)	5.0	3.9	0.071
Cycling 11.3 km/h or 7.0 mph (8.5 min/mi)	5.0	3.9	0.071
Tennis	7.1	5.5	0.101
Vigorous activity			
Basketball	8.6	6.8	0.123
Running 12.1 km/h or 7.5 mph (8 min/mi)	14.0	11.0	0.200
Swimming 4.8 km/h or 3.0 mph	20.0	15.7	0.285

*(Wilmore & Costill, 2004)

Data collection

The data for this study were collected in the Summer of 2011. Each participant reported to a Hula Hālau on O‘ahu, Hawai‘i for a one, two-hour testing session. Before beginning the dance set, participants were familiarized with the testing protocol, including instruction as to the importance of dancing to their best ability. A heart rate monitor (Polar®, T31 Coded Transmitter, Polar Electro Inc., New York, USA) that transmitted data to the metabolic system was attached to the participants, and they were familiarized with the Oxycon Mobile system and facemask that they would be required to wear during dancing. The facemask was attached to a backpack, which transmitted information from the participant (heart rate and breathing) to the computer.

The Oxycon Mobile system is a portable cardiopulmonary stress test system (OxyCon Mobile® CardioPulmonary Stress Test System, Erich JAEGER, Hoechberg, Germany) used to collect heart rate (beats/min), VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$), and energy expenditure (kcal/hour). The Oxycon system is secured to the body by a vest. The main components of the system are a sensor box for the gas and flow signals, a data exchange and storage unit, a calibration and receiver unit,

and a computer. The total weight of the unit attached to the participant is approximately 950 grams or 33.51 ounces, which researchers considered to be negligible and would only minimally hinder the movements of the participants. A sampling tube is connected from the facemask to the sensor unit in the vest. As the participant breathes, the amount of oxygen and carbon dioxide in each breath is analyzed. The data exchange unit collects the data and sends the information to the calibration and receiver unit, which is connected to the computer. The computer stores and displays the data. The Oxycon Mobile system was turned on 30 minutes before data collection to warm-up and for air flow calibration, using the automatic flow calibrator, and gas analysis of the room.

Before each testing session, the facemask was checked to ensure that that no air leaks were present (Arvidsson, Slinde, Larsson, & Hulthen, 2009; Hannink et al., 2010; Rosdahl, Gullstrand, Salier-Eriksson, Johansson, & Schantz, 2010). Every dancer sat in a chair for approximately 10 minutes to establish a resting, baseline heart rate with the Oxycon and facemask attached. Then the dancer completed a 5-10 minute self-directed warm up of sitting and standing stretches. At the completion of the warm up, participants performed either dance set 1 or dance set 2 (see Table 2.1). Each dance set contained low and high intensity dances, selected by a *kumu hula* (hula teacher and expert). Intensity was defined by the tempo of the music and complexity of the choreography. After the dancer completed the first set, they rested in a chair for 20-30 minutes in a sitting position with the facemask removed. Once their heart rate returned to within 10% of their baseline, the dancer continued with their dance set (Table 2.1).

Community partners. The community partner in this study was *Hālau Mōhala ʻIlima* (HMI), a traditional Native Hawaiian school of education. The primary kumu hula of HMI participated in the development and implementation of previous studies with the University of Hawai'i (Look, Kaholokula, Carvhalo, Seto, & de Silva, 2012; Look, Maskarinec, de Silva, Seto, Mau, & Kaholokula, 2014; Maskarinec et al., 2015), has over 30 years of teaching hula, and a background in physical education. All of the participants were current dancers of HMI and will be the first to know about the results of this study.

Data analysis

The data were analyzed using SPSS v.19 (IBM SPSS Inc.). All combinations of variables were examined for outliers and normality of distribution utilizing Shapiro-Wilk's test. Appropriate transformations were considered for non-normally distributed variables. When

transformations were not effective, non-parametric tests were utilized. For this analysis, both forms of high intensity hula and both forms of low intensity hula were aggregated, to create two hula conditions: high intensity hula and low intensity hula. HR, $\%HR_{max}$, VO_2, and caloric expenditure were compared across conditions. A descriptive analysis was conducted for the overall means and standard deviations of these variables. In addition, a two-by-two analysis of variance (ANOVA) was done between gender and intensity for each variable to assess if there were differences between male and female dancers. Levene's test was inspected to determine homogeneity of variances.

An analysis was also completed between the two forms of hula, 'auana and kahiko. To determine if either of the different forms of hula met the recommended levels of physical activity, based on the indicators described in Table 2.3 (HR, $\%HR_{max}$, VO_2, and caloric expenditure), a two-by-two analysis of variance (ANOVA) was conducted between type of hula,'auana and kahiko, and intensity, low and high. Another two-by-two ANOVA was conducted between gender and type of hula within each intensity category. Due to the inflation of type 1 error with multiple measures, a Bonferroni correction was applied (p=.05/5 = .01).

Results

The demographics of participants are shown in Table 2.5. The most salient differences between the male and female dancers were the number of years dancing hula and competitive dancing. The females had over ten more years of dancing and almost eight more years of competitive dancing than their male counterparts. Average body mass index (BMI) for the male participants was high compared to the female participants. On average, the male participants fell into the obese category and the females fell into the normal range, according to their BMI.

Table 2.5.

Descriptive data for participants (mean ± SD)

Variable	Female (n=10)	Male (n=9)
Age	25.8 ± 4.8	33.2 ± 9.1
Height (cm)	164.6 ± 5.6	169.4 ± 9.2
Mass (kg)	64.8 ± 19.0	97.3 ± 14.2
BMI	23.7 ± 6.1	30.8 ± 8.0
Years dancing	19.1 ± 3.3	3.0 ± 1.4
Years competitive dancing	10.4 ± 4.3	2.2 ± .8

The descriptive statistics for the dependent variables are shown in table 2.6. The two forms of hula, ‘auana and kahiko, were aggregated into low and high intensity. All dependent variables except for caloric expenditure were normally distributed for low and high intensity, as assessed by Shapiro-Wilk’s test ($p < .05$).

For the first hypothesis, the average VO_2 value for low-intensity hula (19.96 $ml \cdot kg^{-1} \cdot min^{-1}$) did not reach the range of values for moderate intensity exercise (20.0 – 33.75 $ml \cdot kg^{-1} \cdot min^{-1}$), as indicated in Table 2.3. The 95% confidence interval did have a slight overlap with the range. The average VO_2 for high intensity hula also failed to reach the range of values for vigorous intensity exercise (29.6 – 37.8 $ml \cdot kg^{-1} \cdot min^{-1}$).

Table 2.6.

Descriptive statistics and confidence intervals for variables

	Mean (SD)	Minimum	Maximum	95% CI
Low intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	19.9 (4.5)	11.1	34.3	18.5, 21.4
HR (beats/min)	147.0 (18.5)	110.3	186.7	140.9, 153.1
% HR maximum (%)	79 (9.2)	60	95	75.9, 82.0
Caloric expenditure (kcal/hour)	453.56 (137.2)	252.9	787.3	408.5, 498.6
High intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	26.4 (5.2)	15.6	42.0	24.7, 28.1
HR (beats/min)	170.7 (16.1)	137.7	195.7	165.4, 176.0
% HR maximum (%)	92 (8.2)	74	104	89.3, 94.6
Caloric expenditure (kcal/hour)	608.0 (158.0)	376.6	936.3	556.1, 660.0

HR and $\%HR_{max}$ for low intensity hula both exceeded the ranges for moderate intensity exercise. The ranges for $\%HR_{max}$ are listed in Table 2.3. HR is dependent on a person’s age, so taking the mean ages of the participants (25.8 for females and 33.2 for males) gives a range of 93.56 – 131 beats per minute for females and 91.89 – 128.65 beats per minute for males. Both of the ranges are lower than the mean HR for low intensity hula. The mean HR and $\%HR_{max}$ for high intensity hula also exceeded the ranges for vigorous-intensity exercise, more than 131 and 128.65 beats per minute and 70 – 85% HR_{max}, respectively. For caloric expenditure at low intensity, the mean value was higher than the ranges indicated in Table 2.3 (3.5 – 7.0 kcal/min or

210 – 420 kcal/hour). High intensity hula reached the values for vigorous intensity exercise (greater than 420 kcal/hour).

The descriptive statistics with the variables disaggregated are shown in Table 2.7. For low and high intensity ‘auana, all variables except for VO_2 met or exceeded the ranges for moderate and vigorous intensity exercise. The mean VO_2 was lower than the ranges listed in Table 2.3. All of the variables in low-intensity kahiko met or exceeded the ranges for moderate-intensity physical activity. For high-intensity kahiko, only VO_2 did not reach the values for vigorous-intensity physical activity.

Table 2.7.

Descriptive statistics and confidence intervals for variables by hula form and intensity

	Mean (SD)	Minimum	Maximum	95% CI
‘Auana low intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	17.6 (3.5)	11.1	23.4	15.9, 19.3
HR (beats/min)	136.7 (15.3)	110.3	166.3	129.3, 144.0
% HR maximum (%)	73.5 (7.7)	60	85	69.8, 77.2
Caloric expenditure (kcal/hour)	393.2 (94.7)	252.9	599.7	347.5, 438.8
‘Auana high intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	25.38 (5.15)	15.60	36.30	22.9, 27.9
HR (beats/min)	166.0 (14.9)	137.7	191.7	158.8, 173.2
% HR maximum (%)	89.7 (7.8)	74	103	85.9, 93.5
Caloric expenditure (kcal/hour)	580.5 (144.4)	376.6	870.5	511.0, 650.1
Kahiko low intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	22.29 (4.2)	16.5	34.3	20.3, 24.30
HR (beats/min)	157.3 (15.6)	128.3	186.7	149.8, 164.8
% HR maximum (%)	84.4 (7.2)	70	95	80.9, 87.8
Caloric expenditure (kcal/hour)	514.0 (148.3)	336.3	787.4	442.5, 585.5
Kahiko high intensity				
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	27.3 (5.1)	19.5	42.0	24.9, 29.8
HR (beats/min)	175.4 (16.3)	142.0	195.7	167.53, 183.2
% HR maximum (%)	94.2 (8.1)	77	104	90.3, 98.1
Caloric expenditure (kcal/hour)	635.5 (169.8)	420.8	936.3	553.7, 717.4

Hula form and intensity level. The results for the two-way ANOVA on hula form and intensity are shown in Table 2.8. There were no outliers in the data for caloric expenditure, HR,

and $\%HR_{max}$, as assessed by inspection of the boxplots for values greater than 1.5 box-lengths from the edge of the box. The variable of VO_2 had one outlier, which was not perceived to affect the analysis, therefore it was not removed. HR and $\%HR_{max}$ were normally distributed for all group combinations of gender and intensity, as assessed by Shapiro-Wilk's test ($p > .05$). VO_2 and caloric expenditure were not normally distributed. For VO_2, because of the extreme values, a logarithmic transformation was applied. No transformations were effective for caloric expenditure, so a non-parametric analysis was conducted.

For HR, $\%HR_{max}$, and VO_2 there was homogeneity of variances, as assessed by Levene's Test (p=.922, p=.960, and p=.735, respectively). For HR, $\%HR_{max}$, and VO_2 the main effect of intensity was significant and the main effect of hula type was significant as shown in Table 2.8. The interaction effect was non-significant for all variables.

A Freidman test was used as a non-parametric alternative for caloric expenditure (CAL) Pairwise comparisons were performed with a Bonferroni correction for multiple comparisons. The variable of CAL was significantly different in the different intensities and hula forms, $\chi^2(3)=35.40$, $p<.001$. Pairwise comparisons revealed significant differences between low 'auana and high 'auana ($p<.001$), low 'auana and high kahiko ($p<.001$), low kahiko and high 'auana (p=.023), and low kahiko and high kahiko (p=.003). There were no significant differences between low 'auana and low kahiko (p=.614) and high 'auana and high kahiko (p=1.000).

Table 2.8

Means, standard deviations, and Analysis of Variance (ANOVA) results for variables by hula form and intensity

	'Auana	Kahiko	ANOVA $F(1, 72)$		
	Mean (SD)	Mean (SD)	Intensity (I)	Hula type (H)	I x H
HR (beats/min)			44.32**	17.80**	2.50
Low intensity	136.7 (3.5)	157.3 (3.6)			
High intensity	166.0 (3.4)	175.4 (3.7)			
$\%HR_{max}$ (%)			54.09**	18.90**	3.19
Low intensity	73.5 (1.8)	84.3 (1.6)			
High intensity	89.7 (1.8)	94.2 (1.9)			
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)*			41.29**	12.92***	3.33
Low intensity	1.24 (.021)	1.34 (.017)			
High intensity	1.40 (.021)	1.43 (.018)			

*VO_2 was logarithmic transformed, ** $p<.001$, ***p=.001

Gender and intensity. The results for the two-way ANOVA on gender and intensity are shown in Table 2.9. Mean and standard deviations for the dependent variables are also included. There were no outliers in the data for HR as assessed by inspection of the boxplots for values greater than 1.5 box-lengths from the edge of the box. The variable VO_2 had one outlier, which was not perceived to affect the analysis, therefore it was not removed. The variables HR and VO_2 were normally distributed for all group combinations of gender and intensity, as assessed by Shapiro-Wilk's test ($p > .05$). For CAL, because of the extreme values a logarithmic transformation was applied. The variable $\%HR_{max}$ was not normally distributed, and no transformations were effective, therefore a non-parametric test was performed.

The variables HR and CAL (with a log transformation applied) demonstrated homogeneity of variances, as assessed by Levene's test (p=.303 and p=.254, respectively). Levene's test was statistically significant for VO_2, and all efforts to transform the variable did not produce homogeneity of variance, resulting in the utilization of a non-parametric test. The main effect of gender and the main effect of intensity were significant for HR and CAL. The interaction effect was not significant for either variable.

Table 2.9

Means, standard deviations, and Analysis of Variance (ANOVA) results for variables by gender and intensity

	Female	Male	ANOVA $F(1,72)$		
	Mean (SD)	Mean (SD)	Intensity (I)	Gender (G)	I x G
HR (beats/min)			49.59**	31.97**	.119
Low intensity	155.4 (3.5)	180.2 (2.2)			
High intensity	137.6 (4.0)	160.1 (3.6)			
CAL*			36.22**	41.26**	.029
Low intensity	2.57 (.022)	2.71 (.025)			
High intensity	2.71 (.018)	2.84 (.022)			

*CAL was log transformed, **p<.001

A Friedman test was used for $\%HR_{max}$ and VO_2. Pairwise comparisons were performed with a Bonferroni correction to adjust for multiple comparisons. Both $\%HR_{max}$ and VO_2 were significantly different in gender and intensity, $\chi^2(3)=36.66$, p<.001 and $\chi^2(3)=34.61$, p<.001, respectively. Pairwise comparisons revealed significant differences in $\%HR_{max}$ between low

intensity male (LM) and high intensity male (HM), LM and high intensity female (HF), and low intensity female (LF) and HM (p=.004, p<.001, and p<.001, respectively). Comparison between LM and LF, HM and HF, and LF and HM were not significantly different. For VO_2, pairwise comparisons revealed significant differences between LM and HM, LM and HF, LF and HF (all with p<.001) and LF and HM (p=.001). Comparisons between LM and LF and between HM and HF were not significant.

Gender and hula form. The results for the two-way ANOVA between gender and hula form are shown in Table 2.10. Mean and standard deviations for the dependent variables are also included. There were no outliers in the data for HR and $\%HR_{max}$ as assessed by inspection of the boxplots for values greater than 1.5 box-lengths from the edge of the box. There were two outliers in the data for VO_2, but this did not appear to effect analysis, so both outliers were left in the final data set. The variables HR and $\%HR_{max}$ were normally distributed for all group combinations of gender and hula form, as assessed by Shapiro-Wilk's test (p > .05). The variables VO_2 and CAL were not normally distributed, so square root and logarithmic transformations were applied, respectively. Once transformed, both variables were normally distributed as assessed by Shapiro-Wilk's test (p > .05).

Levene's test was not significant for any variables, indicating homogeneity of variances. The main effect of gender and the main effect of hula form were statistically significant for HR, $\%HR_{max}$. The main effect of gender was not significant for VO_2 (with a square root transformation applied), however the main effect of hula form was significant. For CAL (with a logarithmic transformation applied), the main effect of gender was significant, with the main effect of hula type approaching significance (p=.012). The interaction effect for all variables was not significant.

Table 2.10

Means, standard deviations, and Analysis of Variance (ANOVA) results for variables by hula form and gender

	‘Auana	Kahiko	ANOVA $F(1, 72)$		
	Mean (SD)	Mean (SD)	Gender (G)	Hula type (H)	G x H
HR (beats/min)			22.64***	14.38***	0.26
Male	140.3 (4.0)	157.4 (4.4)			
Female	161.3 (4.4)	174.4 (3.1)			
$\%HR_{max}$ (%)			14.17***	12.94****	0.60
Male	76.4 (2.2)	85.9 (2.3)			
Female	86.3 (2.4)	92.4 (1.6)			
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)*			0.81	7.54^	0.38
Male	4.5 (.2)	4.9 (.2)			
Female	4.7 (.1)	5.0 (.1)			
CAL (kcal/hour)**			30.92***	8.93^*	0.55
Male	2.7 (.027)	2.8 (.024)			
Female	2.6 (.028)	2.7 (.021)			

*VO_2 was square root transformed, **CAL was logarithmically transformed
***p<.001, ****p=.001, ^p=.008, ^*p=.012

Hula form, gender, and intensity level. The differences between gender and intensity level were stratified by hula form. The results of the two-way ANOVA between gender and intensity level by ‘auana and kahiko are shown in Table 2.11. For ‘auana, HR and $\%HR_{max}$ contained no outliers and were normally distributed, as assessed by inspection of box plots and Shapiro-Wilk’s test (p>.05). The variable CAL was transformed by inverse calculation, which resulted in a normal distribution. No transformations were effective for VO_2, so a non-parametric test was utilized. For kahiko, HR, $\%HR_{max}$, and VO_2 contained no outliers and were normally distributed, as assessed by inspection of box plots and Shapiro-Wilk’s test (p>.05). CAL was not normally distributed and no transformations were effective, so a non-parametric test was utilized.

Table 2.11

Means, standard deviations, and Analysis of Variance (ANOVA) results for variables by hula form, gender, and intensity

‘Auana					
	Male	Female	ANOVA $F(1, 34)$		
	Mean (SD)	Mean (SD)	Gender (G)	Intensity (I)	G x I
HR (beats/min)			35.70**	69.18**	.250
Low intensity	126.5 (3.2)	145.8 (4.4)			
High intensity	154.0 (3.1)	176.8 (3.1)			
$\%HR_{max}$ (%)			24.97**	67.28**	.543
Low intensity	69.0 (1.9)	77.6 (2.2)			
High intensity	83.9 (1.9)	94.9 (1.8)			
CAL (kcal/hour)*			19.82**	36.40**	.418
Low intensity	.0023 (.00012)	.0030 (.00020)			
High intensity	.0015 (.00010)	.0021 (.00012)			
Kahiko					
HR (beats/min)			14.43**	16.32**	.016
Low intensity	148.7 (5.3)	165.1 (3.5)			
High intensity	166.1 (6.0)	183.7 (2.9)			
$\%HR_{max}$ (%)			7.85***	18.16**	.907
Low intensity	81.1 (2.6)	87.3 (1.6)			
High intensity	90.7 (3.2)	97.4 (1.6)			
VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)			.010	10.26****	.126
Low intensity	22.5 (2.0)	22.1 (0.6)			
High intensity	27.0 (2.1)	27.7 (1.2)			

*CAL was transformed by inverse, **p<.001, ***p=.008, ****p=.003

All variables listed in Table 2.11 demonstrated homogeneity of variances, which was determined by non-significant Levene’s tests. For all variables, the main effect of intensity was significant and the interaction effect was non-significant. All variables except VO_2 in kahiko, exhibited a significant main effect for gender. A Friedman test was run for VO_2 in ‘auana and CAL in kahiko. Pairwise comparisons were performed with a Bonferroni correction to adjust for multiple comparisons. Both VO_2 and CAL were significantly different in gender and intensity, $\chi^2(3)=20.33$, p<.001 and $\chi^2(3)=18.20$, p<.001, respectively. Pairwise comparisons showed that for VO_2 in ‘auana, LM and HM, LM and HF, and LF and HF, were all significantly different (p=.011, p=.001, and p=.011, respectively). Pairwise comparisons also revealed that in CAL for kahiko, LM and LF were significantly different (p=.037) and LF and HM were significantly different (p<.001).

Additional analyses performed. Due to the gender differences found and the disparity in BMI between males and females, an analysis of covariance (ANCOVA) was performed, with BMI as the covariate (Table not shown). When comparing ‘auana and kahiko (combining intensities), there were no differences found between genders when controlling for BMI (p=.08). When stratifying by intensities and hula type, there were differences found between genders in kahiko (p=.044) but not ‘auana (p=.208). Due to the conflicting evidence, only the ANOVA results are presented.

Discussion

The purpose of this study was to examine the HR, % HR_{max}, VO_2, and caloric expenditure of hula during a 12 – 15 minute dancing set to evaluate hula as a physical activity that meets the recommended intensity of physical activity as noted by the CDC and ACSM (Haskell et al., 2007, Pate et al., 1995). This study also examined various combinations of type of hula, intensity of hula, and gender to determine if there were any differences.

The first hypothesis stated that low and high intensity hula would elicit values that would meet moderate and vigorous physical activity, respectively (Table 2.6). The second and third hypotheses looked at the two different forms of hula, ‘auana and kahiko separately, at low and high intensity, to determine if the disaggregated variables met moderate and vigorous intensity physical activity values (Table 2.7). Results indicated that most of the variables that were measured reached values that suggest that hula, when appropriately performed, may be considered as a moderate and/or vigorous intensity exercise. Oxygen consumption, or VO_2, did not reach the range of values that the ACSM listed the range of values a person must achieve to reach moderate and vigorous activity. However, if we use the metabolic equivalents (MET) for moderate intensity exercise (3.0 – 5.9 METs) and vigorous intensity exercise (greater than 6.0 METs) according to the CDC, the values are slightly lower than the VO_2 range would be 10.5 – 17.7 $ml \cdot kg^{-1} \cdot min^{-1}$ and greater than 21 $ml \cdot kg^{-1} \cdot min^{-1}$, respectively, which would put low intensity above moderate physical activity (19.96 $ml \cdot kg^{-1} \cdot min^{-1}$) and high intensity hula above vigorous physical activity (26.35 $ml \cdot kg^{-1} \cdot min^{-1}$). The other variables HR, %HR_{max}, and CAL all reached the established ranges for physical activity.

The fourth hypothesis looked at low and high intensity hula stratified by gender and by form (‘auana and kahiko). We hypothesized that there would be no differences by gender or by type of hula. These results were expected for differences between low intensity and high

intensity, but were unexpected for differences in hula form and gender. Females consistently demonstrated higher values than males in all variables. The two forms of hula have similar lower body movements and upper body movements. The tempo of the songs chosen for each intensity were also similar for this study. In addition, the complexity of choreography was thought to be comparable according to the *kumu hula*.

The differences between the forms of hula could be due to familiarity and knowledge of the song or affinity for one form of hula over the other. Some dancers may have known one form better than the other, allowing them to fully execute the physical motions of the dance, instead of simply trying to remember what comes next. Not having to think about the next part of the dance frees the dancer to put more energy into performing. Another reason for the differences between hula forms could be due to a preference of one form over the other. Some of the dancers might enjoy dancing one form, and therefore may have put more effort into those dances than the other form. More effort could translate to higher values, even if the dances are similar in difficulty. In addition, from the current results it seems to indicate that low intensity ‘auana is a more appropriate dance for novice and less physically trained individuals, whereas kahiko may be too vigorous for this population. Kahiko might be more appropriate for advanced dancers and people whose baseline fitness is above average. However, this recommendation is only for the individuals who wish to gain physiological benefits from dancing.

Gender differences were also found in almost all combinations of independent variables even though all dancers performed using the same songs. The differences could be due to the disparities in demographic variables between males and females. The male dancers were on average older and had less experience dancing. Both of these factors may have contributed to the differences between males and females. Males are expected to be able to reach higher values of the measured variables (Wilmore & Costill, 2004). Less experienced dancers may not have possessed the necessary skill to properly and completely execute each movement. This could result in lower values. In one study, it was found that advanced dancers elicited higher values of oxygen consumption (VO_2) than novice dancers during a typical ballet performance (Guidetti, Emerenziani, Gallotta, Da Silva, & Baladari, 2008). From the results, it appears that the female dancers achieved a more vigorous workout than their male counterparts. This could indicate that some intensities and forms of hula are only appropriate physical activities for females, while males would need to participate in higher intensity forms if they wish to achieve a standard

workout. However, as shown in Table 2.5, on average the female dancers had more experience in competitive dancing than males. The female dancers could have been able to exert more energy than the male dancers because they were more familiar with the dance and the steps associated.

The results indicated that for all of the comparisons, caloric expenditure was higher in males even though females achieved higher values in almost all other variables. One of the reasons for this interesting finding could be the in the limitations of calculating METs and BMI. For BMI, the measurement does not take into account body composition (the amount of fat mass to fat-free mass) (Nevill, Stewart, Olds, & Holder, 2006), which is a factor in determining the caloric expenditure of an individual. People with higher percentages of fat-free mass were shown to have a higher resting metabolism (Webb, 1981). Males also tend to have a higher percentage of fat-free mass than females.

Resting metabolism is a factor that determines a person's daily energy expenditure, and also the MET level of an activity they participate. Another study calculated the resting oxygen consumption of over 600 participants to determine if the accepted 3.5 $ml \cdot kg^{-1} \cdot min^{-1}$ for a resting MET was accurate (Byrne, Hills, Hunter, Weinsier, & Schutz, 2005). This study found that 3.5 $ml \cdot kg^{-1} \cdot min^{-1}$ was significantly higher than in the tested population, which was 2.6 ± 0.4 $ml \cdot kg^{-1} \cdot min^{-1}$. This demonstrates the variability in MET values and their associated intensity levels. Caloric expenditure can also be calculated based on MET values; one MET is equal to 1.0 kcal $\cdot kg^{-1} \cdot hour^{-1}$ (Ainsworth et al., 2000; Byrne et al., 2005). These limitations for measuring BMI and MET values could have contributed to the differences in caloric expenditure between males and females.

Limitations

A consideration that researchers were not able to take into account was baseline fitness of the dancers. The $\%HR_{max}$ values were only estimated, and VO_{2max} was also not measured. If these variables were actually measured, through a maximum stress test, researchers may have calculated the percentage of VO_2 and HR each dancer achieved, which may have given a better indication of intensity for each person. Another consideration was the high BMI of the male participants. A higher BMI requires more energy to complete the activity and without knowledge of baseline fitness, the participants may have experienced a greater intensity level because of their BMI and lack of fitness. These factors, BMI and baseline fitness, should be taken into

consideration when prescribing hula to inexperienced dancers. Perhaps future research should control for BMI and/or baseline fitness when evaluating the intensity of a physical activity.

Another limitation of this study was the small number of participants, which could limit the generalizability of the findings. However, the number of participants was comparable to other research studies that investigated the energy expenditure of different forms of dancing (Blanksby & Reidy, 1988; Di Blasio et al., 2009; Guidetti et al., 2008; Jette & Inglis, 1975). Another limitation was that all the participants were from the same hula hālau or hula school. While this may have increased the uniformity of the participants, it could also limit the generalizability to other dancers with different styles. These participants were also younger, healthy adults, with no contraindications for exercise. Both of these factors could influence the participants' dancing ability, and might not make the results generalizable to the entire hula population.

Conclusion

The main purpose of this study was to examine the HR, $\%HR_{max}$, VO_2, and caloric expenditure to quantify hula as a physical activity that meets moderate or vigorous intensity. Overall, all of the indicators of physical activity except for VO_2 met or exceeded the values for moderate or vigorous activity. In addition, hula form, intensity, and gender were other variables that were compared. All combinations of independent variables were significantly different except for the main effect of VO_2 in kahiko between low and high intensity, and between gender and hula form. The findings of this study support the use of hula as a physical activity for health interventions and for cardiorespiratory fitness, but the type of hula and intensity of the dances need to be taken into account to ensure the level of exertion is appropriate to achieve health benefits. For more compromised or sedentary participants, it appears that starting with 'auana might be appropriate. But to gain cardiorespiratory benefits, it is best to engage in high intensity dances continuously for an extended period of time. More research should be done to evaluate the differences between genders in dancing hula.

Chapter 3: A qualitative investigation of hula as a physical activity for hypertension control in Native Hawaiian and Pacific Islanders

Abstract

Nationally, minority populations are disproportionately affected by hypertension. With the high prevalence and low control of hypertension among minorities, there is a need for culturally appropriate or tailored interventions. A culturally appropriate program to reduce hypertension called Ola Hou i ka Hula, was a 12-week program using hula, the indigenous dance of Native Hawaiians, as the physical activity (PA) for hypertension control. The purpose of this study was to ask participants of the Ola Hou program, who were primarily Native Hawaiian and Pacific Islanders (NHPI), about how they felt about using hula as a PA for a health intervention. For this study, three, semi-structured, open-ended, focus groups were conducted with participants (n=30). From the focus groups, four themes emerge: 1) Hula can facilitate improvements in physical health, 2) Participation in hula can improve one's mental health, 3) Hula can create social support systems through the formation of relationships, and 4) Spirituality and cultural components are important to learning the dance. The Ola Hou intervention for NHPI was well received. Participants all agreed that hula, when used in a culturally respectful manner, could be used as a part of a health intervention. Even though most of the participants in this intervention were not Native Hawaiian (93.3% were not NH), the culturally-tailored intervention, Ola Hou, was still attractive. From the participant perspective, hula was an appropriate PA for a health intervention for NHPI populations. Future research should investigate if hula is attractive to other groups and if there are other psychological and physiological outcomes that could result from participating in hula.

Introduction

Hypertension is defined as having a systolic blood pressure greater than 140 mmHg or a diastolic blood pressure greater than 90 mmHg (National Heart, Lung, and Blood Institute, 2012; American Heart Association [AHA], 2012). Nationally, one in three Americans is diagnosed with hypertension (AHA, 2012). Also known as the "silent killer," hypertension does not typically have any signs or symptoms. However, if left untreated over time, having hypertension can damage a person's heart, blood vessels, and other parts of the body (National Heart, Lung, and Blood Institute, 2013). It is one of the major risk factors for cardiovascular disease (CVD). One study has shown that even a moderate reduction in systolic blood pressure of 5 mmHg can reduce a person's mortality due to stroke by 14%, coronary heart disease by 9%, and overall mortality by 7% (Appel et al., 2006).

Nationally, minority populations are disproportionately affected by hypertension. Native Hawaiians and other Pacific Islanders (NHPI) are not the only ethnic minority group in the US that experiences an unequal burden of hypertension (Mau et al., 2009). African Americans have shown to consistently have higher rates of hypertension, as well as higher associated morbidity and mortality, as compared to Whites (dela Cruz & Galang, 2008; Lukoschek, 2003). Hispanics living in the US represent one of the largest ethnic minority groups and also suffer from an unequal burden of cardiovascular disease and hypertension (Caballero, 2007; Ostchega et al., 2007; Torres, Azen, & Varma, 2006). According to a recent report of hypertension prevalence, African Americans reported a prevalence of 41.4% compared to 28.1% reported by Whites (Roger et al., 2012). Hispanic rates were equal to or slightly less than Whites (Roger et al., 2012), but control of hypertension was much lower in Mexican-Americans and African Americans (35.5% and 43.0%, respectively) compared to White adults in the US (48.6%) (CDC, 2013). With the high prevalence and low control of hypertension among minorities, there is a need for interventions that will resonate with these populations (Roger et al., 2012).

Culturally tailored interventions

In public health, it is thought that a culturally appropriate or tailored intervention will facilitate better outcomes for minority populations than one that is developed for primarily Caucasian participants (Brach & Fraser, 2000). An intervention developed with Caucasians is thought to be more effective for Caucasians than for a Native Hawaiian, African American,

American Indian, or Asian population. For minority populations, a culturally appropriate or culturally relevant intervention may better facilitate treatment adherence and improve outcomes (Brach & Fraser, 2000). Culturally appropriate health behavior change programs should target a culture's specific health beliefs and views to be successful in changing behaviors (Becker, 1980). Kreuter et al. (2002) describe specific elements of an intervention that can be altered to make a program or intervention more "culturally appropriate." In their review, they describe five different methods that researchers can apply to their intervention to make it more appealing to a specific culture. The five domains are peripheral, evidential, linguistic, constituent-involving, and sociocultural. An additional study by Resniow et al. (1999) also describes levels of adjusting an intervention to be more culturally relevant to a specific culture as "surface" and "deep." These methods mentioned above can work together to create a program or intervention that is culturally appealing.

Interventions targeted for African Americans and Hispanics/Latinos suffering from hypertension have been shown to be successful (Lukoschek, 2003). For example, the Hypertension Improvement Project (HIP) Latino pilot study tested a hypertension intervention designed for Latinos, with materials and interactions provided in Spanish (del Pilar Rocha-Goldberg et al., 2010). In addition, culturally appropriate foods and recipes from different South American countries, such as Honduras, Mexico, Argentina, and Columbia, were included in the education. The physical activity (PA) was also culturally familiar to these Latin countries such as dancing. This project was six weeks in duration, with participants meeting once a week for 90-120 minutes. On average, systolic blood pressure was reduced 10.4 mmHg, and diastolic blood pressure was reduced 9.0 mmHg (del Pilar Rocha-Goldberg et al., 2010). Although the pilot study only involved 17 participants and there was no comparison group, the reduction in systolic blood pressure was shown to have a d-value of 1.01 (large effect size), demonstrating that a culturally appropriate intervention can elicit significant improvements.

Another program called DASH (Dietary Approaches to Stop Hypertension) is a diet program developed to encourage heart healthy eating, found to be effective in lowering blood pressure (Appel et al., 1997). Whitt-Glover (2013) modified DASH for use with African Americans in an underserved community. The program used foods familiar to the African American community and aimed to increase participant knowledge about the foods that were accessible within the neighborhood that would be suitable for the DASH program. The

randomized control trial enrolled 14 participants in the intervention group and 11 participants in the control group. While blood pressure did not improve over the 12-week period, participants in the intervention group increased their fruit and vegetable consumption and their confidence in eating less salt, fat, and unhealthy snacks more than the control group (Whitt-Glover et al., 2013).

An additional intervention tailored for African Americans with hypertension, with more participants (n=134) and longer program duration of 9 months, also included culturally sensitive materials for the intervention such as utilizing African American literature, artwork, and facilitators (Paschal, Lewis, Martin, Shipp, & Simpson, 2006). In a test of this intervention, the prevalence of hypertension was reduced from 70% at baseline to 43% at the end.

Physical activity (PA)

The Center for Disease Control and Prevention (CDC) defines PA as any type of muscular movement above a sedentary or basal level (CDC, 2011c). "Exercise" is a subset of PA, which is considered purposeful activity for the main goal of achieving health benefits or maintaining physical fitness, and is often used interchangeably with PA (CDC, 2011c). PA is an important lifestyle modification to manage chronic diseases such as hypertension. Several studies have demonstrated that PA is considered a protective factor against diseases such as diabetes and CVD (Raum et al., 2007; Rennie et al., 2003; Wannamethee & Shaper, 2001). According to the CDC, the recommended amount of PA for a healthy, normal adult is 150 minutes of moderate-intensity aerobic exercise or 75 minutes of vigorous-intensity aerobic exercise per week (Haskell et al., 2007).

Healthy People 2020 PA objectives include reducing the percentage of adults who engage in no leisure-time PA from 32.6% in 2008 to 36.2% and increase the percentage of adults who meet the CDC guidelines for aerobic PA from 42.5% in 2008 to 49.7% (HHS, Healthy People 2020, 2013). However, the percentage of minority populations meeting the guidelines for PA is lower than Caucasians. According to the CDC, the percentage of adults who meet the guidelines for aerobic and muscle-strengthening activity is 20.6% for Caucasians, but 14.4% for Hispanic or Latino (Schiller et al., 2012). The Healthy Hawai'i Initiative reports that in Hawai'i, the percentage of Native Hawaiians (29.5%) and Pacific Islanders (22.5%) that are meeting the guidelines for aerobic and muscle-strengthening activity are equal to or lower than Caucasians (29.5%) (HHI, 2013).

The lower levels of PA in minority populations, and the lower health status of these populations creates an opportunity for culturally relevant PA interventions or health programs. Various dance forms have been shown to be strenuous enough to elicit energy expenditure levels consistent with traditional forms of exercise. Ballet (Di Blasio, De Sanctis, Gallina & Ripari, 2009), square dancing (Jette & Inglis, 1975**),** African dances (Murrock & Gary, 2008), ballroom dancing (Belardinelli, Lacalaprice, Ventrella, Volpe, & Faccenda, 2003), and traditional Maori dancing (Moy, Scragg, McLean, & Carr, 2006), and hula (Usagawa et al., 2014) are some of these examples. Hula is the traditional dance of Native Hawaiians and is a cultural expression for this indigenous population (Kaeppler, 1993).

One intervention found that a culturally tailored dance program for Latinas could increase vigorous activity (Hovell et al., 2008). The inclusion criteria for participants were a sedentary lifestyle, primarily Spanish-speaking, and no contraindications for participation in an exercise regime. This intervention provided three aerobic dance classes, set to salsa music, per week for 90 minutes each session. The dance instructor and all other facilitators spoke Spanish. The control group received educational classes about home safety and selected disease prevention, but no information about CVD, diet or exercise. At the end of six months, the intervention group reported more vigorous activity and more walking than the control group. They also increased their cardiovascular fitness by 16.9% compared to only 3% in the control group after the intervention. This study provides evidence that a culturally tailored dance program can elicit improvements in exercise (Hovell et al., 2008).

Previous research and Community Partners

Hula, the traditional dance of Hawai‘i, has been tested as a potential component of a culturally relevant program in Hawai‘i for minority people in need of a cardiac rehabilitation program (Look, Kaholokula, Carvhalo, Seto, & de Silva, 2012) and for minority people with hypertension. Because of hula’s low impact movements, and ability to be modified in intensity, it was thought to be an appropriate form of PA for use with participants with compromised exercise capacity. One study has shown that low and high intensity hula was able to reach levels of moderate and vigorous PA intensity, respectively (Usagawa et al., 2014). With hula’s appeal to multiple populations in Hawai‘i, it was also thought to be an appropriate form of exercise for individuals with hypertension (Look et al., 2012). While hula has traditionally thought of as an indigenous dance of the Native Hawaiians, it has become part of the culture of Hawai‘i. A

cultural group is not only defined as a group of people with similar ethnic and racial backgrounds, but can be groups of people that share common beliefs, values, locations, actions, and behaviors (Flores, 2000; The Office of Minority Health [OMH], 2013). People of all ethnicities participate in and enjoy hula not only in Hawai‘i but also around the world. However, there is a lack of studies that investigate the appropriateness of hula as a PA, especially perceived by the participants. If participants perceive hula as a viable form of PA, then it may be a useful alternative to traditional PA for public health interventions.

Research question

The purpose of this qualitative study was to understand the role that hula can play in a health capacity and what participants thought about a hula-based program to reduce hypertension called Ola Hou i ka Hula. This 12-week intervention included two components: hula taught by a trained *Kumu hula* (hula teacher) as the PA, plus heart health education specifically tailored for people living in Hawai‘i (Table 3.1).

Table 3.1

Heart health education modules for the Ola Hou program

Lesson	One	Two	Three	Four	Five	Six
Topic	Hypertension 101 (general information)	Medications part 1	Medications part 2	Healthy eating	Food label reading	Physical activity

The purpose of this study was to ask participants of the Ola Hou program about how they felt about using hula as a PA for a health intervention.

Method

Study design.

The current study was based on a phenomenological approach to qualitative research, which aims to uncover the felt experiences of the participants who were enrolled in the intervention (Creswell, 2007). For this qualitative research study, three semi-structured, open-ended, focus groups were conducted with participants. Participants were recruited from both sites that participated in the intervention trial, and from both the intervention group and the control group. Each focus group consisted of participants from the same intervention site.

Participants

For the current study, Ola Hou was offered at two sites in Honolulu; Kokua Kalihi Valley Comprehensive Family Services (KKV) and at Hālau Mōhala ʻIlima (HMI). KKV is a federally qualified community health center in Kalihi Valley (Honolulu, HI) that aims to provide its community with medical, dental, and behavioral health care. HMI is a Native Hawaiian education school that currently teaches Hawaiian language, culture, hula, and traditional Native Hawaiian customs and practices. The primary populations of these two sites are Pacific Islander (Micronesian, Filipino, Samoan) at KKV and Native Hawaiian at HMI.

To participate in Ola Hou, individuals needed to have been affiliated with one of two community sites on Oʻahu and diagnosed as hypertensive by a physician, which was defined as having a systolic blood pressure greater than 140 mmHg, or 130 mmHg if they were diabetic, and risk factors associated with CVD. People were excluded if they were controlled hypertensives (their hypertension was controlled through medication), if they could not physically participate in dancing, or if they had other co-morbidities that would affect their participation. For intervention testing, participants were randomly assigned to either the intervention group or the wait-list control group. The intervention group received the heart health education and hula classes. The control group was asked to continue their normal routine. At the end of the 12 weeks, the control group received the hula classes and education.

Measures

Focus groups. The purpose of the focus groups was to ask the participants about how they felt about hula as the primary PA in a health intervention and the experience they had during the intervention. The participants were not separated based on their success with reducing their hypertension. For those who benefitted (those who had a reduction in their hypertension), we wanted to know what was unique about Ola Hou that helped them manage their hypertension, and we also asked participants if there were any suggestions for future classes.

The questions were developed based on the phenomenological approach to qualitative research**.** The questions aimed to understand the lived experiences of the Ola Hou intervention from a first-hand participant perspective (Patton, 2002). The questions asked about how they felt about being part of the class, utilizing hula as a PA, their experiences during the class, and if they felt this intervention helped to improve their hypertension. The complete focus group guide is shown in Appendix A. The key focus group questions are as follows:

- Tell me about your experience being in the class.
    - Probe for relationship with other participants
    - Probe for relationship with kumu hula
- What do you think about using hula as the exercise for a health intervention?
- What do you think about the heart health education?
- In what ways do you think each component helped you with your hypertension?
- What were the most challenging parts of being in the class?
- What was different about Ola Hou compared to any other hypertension classes you may have participated in?
- What recommendations do you have for future classes?

Procedures

This study was designated as exempt by the University of Hawai‘i Committee on Human Subjects. Participation in this study was voluntary and confidential. Participants were recruited at community events, such as end of the program *ho’ike* (parties), and through the aid of the community health workers that facilitated the intervention. Three focus groups were recruited: two from KKV and one from HMI. Focus groups were held at KKV or HMI. Focus groups were recorded with a digital voice recorder, and another student or researcher took written notes during the session. Focus groups were utilized instead of surveys because experiences and feelings felt during and after the intervention could be hard to articulate in a survey and might not be the same for each person. Also, some of the participants from the KKV group did not speak English as their first language, so asking them to articulate their thoughts and feelings verbally was easier than in writing. A gift card ($25) was given to each focus group participant and light snacks were provided for the sessions.

Before beginning the focus groups and interviews, participants were asked to sign an informed consent form and asked their permission to audio record the session. The purpose of the focus group was explained to participants so they understood how their responses could help future research.

Most of the participants from KKV did not speak English as their first language, so a translator from KKV was also present during the focus group to translate. The primary language spoken by the KKV participants was *Chuukese*. Other participants spoke English. The translator from KKV translated what was said during the focus group session as the group spoke. This was

the same method utilized during the Ola Hou hula and education classes, so researchers did not feel that this would be a problem for participants. Participants from HMI all spoke English as their first language.

Data analysis

Upon completion of the focus groups, the recordings were transcribed, verbatim, and then deleted. For the focus groups with a translator, only the English portion of the focus group was transcribed. After all of the transcriptions were complete, content analysis was conducted to reduce the transcripts and identify core consistencies and themes. From the transcripts, significant statements were identified, and a thematic analysis was conducted to determine the key themes (Creswell, 2006**;** Patton, 2002). The most meaningful and consistent significant statements were classified into several themes. These themes emerged from the statements through categorizing the statements into larger groups (Creswell, 2006). The results from the analysis and thematic coding were used to describe the participants' experience during the intervention. Written notes taken during the focus groups by another student researcher were compared to the transcripts and used for adding context wherever necessary.

Researcher experience

The lead researcher's interest in and experience with hula stems from a life-long exposure to the dance. Her first encounter with hula was at five years old, when she began taking lessons. Although she is not Hawaiian, she quickly developed an affinity for the cultural dance, participating in numerous performances and competitions through high school. After graduating with her Bachelor's degree in Exercise Science and working with public health professionals, her research focused more on PA and health prevention. When an opportunity presented itself to collaborate on a project that incorporated both PA interventions and hula, she gladly stepped into the role as a student researcher and was fortunate to be given the chance to include this research as a part of her doctoral dissertation.

Results

Participant Demographics

A total of three focus groups were conducted with 30 participants. Out of the 30 participants, 29 were female (96.7%). The average age of participants was 57.0 years (standard deviation = 10.3). Participants' ethnicities were Asian (3.3%), Caucasian (6.7%), Native Hawaiian (6.7%), Filipino (10.0%), Chuukese (66.7%), and other ethnicity (6.7%).

Table 3.2

Significant statements from participants of Ola Hou i ka Hula

- P20 (Participant #20): I like to continue with the hula dance because when there is problem at home, I face all the problems, but when I go out of the house and into this group it makes me feel relaxed, happy, healthy, and it also makes the blood sugar control by dancing and also a chance to socialize with my other friends.
- P11: This one, the reason why she wants to join the hula is because of her high blood pressure, so she believes that the blood pressure lowers down because of the way she kept coming to the hula class
- P8: For her if she doesn't keep coming to the hula, she will not learn anything, especially the movement can help her with her numbness because she starts moving and that's why she thinks that her numbness is getting better because she knows it's hard to move around.
- P26: I like to continue with this group, especially with the hula dance because it helps control with the blood sugar and high blood [pressure] and I feel healthy about that.
- P19: Because we are not just dancing, we are learning. So if we went to watch hula and if they pick up the flowers now we understanding that, oh they are picking up the flowers, they are showing us the flowers and then if they are going up the mountains we would know they are going up to the mountains
- P1:…using hula for health is appropriate, but it still belongs to hālau. You can't take it out of hālau and use it for health.
- P4: Coming once a week and doing it at the end [of the intervention] it was 40 minutes straight [of dancing] so the understanding that you have of the dance and the rhythm and the spirituality of it, just really became more and more clear to me and I found myself dreaming about it at night
- P2: I also really enjoyed the social aspect of it. I'm really introverted and with the number of people in the regular [not Ola Hou] class it can be overwhelming and I feel like I can't get a chance to socialize or get to know people because there's too many people; and so having a smaller group was really nice to get to know more people and I enjoy it more.
- P1: I think that hula and lua both that was originally used for health and so I think it was multi-factored originally and that it was a beautiful thing to do but it was also a healthy thing to do. It was healthy art! It's just fun exercise!
- P1: It's just joyful and fun and it is social too. I just would like to see hula used for health. To me it's not misusing hula to use it to get people healthy

Significant statements

The first step in the analysis process was to identify significant statements. From the three transcribed focus groups, significant statements were identified, also called

horizonalization of the data (Creswell, 2006). Selected significant statements from all three focus groups are presented in Table 3.2.

Themes

After a review to make sure the statements reflected the participants' experience with hula and the intervention, they were organized into clusters of meaning units or themes. Four themes emerged from the significant statements and are presented in Table 3.3.The four themes that emerged from the significant statements were: 1) Hula can facilitate improvements in physical health; 2) participation in hula can improve one's mental health; 3) hula can create social support systems through the formation of relationships; and 4) spirituality and cultural components are important to learning the dance.

Table 3.3

Significant statements clustered into common themes

1. Hula can facilitate improvements in physical health
    - P7: She wants to do hula because she wants to be really strong. She is the oldest among us, but she's great and very strong because of exercising
    - P12: Before she use to sit on the wheelchair yeah and so when she participates in the hula class, just from her lower bottom was hurting a lot before but now her numbness is getting a little bit better because of her moving.
    - P2: I found the hula class to be much more cardiovascular experience ... we are focusing less on technique and more on keeping the movement and definitely I felt that my heart rate was up noticeably much more of the class.
    - P6: You know there's just so many aspects from the hula class that I can apply to my health so there is a relationship.
    - P10: This one, the reason why she wants to join the hula is because of her high blood pressure, so she believes that the blood pressure lowers down because of the way she kept coming to the hula class
2. Participation in hula can improve one's mental health
    - P18: She likes to come because she wants to socialize with her friends and she always feels like boring when she stays home, she also thinks that hula and exercise makes her feel healthy
    - P15: It makes me sweat and sometimes learning gives me a headache but it makes me mentally strong because learning that thing is hard. I practice and I study this.

- P20: I like to continue with the hula dance because when there is problem at home, I face all the problems, but when I go out of the house and into this group it makes me feel relaxed, happy, healthy, and it also makes the blood sugar control by dancing and also a chance to socialize with my other friends.
- P5: So dancing in particular hula, it just brings me a great deal of joy and satisfaction and I look at it as okay that's emotional, mental, and if it adds to physical improvement that's fine too but I come to hula because I love it and I love to dance and all these extra benefits are just the icing on the cake yeah. So these classes are helping my blood pressure, that's cool!

3. Hula can create social support systems through the formation of relationships
    - P27: Yes and just knowing each other now is like rare, we are coming from one family and that's the best thing about the hula, knowing each other.
    - P15: Plus over here [Hawaii] we don't do [things] like back home [Micronesia]. We can go around, we don't worry about anybody to run over us or something but over here it's kind of scary to walk at night and so that's why this is a great opportunity for everybody to come together and work as a group together and learn something especially [like] the hula [dance] and they really enjoy it.
    - P2: I also really enjoyed the social aspect of it. I'm really introverted and with the number of people in the regular class it can be overwhelming and I feel like I can't get a chance to socialize or get to know people because there's too many people and so having a smaller group was really nice to get to know more people and I enjoy it more.
    - P25: She [Kumu Kilohana] is like a mother to us.
4. Spirituality and cultural components are important to learning the dance
    - P1: I think when you start to read Hawaiian history, any student of anthropology or indigenous people in general, once you start to read about people who've been nearly exterminated and you go through understanding that, and you develop a different feeling about people's cultural intellectual property and it makes you want to be more careful with it.
    - P20: I enjoyed learning how [to] dance. The first time I danced hula, I enjoyed learning how to dance hula. The teacher was very nice and she would speak and talk about the song and how expressed the words very strongly.
    - P1: …using hula for health is appropriate, but it still belongs to hālau. You can't take it out of hālau and use it for health.
    - P4: Coming once a week and doing it at the end [of the intervention] it was 40 minutes straight [of dancing] so the understanding that you have of the dance and the rhythm and the spirituality of it, just really became more and more clear to me and I found myself dreaming about it at night
    - P5: I feel honored that I've been ... [able] to share this culture that is not mine but I can share it with other people who then gained appreciate for it

Theme 1: Hula can facilitate improvements in physical health. Participants consistently discussed the physical benefits they received because of their participating in the Ola Hou classes, or hula classes in general. Many of them noted how they physically felt stronger, and were able to move around with more ease than before the class.

> "Cleaning is easier now because they are moving now. Even if they sweep their house and watch TV, if the commercial goes on they can dance. Hula makes them start moving like before [when they were younger]."

Even though the class might have been difficult for new dancers, they recognized that by increasing their activity through the Ola Hou class, everyday activities became easier.

> "Even the short time, we think it's like we're [dancing] for a few hours because we feel tired, even this for 45 minutes to 1 hour we feel tired, but the more we feel tired the more stronger we feel. The doctor can tell their blood pressure is really going down because of their hula exercise."

Another participant mentioned how hula was able to help with symptoms of numbness in her legs.

> "Before she [used] to sit on the wheelchair yeah and so when she participates in the hula class, just from her lower bottom was hurting a lot before but now her numbness is getting a little bit better because of her moving."

Feeling stronger and physically better was mentioned several times by participants as a motivating factor to keep coming to the class.

Another physical aspect the participants experienced were improvements in their blood pressure, blood glucose, and even some weight loss. Again, the physical manifestations as seen by their physicians and the tangible aspect of weight loss was encouraging for participants.

> "For diabetes, every time she finishes hula she goes and checks and diabetes is in [control] and also before she had leg problems like leg pain and she said it also helped with the pain."
>
> "This one, the reason why she wants to join the hula is because of her high blood pressure, so she believes that the blood pressure lowers down because of the way she kept coming to the hula class."

It seemed like as the participants improved in one aspect or another, they were more likely to keep returning to class, which further helped with their health.

> "They said it also helps them lose weight. She said she had big stomach and now stomach is getting smaller. Getting sexy now!"

Overall, the physical improvements from the Ola Hou class were very evident to the dancers, and even though learning the dance might have been difficult, the benefits outweighed the those difficulties.

Theme 2: Participation in hula can improve one's mental health. Many participants expressed that the hula classes were a way for them to relax and focus on something other than their usual daily problems and stressors. It gave them a new place to go.

> "I like to continue with the hula dance because when there is problem at home, I face all the problems, but when I go out of the house and into this group it makes me feel relaxed, happy, healthy, and it also makes the blood sugar [controlled] by dancing and also [gives me] a chance to socialize with my other friends."

Another participant enjoyed the fact that by her participation in the class, that it could help spread and expose hula to other people.

> "The positive aspect is not just me loving hula and getting involved in a program that may be helping take hula to people who need it to lower their blood pressure, [but also] adding it to their lifestyle and making them happier."

The participants noted that the classes weren't easy, but they enjoyed learning a new dance, and learning about the song. "Because we are not just dancing, we are learning." Another participant expressed that if she "doesn't keep coming to the hula, she will not learn anything, especially [since] the movement can help her with her numbness [in her legs]." It seemed like the dancers appreciated being physically as well as mentally challenged and stimulated.

> "It makes me sweat and sometimes learning gives me a headache, but it makes me mentally strong because learning that thing [hula] is hard. I practice and I study this [hula]."

Overall, it was apparent that hula brought happiness and joy to their lives, even if it was only for the duration of the class.

> "... and so with this class I got a chance to know people in a different way and share that way and the whole thing and whole experience gave me a lot of joy and I think that has a lot to do with your health; and you can smile and feel good, I think that influences your health." (P4)

Theme 3: Hula can create social support systems through the formation of relationships. The most salient theme that was expressed was the formation of relationships through the Ola Hou classes. The participants from all the focus groups mentioned that they appreciated the relationships that were created by the Ola Hou classes. It was noted that the classes gave them an opportunity they felt would not have presented itself if it weren't for the class.

> "I also really enjoyed the social aspect of it. I'm really introverted and with the number of people in the regular class it can be overwhelming and I feel like I can't get a chance to socialize or get to know people because there's too many people and so having a smaller group was really nice to get to know more people and I enjoy it more."
>
> "Yes and just knowing each other now is like rare, we are coming from [different families] and that's the best thing about the hula [class], knowing each other."

The participants from one community said that even though some of them were from Micronesia, they were not from the same town and without the class, they would not have met and become friends.

> "That's the good thing about hula [class] also because they [would have] never [known] each other. From this group they [now] know each other and they are happy to participate."

Support between the participants for the dancing as well as the fact that they were all facing health issues, organically facilitated the formation of support groups.

> "Same as the others, but most of all I feel very happy because I [now] have many friends. Wherever I go, if I am in trouble and they are around, I know they can give me support."

Another aspect of the social support was the dancers' connection with the kumu hula. Many of them respected and appreciated their kumu. This rapport with the participants was one of the reasons they continued with the program.

> "She is like a mother to us. She is like a mother to all of us."
>
> "She really likes [the kumu] because she is the best teacher because even if we don't do it right the first time she is very patient and she [isn't] like the other people ... [making a] sad face even if we make a mistake. [Kumu] is not picky, it is like we are working as a family together."

It was apparent that without the good-natured support of the kumu, the dancers would not have been so willing to come to class, which might not have allowed them to make improvements in their health.

Theme 4: Spirituality and cultural components are important to learning the dance.

One of the important aspects of learning hula, includes not just mastering the steps and motions, but the cultural aspect behind the actual dance. Many of the participants appreciated learning about Native Hawaiian culture. It was apparent that even though all of them were not Native Hawaiian, they were still aware of and respectful of the cultural aspects of the dance.

> "I think when you start to read Hawaiian history, any student of anthropology or indigenous people in general, once you start to read about people who've been nearly exterminated and you go through understanding that, and you develop a different feeling about people's cultural intellectual property and it makes you want to be more careful with it."

Other participants acknowledged that they watched hula before, but now have a better understanding of the dance.

> "Because even myself I watch hula so many times I [went] to the PCC (Polynesian Cultural Center) and the other kind but I didn't really think of what they are doing and now we know the [movements like] ocean, we know the birds, the trees, the flowers, picking up the flowers, so we learn a lot [about the] performance of the hula."

Some of the dancers who have been dancing for many years also talked about maintaining the cultural integrity of hula, even when being taught for a health intervention.

> "So because hula addresses the cultural loss and colonization and cultural trauma, it addresses language, history and while doing all of that it also addresses reclaiming cultural identity and doing the whole thing about adding activity in a culturally appropriate way that can be adjusted for every age and activity level in a way that is not losing cultural [aspects] and also in a way that is healthy and fun and can be done anywhere and it doesn't cost money ideally and can be used for free in a way like walking."

The participants agreed that hula isn't the same as other physical activities like running or swimming. To entirely learn to dance involves a hula hālau (hula school) and kumu hula.

"Yeah, I agree using hula for health is appropriate, but it still belongs to hālau. You can't take it out of hālau and use it for health, you can't just have anybody…it's just that it's still part of a hālau."

"Some people just go out and learn a new dance and think they can go and just teach it. I've seen it and it pains me, it really pains me."

Involving a kumu hula and a hālau setting are cultural contexts that can't be removed from learning hula if the dancer wants to be cognizant and respectful of the dance and gain the physical improvements as well.

Textual and structural description

From the statements extracted from the focus group transcriptions, it seems that participants were able to experience improvements in their physical, mental, and spiritual health through the use of hula. Some dancers have been experiencing the benefits of hula for years, while others have only just begun to learn the dance. The physical changes they saw were weight loss, lower blood pressure, lower blood glucose levels, and they felt better about being physically active overall. The physical improvements were possible because participants were more inclined to continue with the hula class, which was attributed to the social relationships that were formed, both with each other and with the kumu hula. Participants were also able to experience learning the dance in a holistic manner. They were able to not only focus on improving their physical health, but their mental and spiritual health as well. Many recognized that they were able to relax and de-stress during and after the classes. In addition, participants understood that in order to fully understand and learn hula, that historical and cultural education of Native Hawaiians was important. They all embraced learning the meaning behind the song and the motions, which allowed them to learn the dance at a deeper level. The combination of all of the aspects of hula, (cultural, spiritual, and physical) created an environment for overall health improvements.

Discussion

The purpose of this study was to ask participants of the Ola Hou program about how they felt about using hula as a PA for a health intervention. From the focus groups, four themes were extracted: 1) Hula can facilitate improvements in physical health, 2) Participation in hula can improve one's mental health, 3) Hula can create social support systems through the formation of relationships, and 4) Spirituality and cultural components are important to learning the dance.

Consistently stated was the improvements seen in their physical health. This ranged from lower blood pressure, lower blood glucose, weight loss, and just being able to move around with greater ease than before the class. However, not only were they seeing physical benefits, they enjoyed dancing hula. Enjoying the activity is an important factor to determine if the person is expected to maintain the activity and eventually develop it into a habit (Baranowski et al., 1997). The fact that hula was fun for the participants helped facilitate retention, which further increased the physical improvements. It created a nice cyclic effect, to keep participants coming back. Dancing hula may have more variety compared to running or walking. It involves more than just the physical; it includes mental and social components that make it fun.

Participants expressed that the Ola Hou classes were able to give them an opportunity to mentally relax and enjoy the time away from their daily stressors. Even though learning the dances wasn't easy, the participants liked being challenged by something new and different. A review of literature reported that PA can enhance mood and can be effective in treating depression (Fox, 1999). The review also found that a person's self-perception could be enhanced through participation in PA. Participants in Ola Hou started to notice physical improvements which could have also lead to self-esteem improvements.

In another qualitative study of Asians and Pacific Islanders living in Hawai‘i, the researchers asked participants with diabetes about their perceptions of PA and diet, and how their culture can affect their ability to engage in a healthy lifestyle (Braginsky, Inouye, Wang, & Arakaki, 2011). Results showed that engaging in an activity was more difficult if they were expected to do so on their own. One of the participants said he preferred to exercise as a group rather than by himself. Hula is an example of an activity that is appropriate with others in a class setting. The participants in the current study seemed to echo this sentiment, commenting on the social aspect as one of the salient reasons they enjoyed the Ola Hou classes and continued their attendance throughout the program.

The Ola Hou intervention for NHPI was well received. Participants all agreed that hula, when used in a culturally respectful manner, could be used as a part of a health intervention. Some did express the caveat of hula being taken out of context could possibly lead to negative experiences and even negative physical effects. Certain aspects of hula need to be kept in order for future programs to produce the same positive results (Look et al., 2014). The class should be taught by a trained kumu hula, and the classes should be taught at a hālau, or in a hālau setting.

In hula, often the songs and dances are place-based and provide a way for the dancer to connect, on multiple levels (mental & spiritual), to the land, people, and its history (Barrere, 1980; Emerson, 1909). While the Chuukese participants were not in their homeland, perhaps they still were seeking a way to connect to their new "homeland" of Hawai'i. This allowed them to fully embrace not only hula as a dance but as a cultural practice. They enjoyed learning the song and dance, but also learning about the history of Hawai'i. The Chuukese were able to connect to their new home and new cultural environment. Culture can be defined in a variety of ways, such as shared beliefs and values of a group, people with shared beliefs and practices, or shared attitudes (Hofstede, 1997). Part of this definition is a shared location and environment. Ola Hou, while not ethnically cultural for the Chuukese participants, was culturally relevant to these people because they now live in Hawai'i, and have assimilated to their new home.

From the results, it's apparent that a hula-based intervention was enjoyable and resonated with participants that were not Native Hawaiian. The various components of hula, when implemented together as a complete package, were appealing to all of the participants. A person does not have to be Native Hawaiian to acquire the benefits of the dance. This raises the issue that an intervention that utilizes hula should not be called "culturally appropriate" because that term assumes that the only population for which the intervention would be effective would be Native Hawaiians, or people living in Hawai'i. This current study suggests that even for the Chuukese participants who have recently immigrated to Hawai'i, appeared to have the same thoughts and feelings about the intervention as previous participants in a similar hula-based intervention (Maskarinec et al., 2014). The parallel findings demonstrate that hula is cross-cultural and can be applied to many different people.

Some of the aspects of hula that seem to translate well to other cultures are story-telling, the passing of knowledge, and the values that are important to the dance. Story-telling is a tradition that is present in many cultures. Hula is a way of telling a story through song and dance. Some of the songs are about love and some tell stories of Hawaiian history. Hula is a way of expressing these stories in dance form. Because this tradition is a part of other cultures, it allows for people from these cultures to connect to hula. Kumu hula can also be seen not only as teachers, but also as the keepers of knowledge that they pass on to their students. They could be considered analogous to elders or chiefs that are responsible for passing the history of their people from one generation to the next. Kumu hula also encourage values like *aloha* (love),

family, and relationships, that resonate well with other cultures. Hula is typically danced with others, which helps to create and foster relationships with other dancers. These relationships are one of the reasons dancers continue to come back and how organic support groups form.

The cross-cultural appeal of hula is due to a variety of factors. When hula is taught by a trained kumu hula and in a halau setting, hula becomes a dance that is appealing and effective for people of all ethnicities and cultures.

Limitations

Even though most of the participants in this intervention were not Native Hawaiian, the culturally-tailored intervention, Ola Hou, was still effective. The cultural aspect of hula was included in this intervention as taught by the respective kumu hula. Both kumu inherently include culture when teaching the dances by educating the dancers about the history of the song, the meaning of the song, and the meaning of the motions they are performing. This study was able to show positive effects of the intervention, however the mechanism by which these effects were created is still unclear.

One limitation of this study was the make-up of the participants. The people that agreed to join in the focus groups were likely to be those who had strong negative or positive feeling about the intervention. There were also a disproportionate number of women versus men. An intervention with dance as the main component could have been more appealing to a female audience. The participants were older middle-aged, however this was expected as the intervention was targeted for adults with hypertension.

Another limitation was the generalizability of the results. The participants were selected from sites that primarily serve NHPI; a local, Caucasian person from Hawai‘i might not feel the same. The findings from this study could help inform future researchers that work with NHPI populations that a hula-based intervention had cultural appeal and participants enjoyed the classes.

Conclusion

The participants of the Ola Hou i ka Hula intervention were able to not only report physical benefits, but mental and spiritual benefits as well. The social aspect of the hula class aided improvements in participants' mental and spiritual health. Hula brought joy and happiness to their lives, and gave them a space to relax and have fun with their friends. The classes were structured to include cultural components to maximize the health outcomes.

Hula, from the participant's perspective, is appropriate as a PA and health intervention. This supported the findings from Study 1 that hula can be a suitable and enjoyable alternative to traditional PA. Therefore, future research should investigate if hula is attractive to other groups, if hula is appropriate as a component to comprehensive lifestyle PA interventions, and if there are more linkages between physical, mental, social, and spiritual as a result from participating in hula.

Chapter 4: An investigation of health-related quality of life and hypertension from a hula-based hypertension control intervention

Abstract

Cardiovascular disease (CVD) is the leading cause of death in the United States, and hypertension is one of the major risk factors for the development of CVD. Chronic diseases can affect a person's overall health-related quality of life (HRQOL). The chronic nature of hypertension can influence HRQOL, despite the fact that hypertension has few symptoms and is often unnoticed or undetected. The purpose of this study was to determine the relationship between HRQOL and hypertension in a Native Hawaiian and Pacific Islander (NHPI) population. Blood pressure and HRQOL were measured at baseline and at the end of a 12-week hypertension management intervention. HRQOL was measured using the SF-12 and subscales and composite scores were calculated. A hierarchical multiple regression analysis was run (n=49) to determine if the addition of change in systolic and diastolic blood pressure improved the prediction of health-related quality of life subscales over and above age, gender, BMI, and ethnicity, and intervention group alone. The full model of age, gender, BMI, ethnicity, intervention group, change in systolic blood pressure and change in diastolic blood pressure was statistically significant for the subscale Social Functioning (SF), R^2=.33, $F(2, 41) = 2.79$, p = .017; adjusted R^2=.21. The current study demonstrated that participation in an intervention with a physical activity component helped lower blood pressure but it was not a predictor of improvements of HRQOL, except for the subscale Social Functioning. A decrease in blood pressure does not appear to have an impact on HRQOL for a primarily female NHPI population.

Introduction

Globally, it is estimated that the prevalence of hypertension in adults is over 40% (Al-Ansary et al., 2013). In the United States (US), it is estimated that one in three American adults has hypertension, defined as a systolic blood pressure greater than 140 mmHg or a diastolic blood pressure greater than 90 mmHg (American Heart Association, 2012). In a longitudinal study of men, it was found that by the age of 65, 37% of participants had developed hypertension over the median follow-up of 46 years (Shihab et al., 2012). This study demonstrated the high incidence of blood pressure over a lifetime. Minorities have a higher prevalence of hypertension in the US, with African Americans reporting to be 1.4 times more likely, and American Indian and Alaskan Native reporting to be 1.3 times more likely than Caucasians to have high blood pressure (Office of Minority Health [OMH], 2012). OMH also reports that Native Hawaiians in Hawai‘i are 1.7 more likely to have hypertension than their Caucasian counterparts (OMH, 2012).

Cardiovascular disease (CVD) is the leading cause of death in the US (Go et al. 2013). The American Heart Association (AHA) outlined behaviors that have been shown to reduce CVD mortality. These include not smoking, being physically active, maintain a normal blood pressure ($\leq$ 120/80 mmHg), having normal blood glucose and cholesterol levels, and eating a healthy diet (Lloyd-Jones et al., 2010). Hypertension is the number one risk factor for CVD. In a study conducted by Yang et al. (2012) the researchers found that the population-attributable fraction for blood pressure greater than 120/80 mmHg for risk of all-cause mortality was 30.4% and for risk of CVD mortality was 40.6%. This study also demonstrated that pre-hypertension was associated with adverse health outcomes (Yang et al., 2012). The AHA recommends changing diet, increasing physical activity, managing stress, maintaining a healthy weight, avoiding smoking, limiting alcohol consumption, and complying with medications as strategies to reduce or control high blood pressure.

The American College of Sports Medicine (ACSM) recommends and advocates for exercise in people with hypertension. Physical activity (PA) has been shown to consistently assist in lowering blood pressure in hypertensive patients when added into their normal routine. A meta-analysis found that regular aerobic training was able to reduce resting blood pressure in both normotensive and hypertensive participants (Pescatello et al., 2004). Another study completed in California (Young, Coleman, Ngor, Reynolds, Sidell, & Sallis, 2014), asked over

600,000 patients in a hospital how much physical activity did they regularly participate during the week. This retrospective study found that both females who were consistently active (>150 minutes per week of moderate to vigorous activity) had lower systolic (-4.60 mmHg) and diastolic (-3.28 mmHg) blood pressure than women who were inactive (0 minutes per week of moderate to vigorous activity). Men who were consistently active had a slightly higher systolic blood pressure (0.98 mmHg) than men who were inactive.

In addition, it was also reported that there is a significant reduction in blood pressure after an acute bout of exercise, termed post exercise hypotension (PEH) by Kenny and Seals (1993). One study demonstrated the effects of PEH in a laboratory setting. The authors found that postexercise systolic and diastolic blood pressure was reduced 15 mmHg and 4 mmHg, respectively, for several hours. This study gave evidence for an exercise session in the morning to assist in reducing blood pressure during the day, when measurements are expected to be highest (Pescatello et al., 2004).

Chronic diseases can affect a person's overall health-related quality of life (HRQOL). HRQOL is defined as a person's overall perceptions about their individual and community environment, and how those perceptions relate to their overall health status (Centers for Disease Control and Prevention [CDC], 2011a). Their total environment can include individual factors like socio-economic status, health risk factors, and social support. At the community level, quality of life can be affected by policies concerning health care, resources, and practices associated with a population's health status (CDC, 2011a). HRQOL commonly is measured through the Medical Outcomes Study Short Forms (SF-12 and SF-36) (Ware & Sherbourne, 1992; Ware, Kosinski, & Keller, 1996), the Sickness Impact Profile (Bergner, Bobbitt, Carter, & Gilson, 1981), and the Quality of Well-Being Scale (Kaplan, Ganiats, Sieber, & Anderson, 1998). HRQOL goes beyond quality of life, and assesses how a person's mental or physical state affects their health (CDC, 2011a). The SF-36 and SF-12 are generic questionnaires that ask about overall health status and how it affects their daily lives. They are not specific questionnaires addressing a particular disease or health status, but rather given to everyone as a way to compare across populations. HRQOL is of interest for physicians and researchers because it gives subjective views into how a disease affects each person. Two people can have the same disease, similar objective measurements, and have completely opposite views about their quality of life.

The chronic nature of hypertension can influence HRQOL, despite the fact that hypertension often is not accompanied by distressing symptoms. Unlike other chronic diseases, like diabetes or chronic obstructive pulmonary disease, hypertension does not present with many physical indications until it results in a severe event, like a stroke (Stein et al., 2002). This compromises the ability of physicians to convince their patients to adhere to lifestyle changes and medication compliance when they do not "see" any adverse health symptoms (Stein et al., 2002). Most studies do not report a difference between a reduction of systolic and diastolic blood pressure and the relationship with HRQOL. However, one study found that an at-home yoga program significantly reduced diastolic blood pressure (4.4 mmHg) and significantly improved self-reported quality of life among yoga participants compared to a control group (Wolff, Sundquist, Lonn, & Midlov, 2013).

In addition, it has been shown by various studies that HRQOL is influenced by physical functioning (Larsson, Karlsson, & Sullivan, 2002; Schrag, Jahanshahi, & Quinn, 2000). The decreased ability of people to conduct certain physical activities, like walking for a sustained amount of time, can lead to a reduced HRQOL. In one study that assessed the HRQOL in people with Parkinson's disease, a disease known for significantly decreasing a person's physical functioning, researchers found that people with the disease reported lower scores in HRQOL when compared to general scores from the population (Schrag et al., 2000). Another study looked at physical activity in older adults, ages 60 – 89 and HRQOL (Acree et al., 2006). Researchers administered the SF-36, and stratified participants into a lower or higher physical activity group based on a self-reported questionnaire. The higher activity group reported higher scores in all eight domains from the SF-36, supporting that participation in physical activity is related to a person's quality of life (Acree et al., 2006).

Various research studies have been conducted to determine the relationship between high blood pressure and HRQOL (Carvalho, Siqueira, Sousa, & Jardim, 2013; Erickson, Williams, & Gruppen, 2004; Maruf, Akinpelu, & Salako, 2013; Stein et al., 2002; Trevisol, Moreira, Kerkhoff, Fuchs, & Fuchs, 2011; Trevisol, Moreria, Fuchs, & Fuchs, 2012). Researchers developed a modified Symptom Distress Checklist (SDC) for participants with hypertension that consisted of a list of 51 symptoms that included items relating to cognitive impairment, weariness, vision problems, moodiness, pain, and sexual dysfunction, to name a few (Erickson, Williams, & Gruppen, 2001). Researchers utilized this checklist to compare hypertensive

participants to normal participants. The study found that hypertensive patients reported more symptoms, such as cognitive changes, headaches, mood changes, and dizziness, and also reported a lower HRQOL than normal participants (Erickson et al., 2001; Erickson et al., 2004). Another study in Brazil found that people with higher blood pressure had lower HRQOL than people with normal blood pressure (Carvalho et al., 2013). Stein et al. (2002) found that there were no differences between people with and without hypertension in HRQOL, which could contribute to the non-compliance of management, such as diet, exercise and medication, of those with the disease. However, it is still unclear as to why some hypertensive patients experience symptoms while others do not. This raises the challenge to educate and encourage asymptomatic and symptomatic people to take action in regards to their blood pressure. Psychosocial variables and other health-related problems could be a reason for poor hypertension control. Lifestyle risk factors for hypertension include stress, sedentary lifestyle, excessive alcohol intake, and a high sodium diet (AHA, 2012).

A previous cross-sectional study compared the HRQOL between people with hypertension and people with other chronic diseases (Maatouk et al., 2012). This study found that people with hypertension scored lower on HRQOL. There has been one meta-analysis that synthesized various studied that looked at HRQOL and hypertension (Trevisol et al., 2011). The authors found that people with hypertension reported a lower HRQOL as measured by the SF-36 when compared to a normal population. In addition, one study found that people who controlled their hypertension through medication, reported a lower HRQOL than those that were not on medication and normotensive individuals (Trevisol et al., 2012).

However, there have not been many studies that included only minority participants, specifically Native Hawaiians and Pacific Islanders (NHPI). Considering that NHPI have a much higher prevalence of hypertension and that hypertension can lead to a reduced HRQOL, an investigation of this relationship in this population is warranted. Thus, the purpose of this study was to determine the relationship between HRQOL and hypertension in an NHPI population. Specifically, the research question for this study was: “Can improvements in hypertension predict improvements in HRQOL as measured by the SF-12?” in NHPI individuals.

Method

Study design

This study was a secondary data analysis of longitudinal data from the "Ola Hou i ka Hula" (Ola Hou) program, conducted at Kula no na Po'e Hawai'i (Kula) and Kokua Kalihi Valley Comprehensive Family Services (KKV).

Community partners

The community partners in this study were Kula and KKV. Kula is a non-profit organization in the Papakolea community that provides health education and services to the people residing in the community. KKV is a federally qualified health center in Kalihi valley that offers comprehensive health services to the Kalihi community. The primary populations of these two sites are Native Hawaiian at Kula, and Pacific Islander (Micronesian, Filipino, and Samoan) at KKV. In addition, both of these sites have participated in previous research with the Department of Native Hawaiian Health (Kaholokula et al., 2012; Kaholokula et al., 2013; Kaholokula et al., 2014; Nacapoy, 2008).

Previous studies

Data were from a study titled Ola Hou i ka Hula, which was a 12-week, randomized control intervention for individuals with hypertension conducted at the two community sites, Kula and KKV. After participants were screened for hypertension, they were randomized to the intervention group or the control group. The control group was instructed to continue their usual care routine. The intervention group received a total of three hours of heart health education and one-hour hula classes, two times a week for 12 weeks. A community health worker delivered the education, which consisted of general information about hypertension, medications, healthy eating, and physical activity (see Table 3.1). A *kumu hula* (hula teacher and expert) taught the hula classes. The intervention and control groups were able to reduce their systolic blood pressure by 20.0 ± 16.4 and 9.9 ± 17.1, respectively. This reduction was a significant change from baseline for both groups, and it was also significantly different between groups ($p = .045$). The intervention and control groups were also able to reduce their diastolic blood pressure by 6.0 ± 8.7 and 4.0 ± 11.3, respectively. This change was significant for the intervention group but not the control group.

Human subjects

Approval from the University of Hawai‘i Committee on Human Subjects was obtained for the original study in 2012. Consent was obtained from all subjects prior to data collection. The University of Hawai‘i Committee on Human Subjects also approved this secondary data analysis.

Participants

Between Kula and KKV, 27 individuals joined the intervention group and 28 individuals joined the control group. Six participants were lost to follow-up, yielding 49 participants in the final analysis. All participants were adults (N=49), and had been cleared by their doctor to participate in a physical activity program. Participants were included in the study if their blood pressure was above 140/90 mmHg or 130/80 mmHg if also diagnosed with diabetes.

Data collection

Measurements consisted of demographic information, blood pressure, and the SF-12. Demographic information was collected at baseline, and blood pressure and SF-12 were collected at baseline and at 12 weeks. The data for this study were collected in 2012 and were entered into an online data program, RedCap, by facilitators from each site. Researchers checked the entered data for entry errors and missing data. The data were exported to SPSS, and was de-identified so researchers did not have any personal information about participants.

Measures

***Demographics*.** The demographic variables collected from the participants were gender, date of birth, self-reported ethnicity, and hypertensive medications. Facilitators also obtained height and weight at each testing session.

Dependent Variables

Medical Outcomes Study 12-item Short Form Health survey. The tool utilized for this study to determine HRQOL participants was the Medical Outcomes Study 12-item Short Form Health Survey (SF-12). It is a shorter version of the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) that has been validated to produce comparable and correlated scores to the SF-36 (Ware, Kosinski, & Keller, 1996). The SF-12 is a 12-item questionnaire administered by various health professionals to assess a person’s general health (Busija et al., 2011). Questions from this survey evaluate the survey taker’s perceptions about aspects of their daily lives and to what degree their mental and physical health limits their ability to carry out

these activities (Ware & Sherbourne, 1992). Researchers have found that the SF-12 can be completed in approximately two minutes by most participants, which is valuable for studies that include many forms to fill out or have a large number of participants (Ware et al., 1996). The SF-12 is also helpful for non-English speaking people that need translation, as the SF-12 is available in more than 50 different languages.

The SF-12 produces eight subscale scores, two aggregate scores – a physical component score (PCS) and a mental component score (MCS), and an overall total score. The scores for each subscale ranges from 0-100, with a higher score indicating better health. To get a total score, questions are weighted, transformed, and calculated to get an overall score ranging from 0-100 (Ware et al., 2002). A recent review found that the reliability of the SF-12 is generally high (Cronbach's alpha $\geq$ 0.75 and 0.82, for PCS and MCS, respectively) and that the test-retest scores were also adequate (r = 0.89 and 0.76 for PCS and MCS scales, respectively) (Busija et al., 2011). The validity of the PCS and MCS scores were also found to be consistent with the SF-36 (Busija et al., 2011). The authors found that the SF-12 was a reliable and valid method to assess HRQOL when conducting a research study, based on the reliability and validity, but cautioned its use in clinical settings where a more thorough evaluation of psychometric is needed to make individual recommendations (Busija et al., 2011). In addition, a study was conducted specifically for participants with hypertension to determine if the SF-12 was a suitable alternative to the SF-36 for this particular population (Cote, Gregoire, Moisan & Chabot, 2004). The researchers found that the SF-12 was a valid alternative to the SF-36 in hypertensive participants. The mean population scores on the SF-12 for the population and for people with hypertension are shown in Table 4.1 (Ware, Kosinski, Turner-Bowker, & Gandek, 2002).

Table 4.1

*SF-12 scores from a hypertension population**

	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Mean	44.23	45.19	46.24	44.57	47.77	47.98	47.33	49.40	43.68	49.11
Standard deviation	10.89	10.72	10.56	9.88	9.55	10.37	11.00	9.54	10.31	9.51
Minimum	22.11	20.32	16.68	18.87	27.62	16.18	11.35	15.77	4.92	8.14
Maximum	56.47	57.18	57.44	61.99	67.88	56.57	56.08	64.54	65.32	73.24

*Mean age of respondents with hypertension was 58.4 years and 61.7% female. From Ware et al., 2002.

The SF-12 forms completed by participants at baseline and at 12 weeks were scored and used to generate eight subscale scores: Physical functioning (PF), role physical (RF), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional, (RE), and mental health (MH). In addition, the PCS and MCS were also aggregated and assessed. Table 4.2 shows all of the scales and describes the meaning of the lowest and highest score in each scale. The results of the SF-12 were used to determine if changes in blood pressure predicted improvements in the eight subscales, PCS, and MCS, which measure HRQOL.

Independent Variables

Blood pressure. Blood pressure was collected at each assessment. Utilizing an automatic blood pressure cuff, participants were asked to sit quietly for 2-5 minutes before facilitators obtained their blood pressure. This helped to reduce the variability in readings for the participant. The sitting position has been widely accepted as the standard position for the participant to maintain during blood pressure reading (Pickering et al., 2005). Facilitators measured blood pressure three times to acquire a mean blood pressure as recommended (American Heart Association, 2005; Glynn, Murphy, Smith, Schroeder, & Fahey, 2010; Pickering et al., 2005) for each participant, with a 2-5 minute rest between each reading. This is the method endorsed by the American Heart Association for clinical trials.

Table 4.2

Summary information about the SF-12 subscales and physical and mental component summary measures

Scale	Lowest possible score	Highest possible score
Physical Functioning (PF)	Very limited in performing all physical activities, including bathing or dressing	Performs all types of physical activities including the most vigorous without limitations due to health
Role Physical (RP)	Problems with work or other daily activities as a result of physical health	No problems with work or other daily activities
Bodily Pain (BP)	Very severe and extremely limiting pain	No pain or limitations due to pain
General Health (GH)	Evaluates personal health as poor and believes it is likely to get worse	Evaluates personal health as excellent
Vitality (VT)	Feels tired and worn out all of the time	Feels full of pep and energy all of the time
Social Functioning (SF)	Extreme and frequent interference with normal social activities due to physical and emotional problems	Performs normal social activities without interference due to physical or emotional problems
Role Emotional (RE)	Problems with work or other daily activities as a result of emotional problems	No problems with work or other daily activities
Mental Health (MH)	Feelings of nervousness and depression all of the time	Feels peaceful, happy, and calm all of the time
Physical Component Summary (PCS)	Limitations in self-care, physical, social, and role activities, severe bodily pain, frequent tiredness, health rated "poor"	No physical limitations, disabilities, or decrements in well-being, high energy level, health rated "excellent"
Mental Component Summary (MCS)	Frequent psychological distress, social and role disability due to emotional problems, health rated "poor"	Frequent positive affect, absence of psychological distress and limitations in usual social/role activities due to emotional problems, health rated "excellent"

*From Ware, 2000

Data analysis

The data was analyzed in SPSS version 19. Baseline demographic data was analyzed for descriptive characteristics of participants. Changes in systolic blood pressure, diastolic blood pressure, eight subscale scores, and two composite summary scores from the SF-12 from baseline to 3-month post-intervention were calculated (score at 12 weeks – score at baseline). The variables were entered into hierarchical regression models to assess if there was a relationship between changes in systolic blood pressure and diastolic blood pressure and changes in scores on the SF-12. The analysis controlled for demographics (age, gender [dummy coded], BMI, and ethnicity [dummy coded]). The addition of intervention group (dummy coded) was added in the second step of the regression model, and change in systolic and diastolic blood pressure was included in the final model. The regression coefficient B, and the standardized beta were examined for significance (a priori set at $p<.05$) and strength of association interpretation.

Results

Descriptive data about the participants are shown in Table 4.3. Participants were mostly female, Native Hawaiian, overweight, and with a starting blood pressure above the range for hypertension. Also shown in Table 4.3 is the mean change in systolic and diastolic blood pressure from pre-intervention to post-intervention.

Table 4.3

Descriptive variables for participants (n=49)

Variable	
Age (mean ± sd)	54.2 ± 11.0
Gender	
Female (%)	41 (83.7)
Male (%)	8 (16.3)
BMI (mean ± sd)	33.9 (12.0)
Starting blood pressure (mmHg)	
Systolic (mean ± sd)	145.8 ± 12.0
Diastolic (mean ± sd)	84.1 ± 11.6
Ethnicity	
Native Hawaiian (%)	27 (55.1)
Micronesian (%)	17 (34.7)
Filipino (%)	2 (4.1)
Caucasian (%)	2 (4.1)
Other (%)	1 (2.0)

Table 4.4 displays the mean baseline, 12 weeks, and the change in SF-12 scores for all participants from baseline to 12 weeks.

Table 4.4

Baseline and 12 weeks SF-12 sub-scales scores (n=49)

Scale	Baseline (mean ± sd)	12 weeks (mean ± sd)	Δ
Physical Functioning (PF)	40.34 (13.65)	41.74 (12.02)	1.40
Role Physical (RP)	38.09 (10.89)	43.07 (9.38)	4.98*
Bodily Pain (BP)	43.72 (9.88)	31.45 (10.41)	-12.27*
General Health (GH)	46.76 (7.96)	46.15 (7.20)	-.62
Vitality (VT)	50.62 (10.27)	46.93 (7.91)	-3.70
Social Functioning (SF)	41.94 (12.21)	43.38 (10.55)	1.44
Role Emotional (RE)	37.71 (15.23)	40.10 (11.81)	2.40
Mental Health (MH)	45.76 (9.38)	42.02 (6.37)	-3.73*
Physical Component Summary (PCS)	42.49 (7.85)	40.84 (5.86)	-1.46
Mental Component Summary (MCS)	44.93 (9.94)	43.95 (7.75)	-.99

*$p < .05$

For the participants, both groups combined, there was a mean reduction in systolic and diastolic blood pressure of 15.04 mmHg and 5.02 mmHg, respectively. Both of these changes were significantly different from baseline ($p < .001$ and $p = .001$).

A hierarchical multiple regression analysis was run to determine if the addition of change in systolic and diastolic blood pressure improved the prediction of health-related quality of life subscales over and above age, gender, BMI, and ethnicity, and intervention group alone. The assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were met for all models. Table 4.5 displays the full details of each

regression model. Separate regression models were run for each subscale and summary scores, for a total of ten models.

Table 4.5

Hierarchical regression analysis summary for changes in blood pressure predicting changes in health-related quality of life (n=49)

Physical functioning						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-3.81		-5.43		-2.78	
Sex	6.73	.22	8.00	.26	7.23	.23
Age	0.05	.05	0.04	.04	0.03	.03
BMI	-0.10	-10	-.10	.14	-0.12	-.13
Ethnicity	2.95	.23	2.91	.23	2.56	.20
Intervention			4.11	.18	4.67	.20
Δ SBP					.03	.04
Δ DBP					.13	.12
R^2	.12		.15		.17	
F	1.49		1.52		1.19	
ΔR^2	.12		.03		.02	
ΔF	1.49		1.55		.47	
Role Physical						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-2.38		-2.43		-4.00	
Sex	1.62	.07	1.66	.07	2.04	.08
Age	0.10	.12	0.10	.12	0.13	.16
BMI	0.01	.02	0.01	.01	-0.00	-.00
Ethnicity	0.72	.07	0.72	.07	0.70	.07
Intervention			0.13	.01	-0.81	-.02
Δ SBP					-0.09	-.16
Δ DBP					0.10	.12
R^2	.03		.03		.05	
F	.30		.24		.29	
ΔR^2	.03		.00		.02	
ΔF	.30		.00		.43	

Table 4.5 (Continued)

Hierarchical regression analysis summary for changes in blood pressure predicting changes in health-related quality of life (n=49)

Bodily pain						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-41.80		-45.58		-41.45	
Sex	3.81	.09	4.42	.10	4.13	.09
Age	.19	.12	.18	.12	0.17	.11
BMI	.26	.18	.25	.18	0.26	.18
Ethnicity	6.22	.34	6.21	.34	6.18	.33
Intervention			2.0	.06	2.28	.07
Δ SBP					0.05	.05
Δ DBP					-0.04	-.28
R^2	.18		.19		.19	
F	2.47		1.98		1.36	
ΔR^2	.18		.00		.00	
ΔF	2.47		.18		.05	
General health						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-1.34		.33		1.79	
Sex	5.38	.25	4.08	.19	3.61	.17
Age	-0.03	-.04	-0.02	-.03	-0.02	-.02
BMI	0.06	.09	0.07	.98	0.04	.06
Ethnicity	-0.29	-.03	-0.25	-.03	-0.58	-.06
Intervention			-4.24	-.26	-4.00	-2.5
Δ SBP					-0.03	-.05
Δ DBP					0.18	2.4
R^2	.07		.37		.18	
F	.82		1.34		1.27	
ΔR^2	.07		.066		.043	
ΔF	.82		3.26		1.07	

Table 4.5 (Continued)

Hierarchical regression analysis summary for changes in blood pressure predicting changes in health-related quality of life (n=49)

Vitality						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-27.82		-28.06		-33.43	
Sex	-3.90	-.10	-3.71	-.09	-2.34	-.06
Age	0.19	.14	0.19	.14	0.27	.20
BMI	0.36	.29	0.36	.29	0.33	.27
Ethnicity	1.35	.08	1.35	.08	1.48	.09
Intervention			0.61	.01	-0.80	-.03
Δ SBP					-0.24	-.28
Δ DBP					0.20	.14
R^2	.12		.13		.18	
F	1.56		1.23		1.24	
ΔR^2	.12		.00		.05	
ΔF	1.56		.02		1.25	
Social functioning						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	9.00		6.25		-3.33	
Sex	-3.02	-.10	-0.89	-.03	1.67	.06
Age	-0.09	-.09	-0.10	-.10	-0.00	-.00
BMI	0.02	.02	0.01	.01	0.01	.01
Ethnicity	-1.76	-.15	-1.82	-.15	-1.26	-.11
Intervention			6.94	.32	4.58	.21
Δ SBP					-0.32	-.51
Δ DBP					0.09	.09
R^2	.04		.14		.33	
F	.50		1.41		2.82**	
ΔR^2	.04		.10*		.18	
ΔF	.50		4.88		5.57***	

Table 4.5 (Continued)

Hierarchical regression analysis summary for changes in blood pressure predicting changes in health-related quality of life (n=49)

Role emotional						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	-13.80		-14.66		-16.02	
Sex	2.68	.07	3.35	.09	3.83	.11
Age	0.19	.15	0.19	.15	0.17	.14
BMI	0.17	.15	0.17	.15	0.20	.18
Ethnicity	-0.22	-.02	-0.24	-.02	0.17	.01
Intervention			2.17	.08	2.00	.07
Δ SBP					0.06	.07
Δ DBP					-0.25	-.20
R^2	.05		.051		.079	
F	.52		.46		.50	
ΔR^2	.05		.006		.028	
ΔF	.52		.28		.63	
Mental health						
	Model 1		Model 2		Model 3	
Variable	B	*β*	B	*β*	B	*β*
Constant	5.02		4.43		6.05	
Sex	3.35	.13	3.82	.15	3.36	.13
Age	-0.19	-.22	-0.19	-.22	-.020	-.23
BMI	0.01	.01	0.10	.01	0.00	.00
Ethnicity	0.41	.04	0.40	.04	0.24	.02
Intervention			1.51	.08	1.87	.20
Δ SBP					0.03	.06
Δ DBP					0.04	.04
R^2	.07		.07		.08	
F	.77		.66		.50	
ΔR^2	.07		.01		.01	
ΔF	.77		.27		.15	

Table 4.5 (Continued)

Hierarchical regression analysis summary for changes in blood pressure predicting changes in health-related quality of life (n=49)

Physical Component Score						
	Model 1		Model 2		Model 3	
Variable	B	*ß*	B	*ß*	B	*ß*
Constant	-15.38		-15.61		-14.49	
Sex	4.63	.22	4.81	.23	4.44	.21
Age	0.12	.17	0.12	.17	0.13	.18
BMI	0.03	.05	0.03	.05	0.01	.02
Ethnicity	3.41	.40	3.41	.39	3.12	.36
Intervention			0.58	.04	0.74	.05
Δ SBP					-0.03	-.07
Δ DBP					0.17	.23
R^2	.26		.26		.30	
F	3.78*^		2.97*^^		2.46**^	
ΔR^2	.26		.00		.04	
ΔF	3.78*^		.08		1.14	
Mental Component Score						
	Model 1		Model 2		Model 3	
Variable	B	*ß*	B	*ß*	B	*ß*
Constant	-2.42		-3.45		-7.64	
Sex	-1.14	-.05	-0.34	-.01	0.82	.034
Age	-0.03	-.04	-0.03	-.04	-0.00	-.00
BMI	0.16	.22	0.16	.21	0.17	.23
Ethnicity	-1.42	-.14	-1.44	-.15	-1.07	-.11
Intervention			2.60	.15	1.63	.09
Δ SBP					-0.10	-.20
Δ DBP					-0.06	-.07
R^2	.07		.09		.14	
F	.83		.85		.94	
ΔR^2	.07		.02		.05	
ΔF	.83		.96		1.15	

* p=.033; **p=.017, ***p=.007; *^p=.010; *^^p=.022; **^p=.033

The full model of age, gender, BMI, ethnicity, intervention group, change in systolic blood pressure and change in diastolic blood pressure was statistically significant for the subscale Social Functioning (SF), R^2=.33, $F(2, 41) = 2.79$, $p = .017$; adjusted R^2=.21. The addition of change in systolic blood pressure and change in diastolic blood pressure to predict improvements in SF subscale scores led to a statistically significant increase in R^2 of .18, F(2,

41) = 2.82, p = .03. The full model was also significant for the Physical Component Summary score (PCS), R^2=.30, $F(2, 41) = 2.46$, p =.03; adjusted R^2=.18. The addition of change in systolic blood pressure and change in diastolic blood pressure to predict improvements in PCS did not lead to a significant increase in R^2 but the full model was still statistically significant. None of the other models demonstrated significant results. Due to multiple analyses, a Bonferroni correction ($p < .05/10 = p < .005$) was considered. This would change both of the significant the results to non-significant, so for comprehensiveness and to potentially inform further hypotheses the results presented as significant at $p < .05$.

Discussion

The purpose of this study was to determine if a change in systolic and diastolic blood pressure would predict changes on the SF-12 subscales and composite scores. The results of this study indicated that although there was a significant decrease in systolic blood pressure and diastolic blood pressure, this did not affect most of the subscales from the SF-12. The only subscale that was affected by a change in systolic and diastolic blood pressure was Social Functioning. The addition of change in systolic and diastolic blood pressure significantly increased the amount of variance predicted for Social Functioning. The highest score for social functioning indicates that the person experiences little to no social limitations due to physical or emotional complications. In our study, perhaps with a reduction in blood pressure, the participants felt better so they were able to engage in more social activities without worrying about their health.

The Physical Component Score (PCS) also demonstrated significant variance predicted in the final model, however there was not a significant increase in the amount of variance when change in systolic and change in diastolic blood pressure was added to the model. For this study, the mechanism by which intervention participants reduced their blood pressure was through a physical activity and education program. The physical activity for this program was culturally appropriate for the population, which was thought to resonate with participants and increase retention to the program. Participants in the intervention achieved a significant reduction in their systolic and diastolic blood pressure. The participants in the control group were asked to continue their normal lifestyles, but were still able to achieve a significant decrease in their systolic and diastolic blood pressure. Researchers attributed this change to “contamination”

among the communities. Each person within each community is very close with each other, so perhaps some of the hypertension education spread to the control group.

The current study demonstrated that participation in an intervention with a physical activity component helped lower blood pressure but it was not a predictor of improvements of HRQOL, except for the subscale Social Functioning. This finding is in alignment with the results from Chapter 3. The participants in that study expressed that one of the benefits from participation in a hula-based intervention was the social support that they felt from the other participants. This could have an effect on their HRQOL, and in particular, the subscale of Social Functioning. While there were few improvements in HRQOL measures with improvements of blood pressure, the addition of a physical activity into their lives did not appear to reduce their quality of life. An additional commitment can sometimes be perceived as another burden or present as an inconvenience. The asymptomatic nature of hypertension appears to make improving quality of life difficult, as there are few symptoms, if any, which are present. Perhaps knowledge of their disease and the adverse effects and outcomes lowered their perception of quality of life even though they were able to decrease their blood pressure. Future research could also collect data on symptoms so that analyses can control for the presence, or lack of symptoms.

A previous study found that physical activity is associated with higher levels of HRQOL in hypertensive individuals (Cuevas Fernandez, Marco Garcia, Rodriguez Alvarez, Iglesias Giron, & Aguirre-Jaime, 2006). Fernandez et al. (2006) demonstrated that the people who participated in regular physical activity as instructed by their physician, had higher quality of life scores. The fact that our study could only predict improvements in one SF-12 subscale could be due to the short duration of the intervention. The time span between SF-12 administrations was 12 weeks, which could be too short of a time to elicit quality of life improvements. Perhaps a longer program or adding in a long-term follow-up could have showed a larger improvement in HRQOL scores.

Another consideration could be the low starting SF-12 scores in the study population. Comparing the values from Table 4.1 and Table. 4.4, the mean participant scores on the eight subscales and the two composite scores at the 12-week follow up, only General Health had a higher score than the population mean. A lower starting score leaves more room for improvement, but it could also indicate that the population needed a more comprehensive

intervention that addressed the mental ramifications of HRQOL as well as the physical aspects of hypertension.

The main limitation of this study was the sample size. The number of completed participants was 49, which limits the generalizability of the results to the population. The ethnicity of the participants was also primarily NHPI, which further limits the generalizability. Kula had a large population of Native Hawaiians, while KKV had a large population of Micronesian and Filipino participants. However, the design of the study was to investigate the relationship between HRQOL and hypertension in a NHPI population. Another limitation was the unequal distribution of gender in this study. There were very few males that enrolled in the program. This could be due to the nature of the modern reputation of hula as a more feminine type of dancing. The program could have been more appealing to women compared to men, which caused an unequal enrollment.

Conclusion

A decrease in hypertension does not appear to have an impact on HRQOL for a primarily female NHPI population. The significant reductions in blood pressure most likely did not affect HRQOL because of the asymptomatic nature of the disease. Also, changes in quality of life might not be present after only 12 weeks.

Future research should measure participant symptoms at baseline to determine if quality of life improves more in participants with symptoms than those without. The relationship between NHPI with hypertension and HRQOL should continue to be investigated. This could help inform future programs on which aspects of the disease should be targeted (i.e., diet or physical activity) to elicit improvements in both HRQOL and their blood pressure.

Chapter 5: Conclusion

This dissertation sought to investigate if hula, the indigenous dance of Native Hawaiians, could be used as a culturally appropriate physical activity in health interventions. The three-part dissertation explored three research questions. The first research question aimed to evaluate previously collected data from elite hula dancers to establish additional physiological variables of physical activity in hula. This study's objective was to quantify hula as a moderate or vigorous intensity physical activity as defined by the CDC and ACSM. The second study asked participants of a hula-based intervention about their experience with it as a form of physical activity in reducing hypertension. The focus groups from this study explored their thoughts about the experience of being in a hula class that was specifically designed to elicit improvements in health, rather than create competitive dancers. The third and last study looked at if an intervention that demonstrated improvements in hypertension in a Native Hawaiian and Pacific Islander (NHPI) population could also predict changes in HRQOL. The intervention group in this study used hula as their primary physical activity to manage their hypertension.

Summary of findings

Chapter two evaluated data from a previous study (Usagawa et al., 2014) that calculated the metabolic equivalents (MET) of low and high intensity hula and sought to further establish the different forms of hula, and intensities as moderate or vigorous intensity activity. The mean values were calculated for the variables, oxygen consumption (VO_2), heart rate (HR), percentage of heart rate maximum ($\%HR_{max}$), and caloric expenditure (CAL) were compared to the established values as shown in Table 2.3. Results showed that the values, HR, $\%HR_{max}$, and CAL were within the ranges for moderate and vigorous activity when stratified into low and high intensity dances, respectively. Oxygen consumption, or VO_2, did not meet the ranges from Table 2.3, but when converted to METs (by dividing by a factor of 3.5), the values were within the ranges for moderate and vigorous intensity. In addition, the different forms of hula, ʻauana and kahiko, were also compared by intensities. There were differences between low and high intensity for both ʻauana and kahiko. Gender differences were also compared by intensity and by form. There were significant differences between male and females between the intensities, and between the forms of hula. All of the analyses revealed difference between intensities, form, and genders. This study concluded that hula is a viable form of moderate and vigorous intensity activity, and can be scaled to adjust for participant fitness and/or dance experience.

Chapter three focused on the thoughts and experiences of participants from the hula-based hypertension program called Ola Hou i ka Hula (Ola Hou). Three focus groups were conducted with participants from Kokua Kalihi Valley Comprehensive Family Services (KKV) and Hālau Mohala ʻIlima (HMI). From the responses, four themes emerged: 1) Hula can facilitate improvements in physical health, 2) Participation in hula can improve one's mental health, 3) Hula can create social support systems through the formation of relationships, and 4) Spirituality and cultural components are important to learning the dance. Overall, participants felt that hula presented as an appropriate physical activity for a health intervention, and they felt as long as cultural components were kept when teaching, it could be effective as an alternative to traditional exercise.

The main purpose of Chapter four was to evaluate if improvements in systolic and diastolic blood pressure also improved the health-related quality of life (HRQOL) of NHPI that participated in Ola Hou. Ola Hou was a 12-week, randomized control intervention. Participants in the intervention group attended hula classes, for one hour, twice a week, for 12 weeks. At the end of the intervention, participants in both the control group and intervention group were able to significantly reduce their systolic and diastolic blood pressure after the intervention. However, a significant reduction in blood pressure was only able to predict improvements in one subscale from the SF-12, Social Functioning. This study demonstrated that significant changes in HRQOL as measured by the SF-12 could not be predicted by improvements in systolic and diastolic blood pressure. There was no long-term follow-up after the intervention, which could be a reason HRQOL changes were not found; perhaps 12 weeks is not long enough.

Recommendations

Future research. The main findings from all three chapters indicated that hula is a valid form of physical activity and that it is able to meet the CDC and ACSM requirement for both moderate and vigorous intensity physical activity. When implemented in a health intervention, hula appears to be able to elicit physical improvements for participants. More research should be done to determine if hula could be used for different health conditions such as diabetes or obesity, and should be conducted with different populations. The main populations that were tested in this dissertation were NHPI, and all interventions were conducted in Hawaiʻi. This limits the generalizability of the results, so additional research with a larger sample size and various populations are needed. In addition, the population evaluated for chapter two included

only elite dancers who were all from the same hālau. Future research should look at the differences between elite and novice dancers to determine if dance experience affects the level of exertion that can be reached while preforming hula.

Future directions from chapter 3 will be to generalize the qualitative findings to other populations. The main ethnicity of the focus group participants was Chuukese. Additional groups or interviews should be conducted with Native Hawaiians, Japanese, and Caucasians, as these are the prevalent ethnicities in Hawai‘i. With more data gathered from various populations, this will help to generalize the findings, and perhaps a theory can be developed to explain the phenomenon of how hula can improve health outcomes. As the cultural component of the dance was included in the intervention, which aspect of the intervention that produced the health improvements is still unclear, and further research should be done to evaluate the various parts (physical dancing, culture, health education). Future research could focus on determining which of these components is most important or if comprehensive package is necessary.

Chapter four demonstrated that even with a significant improvement in blood pressure, it could not predict improvements in HRQOL. This study suggests that perhaps HRQOL is not a good outcome measure for physical activity studies with a NHPI sample. The SF-12 has been normalized for a variety of populations (Ware et al., 2002), but it hasn’t been tested on a NHPI population for validity and reliability. This could be a next area of research for NHPI. Finding a HRQOL survey that is sensitive and representative for this population could help evaluate future interventions more effectively. Also, the duration of the program might have been long enough to elicit physical or clinical changes, but not subjective quality of life changes. Perhaps a longer follow-up was needed to determine if quality of life improved after the intervention. Future research should focus on a longer follow-up for PA studies when utilizing HRQOL as an outcome.

Overall, the use of hula, regardless of form or gender of participant, was able to reach levels of moderate and vigorous physical activity and was shown to be a culturally appropriate PA for a health intervention, regardless of ethnicity of the participant. Future research will need to be done to validate the findings of this dissertation to make the results more applicable to the general population.

Conclusion

The dissertation chapter conclusions demonstrated that hula, the indigenous dance of Native Hawaiians, can be implemented as a legitimate form of physical activity for health interventions as shown both quantitatively from several indicators and qualitatively from program participants. Chapter two was able to measure and quantify the different forms of hula, ʻauana and kahiko, and intensities, low and high, as moderate and vigorous physical activity. The findings from this chapter validated the use of hula in Ola Hou as the main physical activity for participants to control their high blood pressure. However, the last study was unable to conclude if changes in blood pressure could predict improvements in HRQOL.

Appendix I: Informed consent form

Agreement to participate in interview session for:
Ola Hou I Ka Hula program: Focus groups and interviews

Student researcher: Tricia Usagawa, MS
Office of Public Health Studies, University of Hawai‘i
John A. Burns School of Medicine

This interview session is being conducted as part of an effort to collect information about your experiences in the Ola Hou I Ka Hula classes. You are being asked to participate because you are an individual who has completed the Ola Hou I Ka Hula progam.

The focus group session will last approximately 90 minutes. We will audiotape the session with you at a time and place agreed upon. The information gathered will help us to understand the effectiveness of the Ola Hou I Ka Hula study. If the results of our study are published, your name or any other identifiable information will not be included so that your participation and data are confidential.

Your participation in this focus group is completely voluntary and you may withdraw from participation at any time. You may elect not to answer any question(s) at any time for any reason. The focus group will be informal and conversational and will focus on your recollections of your recovery and experiences during the Ola Hou I Ka Hula intervention. Following the focus group, the tapes will be transcribed and reviewed by researchers. At the completion of the project, the tapes will be erased.

The information you share with us will be confidential. We will not use your name. We will assign a study number to any of the information gathered about you at this session. Your name will not be used in any publication about the study. Taking part in research may involve a loss of privacy; however, your information will be handled as confidential as possible. The focus group may bring back painful or unpleasant memories. We will instruct all participating in the focus group to keep all answers confidential. You may elect not to answer any question(s) at any time for any reason. There will be no direct benefit to you for your participation in this project.

“I certify that I have read and that I understand the foregoing, that I have been given satisfactory answers to my inquiries concerning project procedures and other matters and that I have been advised that I am free to withdraw my consent and to discontinue participation in the project at any time without prejudice. I herewith give my consent to participate in this project with the understanding that such consent does not waive any of my legal rights, nor does it release the Principal Investigator or the institution or any employee or agent thereof from liability for negligence.”

_____ _____
Signature of Participant Date

Please contact student researcher Tricia Usagawa, MS (808) 692-1043 or Investigator Claudio Nigg (808) 956-2862 if you have any questions regarding this research.

If you cannot obtain satisfactory answers to your questions or have comments or complaints about your treatment in this evaluation, contact: Committee on Human Studies, University of Hawai‘i, 1960 East-West Rd., Biomedical Bldg, B-104, Honolulu, HI 96822. Telephone: (808) 956-5007.

Appendix II: Focus group guide

Ola Hou I ka Hula Focus Group Guide

- **Introduction:**
  - The welcome.
    - The Moderator introduces self and her role in the group today. Each of the remaining staff follows the same format, highlighting role with project (e.g., student interested in learning how to conduct focus groups) and role during the group (e.g., note taker).
    - "We will have each of you introduce yourself after we cover the informed consent, which is our way of telling you why we're running this group and getting your permission to participate."
  - The informed consent.
    - Moderator passes out consent forms and pens to all participants.
    - Moderator highlights consent form content.
      - Who is sponsoring/behind the group: "All of us here (name helpers) are students from the University of Hawaii. They are here to help me with my dissertation project."
      - Number of groups conducted: "This is the first of two groups I'll be running."
      - Length of time: "Today, we will be meeting for about 1½ hours. That will give us plenty of time to meet our purpose, which is …
      - Purpose of the group: "… to get a better understanding about your opinions and experiences as a participant in the Ola Hou intervention."
      - Recording: "We will be recording the group today in three ways – using a digital recorder, taking notes, and on a flip chart. We want to make sure we get down everything you say because your opinions and experiences are important."
      - Anonymity: "One of the things I'm going to be doing is analyzing what is said in this group for my dissertation. I would like to use some of your direct quotes in this report. Your name will not be put together with what you say. I want to use your words exactly, because your words have power and you can describe your experience much better than me."
      - Why the participants were selected: "You were selected to participate because you all were participants in the Ola Hou intervention."
      - Benefits and Risks: "We know you might not directly benefit from participating in the group. We hope you get something from talking with us and other participants. BTW, if any of our questions make you

feel uncomfortable, you don't have to answer. You can take a break or stop participating at any point."

- Voluntary participation: "No matter how much you talk today or what you say, it will not affect the services you and your child receive here at Papakolea or KKV."
- Last instruction: "Please check the top box to give us permission to record the group, and then write your name, sign, and date."

- Assistant moderator collects informed consents and pens, and puts them all in a yellow envelope and seals it.

- The overview of the topic.
  - "Welcome again and thank you for being here today."
  - Mention briefly the topic. "Today, we will be discussing your experiences and opinions about the Ola Hou intervention. There are no right and no wrong answers. Some of you might disagree with each other. That's okay! Please feel free to share your point of view even if it differs from what others say."
- The ground rules.
  - Describe the ground rules: "So that we're all on the same page, here are some ground rules for our group:
    - Please speak up so we can hear you – only one person should talk at a time.
    - We will be on a first name basis, and later on in our reports, no names will be attached to comments made in here. Remember, everything you say is confidential.
    - To make sure everyone feels comfortable to share, we encourage everyone to follow this - 'What's said in here, stays in here.'
    - Keep in mind that we are just as interested in hearing your negative comments as well as your positive comments. We encourage you to tell it like it is - honesty counts!"

- **Opening question:**
  - "Let's begin by finding out some more about each other. Let's go around the room, one at a time. Tell us your name, and your favorite physical activity you like to do."

- **Key questions:**
  - Tell me about your experience being in the class.
    - Probe for relationship with other participants
    - Probe for relationship with kumu hula
  - What do you think about using hula as the exercise for a health intervention?

- What do you think about the heart health education?
- In what ways do you think each component helped you with your hypertension?
- What were the most challenging parts of being in the class?
- What was different about Ola Hou compared to any other hypertension classes you may have participated in?
- What recommendations do you have for future classes?

Appendix III: Ola Hou participant information form

Ola Hou i ka Hula

Participant Information Form

Please **check** the correct response or **fill in the blank** to the following questions:

1. What is your sex?
   ☐ Male ☐ Female

2. What is your date of birth? _____

3. Of your ethnic ancestries, which ethnic group do most identify with? (check the one you most identify with)
   1 ☐ Native Hawaiian
   2 ☐ Samoan
   3 ☐ Filipino
   4 ☐ Japanese
   5 ☐ Chinese
   6 ☐ Chuukese
   7 ☐ Caucasian
   8 ☐ Hispanic
   9 ☐ Other ethnic group _____
   (Specify)

4. Have you danced hula before?
   ☐ Yes ☐ No

5. If yes, how many years? _____

6. Please indicate any of the following: (check all that apply)
   ☐ heart attack ☐ heart failure
   ☐ high cholesterol

7. Do you have any other medical conditions?
   ☐ Diabetes
   ☐ Other, please list _____

8. Have you been prescribed medications for hypertension by your doctor? _____

   ☐ Yes ☐ No If yes, how many?_____

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