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Holistic Health and Hawaii's Renewable Energy Future

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This is to certify that the doctoral dissertation by

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Abstract

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Abstract

Collective efficacy, time urgency, and health literacy have been a focus of research since the 1970s. Researchers have demonstrated that these factors influence health and decision making. However, researchers have yet to establish how these factors may be connected to the achievement of policy aims that impact holistic or environmental health. This study utilized the health belief model, social cognitive theory, time urgency theory, health education and promotion theory, Bronfenbrenner's ecological systems theory, and the Meikirch model. The purpose of this quantitative study was to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level are associated with the perception of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045, referred to as REHI45. A sample of 136 residents of North Hawaii County completed a survey to measure these factors. A multiple linear regression analysis was run to test relationships among the variables. Results revealed that collective efficacy, perceived time urgency, and perceived health literacy were significantly associated with the perceived likelihood of REHI45. These findings may inform the design of intervention programs and/or preventative measures to promote overall long-term health and positive social change in North Hawaii County. Individuals, organizations, institutions, cultures, and societies may benefit from the results of this study through its ability to raise awareness of factors that influence the perceived likelihood of achieving REHI45.

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Dedication

This dissertation is dedicated to my beloved Dana Moody whose inspiration, love, and support made this all possible. Thank you, my love! And, to Hawaii Island, the place I call home.

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Chapter 1: Introduction to the Study

Introduction

Planetary health is the health of humanity and the natural systems humanity depends on for life (Whitmee et al., 2015). Ecosystems, climate, land, water, and natural resources have been negatively affected by the use of fossil fuel energy systems (Blunden & Arndt, 2017; David & Watts, 2016: Lancet, 2017; Watts et al., 2015). A holistic or integrated approach to human and planetary health necessitates the implementation of renewable energy systems for overall well-being. This integrated approach will allow for the shift to renewable energy to impact health positively. Renewable energy has been shown to reduce CO_2 emissions and therefore decrease air pollution (Haines, Kovats, Campbell-Lendrum, & Corvalan, 2006). According to Jacobson, Colella, and Golden (2005), the use of renewable energy sources, including wind power, might save up to 6,400 lives per year in the United States from the reduction of air pollution.

According to Landrigan et al. (2017) in the Lancet Commission on Pollution and Health, pollution has been determined to be the largest environmental cause of disease and premature death globally. An estimated 9 million premature deaths in 2015 (16% of all deaths globally) stemmed from diseases caused by pollution (Landrigan et al., 2017). Unhealthy and unsustainable development, including the use of fossil fuel energy sources, leads to pollution (Neira, Pfeiffer, Campbell, & Pruss, 2017). The establishment of targets and timetables for healthy development, including the shift to renewable energy sources, are needed to ensure healthier environmental and social conditions worldwide (Dora et al., 2015; Landrigan et al., 2018; Neira et al., 2017). The continued use of fossil

fuel energy sources impacts health negatively globally and in particularly vulnerable locations such as the Pacific Islands (Hansen et al, 2016; Landrigan et al, 2018; Neira et al., 2017).

Hong, Abe, Barclay, and Arciaga (2015) have called for further research to determine internal and external factors that contribute to the capacity and willingness to adopt renewable energy systems. Additionally, psychology research has been limited in the assessment of various populations regarding constructs related to environmental health, which may impact individual health (Bircher & Kuruvilla, 2014; Freedman, Pitner, Powers, & Anderson, 2014; Hoover, Renauld, Edelstein, & Brown, 2015; Wickens, Wiesenthal, & Roseborough, 2015). Collective efficacy, perceived time urgency, and health literacy are deemed to be such constructs. Determining the factors associated with the perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045, referred to as REHI45, is aligned with this thinking. For the purposes of this dissertation, the Hawaiian language ‘okina or glottal stop has been omitted from Hawai‘i, therefore Hawai‘i is simply referenced as Hawaii. In the current study perceived time urgency, collective efficacy, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level were measured to determine North Hawaii County residents’ perceived likelihood of achieving REHI45. Intervention programs and/or preventive measures might possibly be designed based on the research findings to promote overall long-term health in North Hawaii County.

This chapter begins with a background of the problem, including an explanation of how certain selected articles connect the research topic with holistic health and Hawaii's renewable energy future. Further discussion focuses on a description of the research problem and the purpose of the study. The research questions and hypotheses are stated together with the variables, and the study's theoretical foundations, assumptions, scope, and limitations are described. Key terms are defined, and the significance of the study is addressed.

Background

There appears to be a scientific consensus that human activity, including the use of fossil fuel energy, contributes to climate change (Hansen et al., 2016; Luderer et al., 2014; Smith et al., 2013). The state of Hawaii has responded with a legislative mandate for 100% renewable energy statewide by the year 2045 (University of Hawaii, 2015). Louis and Hess (2008) proposed a collaborative learning initiative in this area that included increasing awareness, strengthening the evidence base, and the incorporation of climate change mitigation and adaptation measures in the design of global health programs. The current study aligns with this initiative.

Selected articles connecting the research topic with holistic health and Hawaii's renewable energy future are briefly touched on here. Detailed reviews of the research follow in Chapter 2. DeVellis (2012) discussed how survey research serves to measure the data that society deemed important. The discussion helped shape the argument that what gets measured is applied in a constructive way to serve local and global public health holistically. Green and Salkind (2014) discussed how a multivariate analysis

allows for the examination of multiple factors that may influence a given outcome, and their work provided a basis for the psychometrics and statistical analysis for my cross-sectional quantitative study. Haines and Patz (2004), Luderer et al. (2014), Smith et al. (2013), and Stern (2011) provided evidence on climate change and the need to transition as quickly as possible from a fossil fuel culture to a renewable energy culture for the health of the planet and humankind. The recently published report by Hansen et al. (2016), which included 19 international climate scientists, provided the negative health consequences of continued fossil fuels use and dependence both globally and in locations such as Hawaii Island.

Harkin et al. (2015) found in a meta-analysis of primarily health outcome studies that goal monitoring promotes goal attainment. In the case of REHI45, perhaps an increased potential for a positive health outcome may follow from the present research study. A report from Hawaii Electric Light Company (2016) confirmed the current state of affairs in regard to fossil fuel dependence in Hawaii County and the planned projected timeframe to transition to 100% renewable energy. Keim (2008) elucidated the dangers that global climate change events pose to public health through excess morbidity and mortality, and discussed public vulnerability through a complex interplay of health, economic, social, and cultural factors that apply to Hawaii County. The 2017 hurricanes in the Commonwealth of Puerto Rico and the U.S. states of Florida and Texas confirm the dangers outlined by Keim (2008) to locations such as Hawaii Island (Hawaii County). According to Dora et al. (2017), the establishment of health-related goal monitoring with renewable energy targets can benefit global and local health and raise resilience.

Innovative methods and analysis are needed to implement this approach (Dora et al., 2017).

The island of Puerto Rico, akin to Hawaii Island, has depended on the use of fossil fuel in the form of petroleum to generate most of its electricity. After Puerto Rico lost 100% of its electricity to Hurricane Maria in 2017, the Governor of the island is considering rebuilding their power grid with 100% solar, which has been done on many islands (CNBC, 2017). Converting from fossil fuel dependence to a 100% renewable solar energy grid that can withstand a Category 5 hurricane has been done recently on the island of Ta'u in the Pacific Ocean (National Geographic, 2017). The shift for Ta'u to 100% renewable energy can be considered health prevention and health promotion. A change from polluting fossil fuel energy to clean renewable energy promotes health by reducing damage to ecosystems and the environment upon which humans depend on for well-being (Dora et al., 2017).

Marks et al. (2011) provided theoretical framework information on how proactive behaviors have been linked to beliefs, such as in self-efficacy and a balanced locus of control that have been connected to positive health outcomes. The current research posits the same link through an examination of factors, such as collective efficacy, in the target population of North Hawaii County. Rockefeller Foundation–Lancet (2014) claimed that a decrease of psychological, social, physiological, and/or economic health locally has implications globally. A shift from the current global fossil fuel culture to a renewable energy culture would benefit environmental health and human health. In this research

study I aimed to elucidate factors in the target population that can be utilized to help achieve the positive health outcome of REHI45.

Wallston (2005a, 2005b) discussed the validity of the Multidimensional Health Locus of Control (MHLC) Scales and psychometrics of the MHLC that related to the research study as a key predictor of health behavior change. The Brief Health Literacy Screen (BHLS) had been validated in research settings, yet it was only recently that Wallston et al. (2014) showed that the measure demonstrated adequate reliability and validity to be used in clinical settings as a health literacy measure. The BHLS relies on self-report and therefore measures subjective or perceived health literacy. The BHLS was implemented in this survey research study to determine whether or not perceived health literacy was a factor in the target population's perceived likelihood of REHI45.

In addition to perceived health literacy (PHL), the concept or construct of environmental health literacy (EHL) is discussed in Chapter 2. There are proven measures for health literacy; however, according to Finn and O'Fallon (2017), there is a need for a standard measure of EHL. In this research study I measured perceived health literacy as a possible precursor to environmental health literacy as it pertained to the local North Hawaii population. Without basic health literacy, future interventions and education regarding environmental health literacy may be difficult. Perceived health literacy factored into the perceived likelihood of REHI45 and could possibly provide the basis for interventions and education that address health literacy and environmental health literacy in the target population.

Problem Statement

On Hawaii Island, a problem exists in that continued fossil fuel use and dependence, including issues related to climate change, pose negative health consequences (Hansen et al., 2016), yet Hawaii Island is dependent on fossil fuel energy (Hawaii Electric Light Company**,** 2016). Culture has been defined as peoples learned and shared behavior and beliefs (Miller, 2009). In the context of fossil fuel, a fossil fuel culture refers to the widespread support for nonrenewable sources of energy, such as oil, coal, and natural gas. Renewable energy culture refers to the widespread support for renewable sources of energy, such as wind, solar, hydropower, and geothermal energy. A shift from the current global fossil fuel culture to a renewable energy culture will benefit environmental health and human health (Blunden & Arndt, 2017; David & Watts, 2016: Frumkin & McMichael, 2008; Hoffman, 2012; Rockefeller Foundation–Lancet, 2014; Tubbs, 2005).

The state of Hawaii has mandated the goal of 100% renewable energy statewide by the year 2045 (State of Hawaii House of Representatives [HB623], 2015; University of Hawaii, 2015), which is referred to as REHI45. Prior to the study, the attitudes of the study's target population of North Hawaii County residents appeared to reflect that REHI45 would not be achievable and the study aimed to clarify that assertion.

Perceptions of the likelihood of an event, such as quitting smoking, can be predicted by self-efficacy (Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012; Smit, Hoving, Schelleman-Offermans, West, de Vries, 2014). In the case of the present research study, self-efficacy has been expanded to collective efficacy. Collective

efficacy or how trust and solidarity among residents of the same community affect life, is an expansion of self-efficacy to include an entire group (Bandura, 2000). In this study, the group was the target population of residents of North Hawaii County.

Perceived time urgency and perceived health literacy were also investigated as possible predictors of perceived likelihood of achieving REI45. Landy et al. (1991) called for further research examining the interaction between environmental and individual-difference variables within the context of time urgency. Researchers have generally supported the constructs of time urgency and health literacy as predictors of health (Conte, Mathieu, & Landy, 1998; Menon, Narayanan, & Spector, 2013; Mõttus et al., 2014). This study sought to equate the prediction of the perceived likelihood of achieving REHI45 with potential implications for overall health in North Hawaii County.

Any or all of the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level did or did not determine whether REHI45 was perceived to be less likely. A possible potential implication of this study was that the target population, in order to inaugurate positive social change, might be encouraged to put pressure on various levels of government, organizations, institutions, and other entities to help ensure REHI45. Given that environmental health and human health are inextricably linked to climate change and environmental pollution (Frumkin, Hess, Luber, Malilay, & McGeehin, 2008; Hess, Eidson, Tlumak, Raab, & Luber, 2014; Marinucci, Luber, Uejio, Saha, & Hess, 2014; Remais et al., 2014), this type of social change action might ensure that REHI45 is achieved by 2045 or sooner.

There was a gap in the literature as relates to theoretical, empirical, and methodological application of health psychology knowledge and techniques to issues related to renewable energy, climate change, and health. Public and environmental health stands to benefit from climate change and renewable energy related psychology research. It was not known whether or not the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, or educational level predicted individuals' perceptions of the likelihood of achieving goals, such as REHI45 in North Hawaii County. Climate change was characterized by Hansen et al. (2016) as a global emergency. The measurement of specific local populations on constructs related to environmental health, such as collective efficacy, perceived time urgency, and health literacy (Bircher, & Kuruvilla, 2014; Freedman et al., 2014; Hoover et al., 2015; Wickens et al., 2015), have implications for individual health. This research study surveyed adult residents in North Hawaii County to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and or educational level predicted perceptions of the likelihood of achieving REHI45.

Purpose of the Study

The intent of this study was to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and or educational level are associated with North Hawaii County residents' perceptions of the likelihood of achieving REHI45. Determining the predictive ability of factors associated with the perception of the likelihood of reaching 100%

renewable energy on Hawaii Island (Hawaii County) by the year 2045 reflects an individual or group's judgement regarding environmental health and illness (Powell, Dunwoody, Griffin, & Neuwirth, 2007). The probability assessment of perceived likelihood has been used in prior research to measure perceived risk, which in turn can affect preparedness for disastrous events (McNeill, Dunlop, Heath, Skinner, & Morrison 2013) or environmental consequences, including health (Perlaviciute & Steg, 2015). This was projected from the data to elucidate factors associated with the perceived likelihood of REHI45 in North Hawaii.

Research Question and Hypotheses

What factors are associated with North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45?

Hypotheses generated by this research question are as follows.

Null Hypothesis #1 ($H_0 1$): There is no association between collective efficacy and perceived likelihood of reaching REHI45. [H_0: $b_1 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #1 ($H_1 1$): There is an association between collective efficacy and perceived likelihood of reaching REHI45. [H_1: $b_1 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #2 ($H_0 2$): There is no association between perceived time urgency and perceived likelihood of reaching REHI45. [H_0: $b_2 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #2 ($H_2$2): There is an association between perceived time urgency and perceived likelihood of reaching REHI45. [H_2: $b_2 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #3 ($H_0$3): There is no association between perceived health literacy and perceived likelihood of reaching REHI45. [H_0: $b_4 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #3 ($H_3$3): There is an association between perceived health literacy and perceived likelihood of reaching REHI45. [H_3: $b_4 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #4 ($H_0$4): There is no association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_0: $b_3 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #4 ($H_4$4): There is an association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_4: $b_3 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #5 ($H_0$5): There is no association between age and perceived likelihood of reaching REHI45. [H_0: $b_5 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #5 ($H_5$5): There is an association between age and perceived likelihood of reaching REHI45. [H_5: $b_5 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #6 ($H_0$6): There is no association between gender and perceived likelihood of reaching REHI45. [H_0: $b_7 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #6 ($H_6$6): There is an association between gender and perceived likelihood of reaching REHI45. [H_6: $b_7 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #7 ($H_0$7): There is no association between perceived financial strain and perceived likelihood of reaching REHI45. [H_0: $b_6 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #7 ($H_7$7): There is an association between perceived financial strain and perceived likelihood of reaching REHI45. [H_7: $b_6 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #8 ($H_0$8): There is no association between educational level and perceived likelihood of reaching REHI45. [H_0: $b_8 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #8 ($H_8$8): There is an association between educational level and perceived likelihood of reaching REHI45. [H_8: $b_78 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Theoretical Framework for the Study

Three testable theories that supported this research and drove the hypotheses were the health belief model (HBM; Hochbaum, 1958), time urgency theory (Conte, 1995), and health education and promotion theory based on ecological models (Glanz, Rimer, &

Viswanath, 2008; Golden & Earp, 2012). According to Glanz et al. (2008), the HBM embodies many fundamental constructs, including self-efficacy, which predict human behavior patterns to prevent disease or achieve wellness. Ecological models utilize an approach concerning health and behavior that emphasizes environmental influences (Golden & Earp, 2012). Health education and promotion (facilitating health) underlie health literacy, which pertains to the ability to process information regarding health enabling an individual to make decisions about treatment and prevention (Glanz et al., 2008). Based on research in psychology, self-efficacy predicts health outcomes (DeVellis, 2012; Marks et al., 2011).

Rosenstock, Strecher, and Becker (1988) stated that the HBM was formulated to predict and explain health-related behaviors from a person's attitudes and beliefs. According to Wallston (2005b), self-efficacy, which the HBM embodies, is best viewed not as the principal indicator of predicting health behavior, but included with similar constructs. Recent studies that have measured self-efficacy and/or collective efficacy that align with the current research are as follows. Cohen, Inagami, and Finch (2008) postulated that collective efficacy not be considered simply a cause, but a construct that embodies shared environmental features that have been linked to positive health outcomes. Ludwig, Tadayon-Manssuri, Strik, and Moggi (2013) found that general self-efficacy was a critical factor in the prediction of residential alcohol dependence treatment outcomes. Carlson, Brennan, and Earls (2012) claimed that increased self-efficacy and collective efficacy followed upon a community health promotion program for HIV/AIDS.

In the case of this study, collective efficacy was assessed. More detailed information on these constructs and the HBM will be given in Chapter 2.

According to Landy, Rastegary, Thayer, and Colvin (1991), time urgency is a multidimensional construct directly related to health. Time urgency theory supports the development of reliable and valid measure for the construct of time urgency (Landy et al., 1991). In particular, the dimensions of scheduling and deadline control pertain to the present study. In this study, the determination of certain factors that predicted perception of the likelihood of REHI45 was investigated based on the above theoretical framework. A detailed discussion is provided in Chapter 2.

Underlying the issue of the interconnectedness of self-efficacy, collective efficacy, and health is the work by Bronfenbrenner (1979) on ecological theory (as cited in Marks et al., 2011). Bronfenbrenner's ecological systems model specifies four nested systems that influence health. At the microsystems level are families, schools, and neighborhoods. The macrosystem level at the top is concerned with political philosophy and social policy (Marks et al., 2011). This is the level that pertained most to the present study since macrosystems concern environmental conditions and pollution, which in turn affect human health.

According to Dooris (2013), the Bronfenbrenner model can provide a theoretical framework for examining the political and practical reasons why health initiatives fail. Following the Bronfenbrenner model, social initiatives that promote health while taking into account the macrosystem may improve holistic health for a region. Thus, overall local community health, which emphasizes the importance of healthy environments, may

predict positive ways to approach the global challenges faced by climate change, ecosystem collapse, and resource depletion (Dooris, 2013; Mahoney, Palyo, Napier, & Giordano, 2009). A detailed discussion is provided in Chapter 2.

Nature of the Study

The nature of the study was quantitative with the implementation of survey research. Quantitative research is consistent with predicting the perception of the likelihood of an event, which aligns with research in health psychology (Glanz et al., 2008; Marks et al., 2011). For the cross-sectional quantitative design, the constructs of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level were used to predict the perceived likelihood of REHI45. This research constituted goal monitoring in the target population. Harkin et al. (2015) determined in a meta-analysis that goal monitoring promotes goal attainment.

After conducting a meta-analysis of primarily health studies, Harkin et al. (2015) claimed that goal monitoring promotes improved behavioral performance and goal attainment. Evidence from the meta-analysis led to their conclusion that goal monitoring robustly fostered goal attainment and was integral to effective self-regulation. Harkin et al. suggested that health behavior change practitioners consider goal monitoring as an intervention in promoting health behavior change.

Beiner and Abrams (1991) found that raising awareness or raising consciousness was considered important in the earlier stages of measuring a readiness to quit smoking. Consciousness raising was listed as the first step in changing health behavior related to

smoking cessation (Prochaska, Velicer, DiClemente, & Fava, 1988). Monitoring the perceived likelihood of REHI45 may lead to a change in health behavior through raising awareness. I developed a survey research questionnaire to measure the aforementioned constructs from reliable and valid instruments (see Appendix A). It was reviewed by a panel of experts for validity and reliability.

Definitions

Collective efficacy: Humans shared beliefs in our ability to produce as a group desired results through collective action. The extent to which we believe that we can work together effectively to accomplish our shared goals (Bandura, 2000).

Perceived time urgency: The level of urgency ascribed to the performance of a given task. A perceived sense of urgency carries with it an impetus to act (Landy et al., 1991). Perceived time urgency accurately describes time urgency when self-report is being used to measure the construct.

Health: A state of wellbeing arising from conducive interactions between individuals' potentials, life's demands, and social and environmental determinants (Bircher & Kuruvilla, 2014).

Health literacy: The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions (Institute of Medicine, 2004).

Environmental health literacy: An understanding of the connection between environmental exposures and human health (Finn & O'Fallon, 2017).

Assumptions

It was assumed that the survey designed to measure the predictive ability of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level on perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045 would provide an accurate assessment. It was also assumed that the sampling frame of a cross-sectional quantitative design with purposive sampling of adults in North Hawaii County and administration of face-to-face (FTF), paper and pencil, closed question, self-administered questionnaire in community centers and other appropriate locations in North Hawaii County, through nonprobability purposive convenience sampling would yield meaningful results based on participants' honest and truthful responses.

Scope and Delimitations

What a study includes or excludes comprises its scope. The scope of this study was shaped by time constraints, limited funding and resources available, the theoretical underpinnings framing the examination and discussion of the topic, variables selected, and questions chosen. The scope of variables chosen was based on past research regarding health and my view of their potential relevance to the research question. There appeared to be no similar studies that had explored the likelihood of achieving renewable energy goals in the context of health. Therefore, the study aimed to extend research and understanding in a new area to benefit the greater good. The smaller rural area of North Hawaii was deemed generalizable to other rural and possibly urban locations throughout the state of Hawaii and beyond. Delimitations of the study were non-inclusion of

participants from other areas of Hawaii County, nonreview of studies that addressed issues that might have pertained to this research (through omission), and noninclusion of other methodical procedures to approach this problem (i.e., not using a more appropriate analysis of the problem). Additionally, children were not included in this sample for practical reasons, and in consideration that the survey questionnaire required an adult understanding of the issues. The following section elaborates on the scope and limitations of the study.

Limitations

Study limitations might have included sample bias and generalization to other communities. For example, using a rural target population as opposed to an urban target population might be a limitation regarding generalizability because rural locations, such as North Hawaii County, might have less resources available (including funding) to ensure compliance to the REHI45 legislative mandate.

Four instruments and/or scales, the NCE, MHLS, BARS, and the brief health literacy screen were modified for the study. An item to measure collective efficacy was adapted from the Neighborhood Collective Efficacy: Community Cohesion and Informal Social Control survey (PhenX Toolkit, 2009) and the MHLC. An item to measure perceived time urgency was adapted from the BARS and input from experts. Adapting items from these existing instruments might have been a limitation. According to Creswell (2009), the modification of an instrument may compromise validity and reliability. The survey questions were taken from the original measures (except for BHLS) but tailored to the new Hawaii State goal of REHI45 and the research hypotheses

(see Appendix A). To address this possible limitation, a panel of experts were consulted to maintain the integrity of the research. In addition, I used the shortened measure of subjective health literacy (the BHLS), and this might have been a limitation because the measure might not accurately reflect perceived health literacy. However, the BHLS has been used to assess subjective or perceived health literacy (a construct like self-efficacy), rather than objective health literacy, and is used widely (Wallston, Personal communication August 3, 2016).

Other potential weaknesses or limitations of this study pertained to selection (non-probability sample) and that the survey questionnaire was self-report. A non-probability sample was a potential limitation because of possible researcher bias in choosing study participants and the lack of generalizability beyond the study's target population (Acharya, Prakash, Saxena, & Nigam, 2013; Bornstein, Jager, & Putnick, 2013; Etikan, Musa, & Alkassim, 2016). The rural location of Hawaii County necessitated attention to considerations of culture and for research to adopt a holistic lens for context competency (Kikukawa, 2017). For this reason, inclusion of the Native Hawaiian perspective as host culture in the current study was considered important. Purposive sampling was required to adequately access the Native Hawaiian population for the research. Self-report is an issue because it is a subjective measure and the participants may not answer honestly. To address this possible limitation, no personal identifying information (e.g., name) was collected from participants.

Significance

This study contributed to linking the interplay of health, renewable energy, and climate change while making a positive contribution to social change. An expanded health psychology perspective was engendered through the study that applied the factors examined to reducing human contributions to climate change and perhaps enable effective social adaptation. According to Swim et al. (2010), in a report for the American Psychological Association (APA), psychologists should be cognizant of the significance of global climate change to professional practice and practical applications. Through the assessment of views on the achievement of REHI45 in North Hawaii County, this study led to an examination of interrelated psychological constructs that applied to adaptation processes and probable mitigation decisions and actions in the context of planetary climate change. Adaptation and mitigation are considered prevailing frameworks for psychological researchers, among others, in addressing challenges related to climate change (Swim et al., 2010). Establishment of a database or adding to databases that monitor the above would be coincident with the anticipated contributions from this research.

Intervention programs and/or preventative measures might possibly be designed based on the research to improve health in North Hawaii County. The study intended to generalize contextually to other locations locally and globally. Harkin et al. (2015) found in a meta-analysis of primarily health outcome studies that goal monitoring promotes goal attainment, and in the case of REHI45, perhaps an increased potential for a positive health outcome might follow from this research.

Possibly closing the gap, namely a lack of attention to the interconnectedness of health, renewable energy, and climate change, has implications for climate change mitigation through REHI45 or sooner and this in turn affects overall health in the region. In this sense, collective efficacy, perceived time urgency, and perceived health literacy were ascertained to possibly pertain, matter, or factor into the perceptions of local residents on REHI45.

The disconnection that many people and organizations have with respect to linking environmental health and individual health is a problem because it relegates people to being spectators and victims regarding public health, rather than being proactive (Marks, Murray, Evans, & Estacio, 2011). According to Marks et al. (2011), proactive behaviors have been linked to beliefs, such as in self-efficacy and a balanced locus of control, that have been connected to positive health outcomes. Similarly, increased collective efficacy, perceived time urgency, and/or perceived health literacy may play a role in the positive health outcome of REHI45. This research study may help the state of Hawaii reach the REHI45 goal by determining factors that predicted the perceived likelihood of achieving REHI45. If REHI45 is reached, public health in Hawaii could be buffered to a greater degree from climate change disasters, environmental pollution, and degraded ecosystems. A decrease of psychological, social, physiological, and or economic health locally has implications globally (Rockefeller Foundation–Lancet, 2014). Haines and Patz (2004), Luderer et al. (2014), Smith et al. (2013), and Stern (2011) called for the need to transition sooner rather than later from a fossil fuel culture to a renewable energy culture for the benefit of public health. In light of the

above, the research appeared to be justified, with one long-term goal of the study being its potential influence on positive public health outcomes.

Summary

The intent of this study was to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level predicted perceptions of the likelihood of achieving REHI45 in North Hawaii County. Determining the predictive ability of factors associated with the perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045 may help ensure that REHI45 is achieved sooner rather than later. An implication of the findings may be to inform intervention programs and/or preventative measures that could improve health in the region. Intervention programs and/or preventative measures might possibly be designed based on this research to promote overall long-term health in North Hawaii County.

Quantifying the factors associated with the perceived likelihood of REHI45 may help to inform policy decisions and citizens' actions that could positively impact the mandated timeline. Hawaii represents a vulnerable environment to challenges faced by the continued use of fossil fuels. This vulnerability can be buffered through renewable energy independence as opposed to energy dependence on fossil fuels. Continued environmental degradation presents real and serious costs to human health. It is important that decision makers recognize the value of increased goal monitoring related to REHI45 for the benefit of successful goal achievement and implementation. This is especially true in a state that is so isolated. Shifting from a fossil fuel culture to a renewable energy

culture in Hawaii, as soon as possible, benefits society and supports and sustains quality of life, including holistic health.

Chapter 2 follows with a thorough examination of the literature as it pertains to the current research study. This literature review includes constructs such as environmental health literacy and related health models (e.g., the Meikirch model of health). These constructs and health models helped expand the discussion.

Chapter 2: Literature Review

Introduction

Although most, if not all, mainstream media do not report the mitigation of climate change as a global emergency, several scientists have done so (Hansen et al., 2016). For the sake of overall human and environmental health, the rapid shift from a fossil fuel culture to a renewable energy culture is important (Hoffman, 2012; Rockefeller Foundation–Lancet, 2014). In Hawaii, there was a need to determine factors associated with the perception of the likelihood of REHI45. Determining these factors may help achieve the 2045 target date and perhaps could even expedite the transition from fossil fuel energy to renewable energy in the region. This in turn, portends to improve health in the region through less air pollution and environmental toxicity. Additionally, being less dependent on fossil fuel importation in Hawaii may increase resiliency to the long-term effects of climate change (Dora et al., 2015; Keim, 2008).

Resiliency may take many forms including economic and psychological, both of which affect holistic health (Clayton et al., 2016; Das & Horton, 2017; Stern, 2011; Swim et al., 2010). Some would argue that it makes economic sense to support a moral imperative that honors moral values that eliminate toxins in the environment that detract from planetary health. Resiliency or the ability to thrive under adverse conditions, such as those posed by climate change, is a sign of health. In the practice of integrative or holistic medicine, the patient and health practitioner partner for the achievement of physical, psychological, and spiritual health or well-being. Likewise, current global environmental challenges require a systems approach with a holistic lens (Burke et al., 2017). According

to Burke et al. (2017), one of the keys to providing a strategic framework and solutions for the protection of public health and the environment is a holistic approach.

The continued use of and dependence upon fossil fuel energy, including issues related to climate change, pose negative health consequences (Hansen et al., 2016), yet Hawaii Island is fossil fuel energy dependent (Hawaii Electric Light Company**,** 2016). Environmental health and human health will benefit from a shift to a renewable energy culture (Hoffman, 2012; Rockefeller Foundation–Lancet, 2014). According to the United States Environmental Protection Agency (U.S. EPA; 2015), the welfare and public health of current and future generations of Americans is at risk due to air pollution and climate change without the continued reduction of conventional air pollutants and greenhouse gases from fossil fuel-based energy production.

Since the state of Hawaii mandated the goal of 100% renewable energy statewide by the year 2045 (State of Hawaii House of Representatives [HB623], 2015; University of Hawaii, 2015), the local power company has sought to increase the use of renewable energy. For the year 2016, Hawaii Electric Light Company reported for Hawaii County (Island) that 54% of the electricity used by customers was from renewable energy sources. At this time though, the attitudes of the general public among the study's target population of North Hawaii County residents appeared to reflect that REHI45 would not be achievable, and the current research study sought to clarify this assertion.

As discussed, perceptions of the likelihood of an event, such as quitting smoking, can be predicted by self-efficacy (Elfeddali, Bolman, Candel, Wiers, & De Vries, 2012; Smit, Hoving, Schelleman-Offermans, West, de Vries, 2014). In the case of this research

study, self-efficacy has been expanded to collective efficacy. Collective efficacy or how trust and solidarity among residents of the same community affect life, is an expansion of self-efficacy to include an entire group. Collective efficacy constitutes a groups' shared beliefs in their ability to produce desired results through collective action. In the current study, the group is the target population, the residents of North Hawaii County.

Perceived time urgency and health literacy were also investigated as possible predictors of perceived likelihood. Research has generally supported these constructs as predictors of health (Conte, Mathieu, & Landy, 1998; Menon, Narayanan, & Spector, 2013; Mõttus, Johnson, Murray, Wolf, Starr, & Deary, 2014). Since the factors of collective efficacy, perceived time urgency, and health literacy were associated with the achievement of REHI45 which was perceived to be less likely, the target population may be encouraged to put pressure on various levels of government, organizations, institutions, and other entities to help ensure REHI45. This type of social change action might ensure that REHI45 is achieved by 2045 or sooner.

Though increased use of renewable energy and decreased use of fossil fuel energy should benefit global holistic health, there remains a gap in the literature pertaining to the theoretical, empirical, and methodological application of health psychology to issues related to renewable energy goals, climate change, and health. How the factors of collective efficacy, perceived time urgency, health literacy, ethnicity, age, gender, financial strain, and/or educational level decrease or increase individuals' perceptions of the likelihood of REHI45 for Hawaii County, was an unknown. Since constructs related to environmental health, such as those stated above, had not been measured in specific

local populations, it limited the field of health psychology. The determination of whether or not collective efficacy, perceived time urgency, and health literacy factor into the perceived likelihood of reaching REHI45 may matter to overall health in this locale.

In this chapter, I restated an explanation and description of the problem and purpose of the study, including a synopsis of current literature connecting the research topic with holistic health and Hawaii's renewable energy future. Further discussion in the chapter focuses on the literary search strategy used, an elaboration on the study's theoretical foundations, and a literature review related to key variables. Key terms are defined, and their relevance explained based on the literature.

Literary Search Strategy

A broad review of the literature was conducted by using Walden University library's search tool, OneSearch, which accessed several library databases including, EBSCO, ELSEVIER, ScienceDirect, ResearchGate, PsychINFO, PsycARTICLES, Business Source Complete, and PubMed. Google Scholar and CrossRef were also used. Databases were searched using (alone and in combinations) such terms as *health, holistic health, goal monitoring, collective efficacy, perceived likelihood, perceived time urgency, health literacy, environmental health literacy, Native Hawaiian, renewable energy, climate change systems theory,* and *holistic health*. Other search terms used included *health belief model, ecological systems theory, functionalism, health education and promotion theory,* and *time urgency theory*.

Current literature dating from 2011-2017 was reviewed from psychology, medicine, political science, and sociology peer-reviewed journals. Searches also included

seminal works by Durkheim, Merton, Bandura, Bronfenbrenner, and others. Research on how renewable energy directly affects human health was limited. This was handled by referencing studies regarding links between environmental pollution, including air pollution, and fossil fuel sources versus renewable energy sources.

Theoretical Foundation

Health Belief Model

The origin of the HBM dates back to the 1950s. According to Glanz et al. (2008), the HBM (Hochbaum, 1958), embodies many fundamental constructs, including self-efficacy, which predict human behavior patterns to prevent disease or achieve wellness. Major theoretical propositions/hypotheses and assumptions of the model are that beliefs about health problems affect health outcomes. The rationale or premise behind HBM consists of concepts put forward initially by psychologists investigating unsuccessful public health programs, such as tuberculosis screening. Later, the model was expanded to include the role of self-efficacy in health behavior change.

Within the field of psychology, self-efficacy predicts health outcomes (DeVellis, 2012; Marks et al., 2011). For some, self-efficacy was best viewed not as the principal indicator of predicting health behavior, but included with similar constructs (Wallston, 2005b). In the current study, collective efficacy was deemed to be more applicable to the research question. The application of the HBM in research has been widespread and includes measuring such constructs as self-efficacy and collective efficacy to explain acting or not to improve one’s health or the health of a community. There are many links to current research as the HBM has become a major framework in guiding studies. The

health belief model related to this research study in that collective efficacy was one of the variables or factors influencing the perceived likelihood of REHI45.

Ludwig et al. (2013) found that general self-efficacy was an important factor influencing resident alcohol dependence treatment outcomes. According to Carlson et al. (2012), a community health promotion program for HIV/AIDS improved self-efficacy and collective efficacy regarding recovery. Collective efficacy includes environmental health issues affecting a group that link to better health outcomes (Cohen et al., 2008; Tieg et al., 2009). The view that a person's group, and consequently one's own self, can affect positive health behaviors through collective efficacy also pertains to pro-environmental goals (Jugert et al., 2016). A group may voice pro-environmental attitudes yet fall short on pro-environmental behavior (Scott & Willits, 1994). According to Homburg and Stolberg (2006), the above discrepancy between attitudes and behavior may be attributable to an individual's self-efficacy beliefs not carrying forward into perceived collective problems, such as addressing climate change or achieving renewable energy goals. My research study sought to determine whether collective efficacy was a factor in predicting the perceived likelihood of attaining 100% renewable energy on Hawaii Island by the year 2045.

Time Urgency Theory

The origin of time urgency theory may be traced back to the development of the construct and its measurement in the 1990's. Time urgency theory (Conte, 1995), factored in *time* to behavioral inquiries. According to Landy et al. (1991), time urgency theory supports the development of reliable and valid measures for the construct of time

urgency. Considered to be a multidimensional construct, time urgency has been measured through behaviorally anchored rating scales (BARS), and has important implications for health (Landy et al., 1991). The application of time urgency in research has been limited since the inception of BARS.

Time urgency has been studied in the context of Type A personalities (Conte, Schwenneker, Dew, & Romano, 2001; Smigelskas, Zemaitienė, Julkunen, & Kauhanen, 2015; Wright & Schmidt-Walker, 1990; Wright, McCurdy, & Rogoll, 1992) and in the health field pertaining to what individuals perceive to be emergencies or imperative tasks (Menon et al., 2013; Quan et al. 2013; Wright et al., 1995). In the business arena, time urgency has been included as an attribute contributing to stakeholder salience (Mitchell, Agle, & Wood (1997). As such, urgency was not deemed a steady-state attribute, but rather capable of variance depending on relationships over time. According to Mitchell et al. (1997), regarding stakeholders, time urgency is met when the nature of a relationship or claim is time sensitive and when the relationship or claim is important or critical. Attending to time urgency serves legal and moral interests of stakeholders (Mitchell et al., 1997). In this same vein, perceived time urgency is suggested as a variable that might count as a factor in the achievement of REHI45. Pahl et al. (2014) claimed that the consideration of time is integral to understanding climate change. The temporal context, in their view, has essential implications for addressing climate change responses.

Major theoretical propositions/hypotheses and assumptions for time urgency pertain to how the factor of time urgency influences decision making and behavior. The rationale consists of observations and evidence that suggest how time matters to thinking

and behavior. Links to current research scan many disciplines including sociology, economics, health, and others. Time urgency is related to this research study, since the variable perceived time urgency was hypothesized to predict perceived likelihood to achieving REHI45.

Functionalism

An old and dominant approach in the social sciences has been functionalism (Merton, 1968). Functionalism includes the application of the scientific method to observable phenomena and the organic unity of social systems (Durkheim, 1915). Social systems from a functionalist perspective work to maintain balance or homeostasis. A healthy society manifests positive functionality supporting balance, while a dysfunctional society demonstrates behavior that does not lead to homeostasis (Merton, 1968).

Bronfenbrenner–Ecological Systems Theory

An influence on this balance or positive functionality is the environment in all its aspects. A healthy environment thus supports healthy societies and individuals. Four nested environmental systems that influence health were outlined by Bronfenbrenner's (1979) ecological systems theory (EST). Level 1, the Microsystem, concerns people in the immediate setting. Level 2, the Mesosystem, addresses interconnections among systems that influence the individual. Level 3, the Exosystem, concerns the community, and Level 4, the Macrosystem, concerns cultural values. Families, schools, and neighborhoods comprise the microsystem level. The macrosystem level at the top concerns political philosophy and social policy. Consequently, the macrosystem level pertains most to the social change issue REHI45, since macrosystems concern

environmental conditions and pollution, which in turn affect human health. All four-level systems (microsystems, mesosystems, exosystems, and macrosystems) are interconnected. Local community health action which emphasizes the importance of healthy environments may engender positive ways to approach the global challenges faced by climate change, ecosystem collapse, and resource depletion.

Dooris (2013) outlined how the Bronfenbrenner model can provide a theoretical framework for examining the political and practical reasons why health initiatives fail. Through the application of the Bronfenbrenner model, social initiatives that promote health while taking into account the macrosystem may improve holistic health for an area. It then follows that localized community health that champions healthy environments may predict positive ways to handle the global challenges faced by climate change, ecosystem collapse, and resource depletion (Dooris, 2013; Mahoney et al., 2009). Localized community health would include resilience as an aspect of health.

A significant assumption of systems theory, which is dated back to Aristotle, is that the whole can be understood by examining emerging properties of smaller units or parts (Corning, 2014). According to Corning (2014), a focus on the interplay of dynamics, biology, ecology, and the bioeconomics of living systems with their artifacts was called for to progress scientific understanding. Bronfenbrenner's ecological systems theory examines smaller systems within the whole yet emphasizes the interconnectedness of all the systems. EST can be viewed as an overlapping configuration of interconnected ecological systems (Neal & Neal, 2013). It has been suggested that EST can be mapped onto the research process as a representation of qualitative, quantitative, and mixed

methods research and thus applicable to the health, social, and behavioral fields (Onwuegbuzie, Collins, & Frels, 2013). New models attempt to integrate a more holistic view in order to understand not just the specifics of life, but the totality of the interconnectedness of being. Building on the work of Bronfenbrenner and others, the Meikirch model of health (MMH) was developed (Bircher & Kuruvilla, 2014) to address the integrative nature of health.

The MMH established a framework for connecting social and environmental determinants of health with individuals' potentials and the demands of life, along with collective action for health. In the model, "Environment", meaning the environmental determinants of health, corresponds to Bronfenbrenner's macrosystem. The model incorporates elements of perceived time urgency and collective efficacy as they relate to environmental health and consequently, health as defined above in Chapter 1. Ecological systems theory and the MMH, along with supportive literature lend credence to the approach used in this study.

Health Education and Promotion Theory

Health education and promotion theory is based on ecological models and supports a functionalist approach. Ecological models utilize an approach concerning health and behavior that emphasizes environmental influences. According to Golden and Earp (2012), health education and promotion theory was based on ecological models. Ecological models utilize an approach concerning health and behavior that emphasizes environmental influences (Golden & Earp, 2012). According to Glanz et al. (2008), health education and promotion underlie health literacy, which pertains to the ability to

process information regarding health enabling an individual to make decisions about treatment and prevention. According to Mottus et al. (2014), health literacy predicts poor health, yet reflects overall cognitive ability and educational and or occupational levels that affect health beyond simple numeracy and reading skills.

The origin of health education and promotion can be said to stem back to the time when humans first started instructing their fellows in what plants were beneficial and which ones poisonous to the body. Major theoretical propositions/hypotheses and assumptions amount to the valuation of instructing one another about health. The application in research has existed for a long time. Health literacy grew out of this approach or framework. The rationale has been that learning about health issues may improve health outcomes. Links to current research regarding health literacy fall under the topic of health literacy (HL) in general and specific areas such as environmental health literacy (EHL). HL and EHL pertained to this study as it related to how these factors affected the dependent variable. Perceived health literacy was measured.

Literature Review Related to Key Variables

Goal Monitoring–Perceived Likelihood of REHI45

Goal monitoring, or the measured identification of discrepancies between a current and desired state, may affect health outcomes. As an activity, goal monitoring reveals the current status of progress toward the outcome of a goal. It assists in decisions on how to apply energy or corrective action to achieve a desired outcome (Harkin et al., 2015). According to a meta-analysis of primarily health studies by Harkin et al. (2015), the literature reflects that goal monitoring promotes goal attainment. The implementation

of the survey research study constituted goal monitoring in the target population (CDC, 2016; Dora et al., 2017). Consequently, the act of bringing REHI45 related awareness to the target population has potential health benefits in that it may promote goal attainment (Biener & Abrams, 1991; Prochaska et al., 1988).

Harkin et al. (2015) determined through a meta-analysis that when participants were prompted to monitor progress toward goals, outcomes were affected. This was particularly true for health studies where outcome changes were likelier through participants monitoring outcomes toward goals versus any specific behaviors of theirs. Research on goal monitoring and health outcomes has included studies that pertain to obesity (Burke, Wang, & Sevick, 2011; Chambers & Swanson, 2012; Oshima, Matsuoka, & Sakane, 2013; Wang et al., 2012), diabetes (Allemann, Houriet, Diem, & Stettler, 2009; Duran et al., 2010; Jennings, Vandelanotte, Caperchione, & Mummery, 2014), heart disease (Blasco et al., 2012; Coen & Curry, 2016), and stress (Logan et al., 2012; Proudfoot et al., 2013; Ralston et al., 2014). Many studies on goal monitoring and health outcomes use biomarkers, such as blood pressure and stress measures, to gauge progress toward wellness or homeostasis.

In my study, the perceived likelihood of renewable energy progress was measured, rather than a biomarker. However, monitoring the perceived achievement of REHI45 may improve health outcomes locally. Renewable energy lowers CO_2 emissions for the planet, which increases the likelihood of overall homeostasis in the global system. Residing in a less toxic or polluted environment through a larger percentage of renewable

energy use means lower CO_2 emissions and consequently less systemic stress with greater chances of health or wellbeing (Bircher & Kuruvilla, 2014; Watts, 2015).

According to Chung et al. (2009), goal setting and goal progress monitoring contributed to significantly improved (p = .0113) workforce cardiovascular risk (CVD) in a target population of company automobile workers (N = 343). Their quantitative intervention study included goal setting and goal monitoring for measures such as blood pressure, total cholesterol, smoking status, diabetes, physical activity level, and age. After 18 months, results supported improved health outcomes and less CVD risk (Chung et al., 2009). The Centers for Disease Control and Prevention (CDC, 2016) and Roy et al. (2009) found that goal setting and goal monitoring provided the means to adjust their programs for addressing the CDC Health Protection Goals aligned with the Healthy People Initiative Goals to increase the effectiveness of public health investments. In addition to tracking goal achievement progress for chronic disease, as outlined in the Healthy People Initiative, progress toward meeting the Healthy People 2010 overall goal of increasing the quality and years of a healthy life was measured (U.S. Department of Health and Human Services [DHHS], 2012). Some areas, like health disparities, showed a marked lack of progress with a 13% increase and 80% unchanged status for health disparities from 2000 to 2010. This led to the development of more informed approaches to close health gaps and improve health outcomes (DHHS, 2012).

Tracking goal progress helped inform health initiatives regarding environmental health, as well, through the National Environmental Health Tracking Program (CDC, 2016). Even a onetime assessment informs progress made and may lead to further

tracking or goal monitoring (Haque et al., 2017). Elucidating links between environmental health and public health is important. Marques and Lima (2011) found in an exploratory study that there was a significant association between living in industrial areas and reduced psychological health contrasted with non-industrial areas. The quantitative quasi-experimentally designed study included measures of well-being, optimism, coping strategies, anxiety, and depression. The authors hypothesized that living in industrial neighborhoods affected psychological health negatively in a myriad of ways. And, that there was an association between "perceptions of industrial activity" and levels of psychological health, such that, participants having a realistic view of living in an industrial area would have better psychological health than industrial area participants who did not perceive their environment as industrial. Results pointed to better psychological health for industrial area residents whose subjective perceptions of living in an industrial area matched their actual environment (Marques & Lima, 2011). In the case of this exploratory study, participants' perceptions of their environment and likelihood of REHI45 matter to their health. Limitations of the Marques and Lima (2011) study included not sampling more non-industrial locations, however the research made important inroads in revealing connections between the environmental quality of the place one resides, a person's perception of that place, and overall psychological health.

Goal monitoring of health objectives plays an important role in health outcomes through intervention development and the evaluation of health promotion policies and programs (CDC, 2006; DHHS, 2012; Roy et al., 2009). Goal monitoring is like the process of grading in education. An assessment is made that informs concerned parties

where things stand in terms of achievement. This goal monitoring intertwines with collective efficacy where the collective efficacy of teacher's perceptions of faculty effectiveness can have a positive impact on learners. According to Goddard, Hoy, and Woolfolk (2000), collective efficacy in the above context impacted students more positively than student demographic characteristics or school location.

Collective Efficacy

Collective efficacy can be a factor that makes a difference in goal attainment or achievement, and thus, health outcomes. According to Bandura (2000), collective efficacy is the extent to which we believe that we can work together effectively to accomplish our shared goals. According to Cohen et al. (2008), collective efficacy is best viewed not as simply a "cause", but a construct that incorporates shared environmental aspects that have been connected to positive health outcomes. According to Jugert et al. (2016), collective efficacy influences pro-environmental intentions through the perception that one's group, and therefore one's own self, can effect change.

Jugert et al. (2016) conducted four experiments in Germany and Australia that provided evidence that collective efficacy interventions were effective when self-efficacy was enhanced as well. The researchers hypothesized that collective efficacy perceptions operated through self-efficacy perceptions. Past research supports self-efficacy as a critical factor in changing health behavior (Ludwig et al., 2013). Jugert et al.'s four experiments used either online or paper and pencil surveys with target populations ranging from around 50 to 300 for each experiment. The measures used for perceived collective efficacy, self-efficacy, and general pro-environmental intentions were

developed and adapted from standard measures. A meta-analysis integrated effect sizes and showed that the direct and indirect association between collective efficacy, self-efficacy, and pro-environmental intentions was small, yet robust. There were several limitations to the research including not finding consistent direct effects, not entirely successful manipulations of the threat of climate change, and the lack of a neutral control condition in the four experiments. Their study provided evidence that collective efficacy manipulations raised efficacy perceptions on a collective and individual level, thus increasing pro-environmental intentions to engage with climate change mitigation. The present study sought to determine if collective efficacy is a factor in the perceived likelihood of REHI45, which may affect pro-environmental engagement locally for the sake of health.

A recent study in Tanzania found that increased self-efficacy and collective efficacy followed upon a community health promotion program for HIV/AIDS (Carlson et al, 2012). The multilevel, cluster randomized-control trial was predicated on the ecological systems theory of Bronfenbrenner (1979). Participants consisted of children between the ages of 9 and 14 (N = 724), with caregivers in attendance, and adults (N = 1119) from an urban district of northern Tanzania. Pre-and post-treatment structured interviews used measures that included a 5-item self-efficacy Likert scale, a 4-item scale for child collective efficacy, a 6-item scale for neighborhood collective efficacy, and a 5-item scale of neighborhood problems (Carlson et al., 2012). The 28-week community health education and promotion intervention utilized group work and skits. Carlson et al. found that the treatment or intervention generated an increase in self-efficacy in

adolescent participants along with greater adult neighborhood collective efficacy. Trained independent observers provided quality assurance and the Human Studies Committee at Harvard Medical School reviewed the research together with local review boards. Limitations included possible report bias and masking of interviewers to the intervention, however these possibilities were minimized. A possible lack of generalizability was acknowledged (Carlson et al., 2012) due to cultural considerations concerning the specific target population in Africa. The Carlson et al. (2012) study showed that interventions that increase awareness may increase collective efficacy, which in turn can have a positive effect on health.

Barth, Jugert, and Fritsche (2016) found that collective efficacy was a factor in the acceptance of electric vehicles in Germany. The mixed methods study utilized in person interviews (N = 33, EV experts and non-experts) and an online survey questionnaire (N = 548) to sample mostly fully employed people (54.3% female) with a mean age of 32.91. The researchers tested whether collective efficacy and social norms (social identity variables) predicted the acceptance of EVs, including goal intentions. The social identity variables each independently predicted EV acceptance over and above personal cost-benefit factors and confirmed earlier findings that collective efficacy was significantly related to intentions (Barth et al., 2016; Klockner, 2014; van Zomeren, Postmes, & Spears, 2008). Six items were used to measure collective efficacy (e.g., “As inhabitants of this region we can do much to noticeably reduce CO_2 emissions together”). Limitations included a non-experimental design which could not establish causality, but only correlations and the determination of the strength of possible predictors on the

dependent variable, and the possible lack of generalizability to other populations (Barth et al., 2016).

There is evidence in the literature for both self-efficacy and collective efficacy affecting outcomes, which include health and pro-environmental goal intentions (Barth et al., 2016; Carlson et al., 2012; Jugert et al., 2016; Klockner, 2014; Ludwig et al., 2013; van Zomeren et al., 2008). Jugert et al. (2016) claimed that when making people aware of matters related to climate change, communications that may foster collective efficacy are important to increasing pro-environmental actions. Factors of either the personal (self-efficacy) or collective (collective efficacy) may impact more than the other in the literature (Carlson et al., 2012; Jugert et al., Ludwig et al., 2013). However, it appears that group or collective efficacy, more than self-efficacy, would predict collective climate action and the determination of intentions to participate in reaching community-based pro-environmental goals, such as transitioning from dependence on fossil fuel energy to 100% renewable energy (Homburg & Stolberg, 2006; van Zomeren et al., 2008). In this study, I aimed to determine whether collective efficacy was a factor in the perceived likelihood of achieving REHI45.

Perceived Time Urgency

Time urgency is the level of urgency ascribed to the performance of a given task and a perceived sense of urgency carries with it an impetus to act (Landy et al., 1991). Time urgency or perceived time urgency (PTU) has implications for health outcomes (Menon et al., 2013) in that PTU affects behavior. Regarding health, perceived time urgency can lead a person to act on a disease symptom or not. Or, in the case of health

care professionals, PTU affected stress levels and actions taken (Menon et al., 2013; Quan et al., 2013). Regarding health and climate change, perspective taking on the element of time may improve engagement and social action leading to an improved quality of life (Conte et al., 1995; 1998). According to Conte et al. (1995; 1998), more research is needed linking the physiological consequences of time urgency to negative health outcomes. The present research study sought to examine the interplay between perceived time urgency and the likelihood of REHI45.

The urgency of time is a factor in job demands with medical emergencies (Verweji et al., 2017). Yet, often nurses and physician's perceptions of urgency differ (Quan et al., 2013). Quan et al. (2013) conducted a mixed-methods study using semi-structured interviews and quantitative surveys to confirm contrasting perceptions of urgency between nurses and physicians in their message communications. Based on their research, they determined that contrasting views on time urgency (urgent or non-urgent) issues revolved around timeframe and context, not clinical condition (Quan et al., 2013). Limitations of the study included a lack of message context in the perception of urgency survey and a small sample size for the survey. Quan et al. suggested that medical messages needed better timeframe and context communication pertaining to perceptions of time urgency.

Temporal dimensions of climate change include "extension into the future" and "time lag" (Pahl, Sheppard, Boomsma, & Groves, 2014). To many observers, there seems to be a distance between current reality and future projections based on climate change scenarios. Additionally, there appears to be a time lag concerning the effects of carbon

emissions today from a distant past plus the impacts to be felt far into the future from current carbon emissions (Pahl et al., 2014).

Research on time urgency is limited. One instrument that has been developed to measure individual differences is the Time Urgency and Perpetual Activation Scale (TUPA) to access levels of time urgency and perceptual activation (Saraiva, Gastal, Campelo, & Iglesias, 2015). Previously, time urgency, which has important links to health, was measured through BARS (Landy et al., 1991).

Medical emergencies demand quick assessments of the relative perceived time urgency to attend to the medical issue at hand. Transposing the same imperative to the perspectives regarding issues of renewable energy and climate change shifts according to location (Blunden & Arndt, 2016). Hawaii has been considered to be one of the places most vulnerable to the overall adverse effects of climate change, including compromised health from drought, food and water shortages, and superstorms ("State of the Climate in 2015," 2016). Being energy independent rather than fossil fuel dependent should help buffer these effects. The determination of whether perceived time urgency was a factor in the target population to the perceived likelihood of REHI45 may help elucidate how to best approach ways to ensure achievement of the REHI45 goal.

Perceived Health Literacy

Health literacy factors into health outcomes. According to Serper et al. (2014), health literacy is an indicator of health. Education can elevate health awareness, which may promote someone to take action to benefit their health. Likewise, low health literacy may adversely affect health (Kobayashi, Wardle, & von Wagner, 2014). Health education

and promotion underlie health literacy, which relates to the ability to process information regarding health enabling an individual to make decisions about treatment and prevention (Glanz et al., 2008). According to Nutbeam (2008), health literacy is an evolving concept.

Mottus et al. (2014) found that lower health literacy was associated with less healthy individuals. And, health literacy indicated the degrees of cognitive ability and educational and or occupational levels that affected health beyond simple reading and numeracy skills. Standard measures of health literacy scores among the community-dwelling older participants (mean age 72.50 years/roughly half female) were associated with poorer health with every health outcome (N = 730, β = .09 to .17; Mottus et al., 2014).

According to Estacio (2013), engagement and participation of community members can potentially increase the effectiveness, meaningfulness, and relevancy of health literacy interventions. This might be the case for local health literacy interventions developed around the perceived likelihood of REHI45. The present study measured perceived health literacy in the population to determine whether it is a factor in predicting perceived likelihood to reach the goal of REHI45. The assumption was that in the event it was a factor, which it was, then perhaps interventions incorporating perceived health literacy and additionally environmental health literacy may increase HL and EHL in the region. Doing so may improve overall health outcomes for the target population.

Environmental Health Literacy

Environmental health literacy has been defined as an understanding of the connection between environmental exposures and human health (Finn & O'Fallon, 2017).

EHL may be a factor in health outcomes related to the environment. Morrone, Mancl, and Carr (2001) devised a metric to measure environmental literacy and some research has been done on public health literacy, but no specific standard instrument has been developed for environmental health literacy. However, Finn and O'Fallon (2017) have called for the measurement and development of interventions that address a person's understanding of the connection between environmental exposures and human health. New tools to promote EHL are needed (Cleary et al, 2017). EHL was not included as an independent variable in the present study; however, possible future health literacy and environmental health literacy interventions may be developed in tandem. According to Wallston (Personal communication dated May 3, 2017), it would be prudent to possibly work with Finn and O'Fallon (2017) to develop a standard measure for environmental health literacy. Working to develop a standard measure or quantitative survey research instrument for environmental health literacy was beyond the scope of this dissertation. However, it is possible that I will pursue developing a standard measure for environmental health literacy in the future (post doctorate) that addresses issues pertaining to health, fossil fuel energy, renewable energy, and climate change. The assessment of perceived health literacy in the target population may serve as valuable information in the design of both health literacy and environmental health literacy for North Hawaii residents. The elevation of either or both of the above may help improve health in the area.

Sociodemographic Variables

Sociodemographic variables can contribute to health outcomes. The present research study determined whether or not ethnicity (Native Hawaiian or non-native Hawaiian), age, gender, educational level, and perceived financial strain predict participants' perceptions of the likelihood of REH145. Five sociodemographic questions were included in the survey instrument to gather this sociodemographic information.

Ethnicity.

Native Hawaiians' perception of the likelihood of REHI45 is relevant due to their collectivist cultural proclivity to value and take care of the whole environment, including themselves, family, and extended family. Health interventions for Native Hawaiians need to be culturally appropriate and geographically localized to be effective (Oneha et al., 2016; Yoon, Bastian, Anderson, Collins, & Jaffe, 2014). A family and community focused approach to changing health behavior enables health psychology to be contextually competent (Kikukawa, 2017). Results of this study may bring increased awareness to the Native Hawaiian perspective relative to REHI45.

It has been assumed that Native Hawaiian cultural traditions were negatively impacted by colonization and socio-economics. This has contributed to Native Hawaiians experiencing significant health disparities, shorter life spans, and greater than average morbidity and mortality (Oneha et al., 2016; Wu et al., 2017; Yoon et al., 2014). Like many other marginalized indigenous peoples in their native lands, the voice of the Native Hawaiian host culture in Hawaii requires attention as environmental concerns become prominent. Doing so may have positive health implications for Native Hawaiians. Native

Hawaiian ethnicity was determined to not be a significant factor in the present research study.

Age.

Age was hypothesized to be factor regarding the perception of the likelihood of REHI45 and thus, it was included as a sociodemographic variable of interest. In a quantitative survey research study that used secondary data analysis, Falk and Anderson (2013) found that age was a factor that affected sun protection behavior and sun exposure habits. People over 65 years of age in general reported the lowest level of sun exposure and a high degree of sun protection. Sun protection behaviors included giving up sun bathing, using clothes to protect from the sun, use of sun screen, and seeking shade when the sun was the strongest. Participants consisted of 415 adults (64% female) from a primary health care population in Sweden. Results of the study supported consideration of age as a factor in mapping and implementing individualized sun protection recommendations to prevent skin cancer. In my research study, the survey question that addressed age (see Appendix A, question number 15), aligned with the adult age groupings in the U.S. Census for Kamuela (Waimea), Hawaii zip code 96743 (U.S. Census Bureau, 2010).

Perceived financial strain and educational level.

Perceived financial strain and educational level were also hypothesized to be factors that predict the perception of the likelihood of REHI45 and thus, were included as sociodemographic variables of interest. According to Falk and Anderson (2013), educational level, in addition to gender and age, were factors that affected sun protection

behavior and sun exposure habits. Participants (N = 415) that had a low educational level used sunscreen less than those with a higher educational level, and when they did use sunscreen chose lower SPF, yet reported less sunburn than other educational level groups. The researchers suggested that the findings support consideration of educational level when health practitioners counsel patients individually regarding sun protection.

According to Osborn, Kripalani, Goggins, and Wallston (2017), financial strain (a discrepancy between income and expenses) as a nontraditional indicator of socioeconomic status (SES) was a determinant in worse self-rated health and medication non-adherence beyond income, education, employment status, race/ethnicity, age, and gender. The above study was based on an initial sample of 1527 patients. The authors completed study (N = 3000) found that the correlation between income and financial strain was r -0.49, (Personal communication from Ken Wallston, June 3, 2017). Their research showed that financial strain predicted important outcomes (e.g., medication adherence and self-rated health status) above and beyond income. In my study, educational level was measured using the categories stipulated in the U.S. Census (2010) for Kamuela, Hawaii (see Appendix A, question number 16).

Gender.

Gender was also hypothesized to be a factor that predicts the perception of the likelihood of REHI45 and thus was included as a sociodemographic independent variable. Gender has been was determined to be a factor that affects sun protection behavior and sun exposure habits (Falk & Anderson, 2013). Through their quantitative survey research study, Falk and Anderson (2013) found that females from a primary

health care population in Sweden sunbathed more than men, used sunscreens more frequently, and used sunbeds slightly more often than men. The adult target population (N = 415) was comprised of 64% females and 36% men. Limitations of the study included skewed distributions for both age and gender in the study sample. The greater number of female and older participants may have been indicative of the distribution of patients at the time of the survey or that females were more interested in health issues and participation in research. Results were thought to perhaps improve the implementation of specifically tailored prevention measures to patients (Falk & Anderson, 2013).

Blom, Kilpelainen, Hultcrantz, and Tornberg (2014) found that women had a greater compliance rate than men to colorectal cancer screening in a Swedish population over a period of five years from 2008 to 2012. Participants were residents of Stockholm County aged 60 to 69 years old with women in general participating more than men on a yearly basis (range by year and age group: 56.1 – 71.2%) compared to men (45.4 – 64.4%). A higher participation rate was also found for older age groups and subsequent screening round in the program. This quantitative secondary analysis study confirmed a lower participation rate among men for the screening program. Blom et al. (2013) called for a greater effort to engage more men in complying with participation in the colorectal screening program. These studies (Falk & Anderson, 2013; Blom et al., 2013) underscore how important the inclusion of gender as a potential sociodemographic predictor variable was in this dissertation research study.

Summary and Conclusions

Pertinent literature that related to the variables of the study including perceived likelihood of REHI45, collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level was reviewed to support the problem statement that the predictors of the perceived likelihood of achieving REHI45 for Hawaii County was unknown. I reviewed studies related to the theoretical frameworks supporting environmental health in relation to human health. Included were explanations of the relevance of functionalism, ecological systems theory, health education and promotion theory, HBM, time urgency theory (TUT), and MMH. Ecological systems theory and the MMH ground the study through addressing environmental health concerns with a theoretical lens that spans local to global contexts. HBM supports the measurement of collective efficacy in the study. TUT pointed to the need to include a temporal component as a possible predictor variable. According to Hansen et al. (2017), imperative action is necessary to mitigate dangerous climate change impacts that will negatively affect the health of future generations. There is an urgent need to eliminate the use of fossil fuel energy and increase actions that reduce CO_2 emissions, including the utilization of renewable energy (Hansen et al., 2017). Health education and promotion theory underlie the construct of perceived health literacy. Health literacy has been a predictor of health outcomes and perceived health literacy was hypothesized to be a factor in predicting the perceived likelihood of REHI45.

There was a gap in the literature regarding human environmental health issues pertaining to renewable energy, climate change, and the shift from a fossil fuel culture to

a renewable energy culture. The literature had not adequately elucidated links between health, renewable energy, and climate change. Studies examining connections between holistic health, health education and promotion, preventative health, renewable energy goals, and goal monitoring had not been adequately explored. Specifically, studies related to predictors of the likelihood of achieving 100% renewable energy under state mandates. This study fills a gap in the literature by using an empirically based research methodology to determine the factors associated with residents' perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045. According to Singer, Denruyter, and Yener (2017), through an in-depth energy analysis, the world could meet all of its energy needs with renewable energy only by 2050. However, in order to do so, individuals, communities, and businesses, not simply governments, need to urgently implement change now. Doing so will help mitigate climate change, bring about less pollution, increase energy security (this may be a critical factor in Hawaii), and improve health globally (Singer et al., 2017).

In Chapter 3, I explain the methodological approach of the study. I will review how quantitative data was collected and statistically analyzed to answer the research question. Instrumentation, sampling strategy, participant recruitment techniques, sample size, data storage, and methods to ensure ethical research practices are also reviewed.

Chapter 3: Research Method

Introduction

On the island of Hawaii (Hawaii County), there was a need to determine factors associated with the perception of the likelihood of REHI45. This study was conducted to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level predicted perceptions of the likelihood of achieving REHI45 in North Hawaii County. The determination of these factors may help Hawaii Island achieve the 2045 target date of 100% renewable energy for the state, and perhaps help expedite the transition from fossil fuel energy to renewable energy.

According to Powell et al. (2007), judgement regarding environmental health and personal illness can be predicted through the perception of the likelihood of reaching goals such as REHI45. The preparedness for disastrous events or environmental consequences, including health, can be affected by perceived risk through the measurement of perceived likelihood (McNeill et al., 2013; Perlaviciute & Steg, 2015). Noel and Firestone (2015) encouraged legislative recognition of the public trust doctrine's application to Hawaiian electricity planning and policy to among other factors, increase community involvement and maximize protection of the environment. This study aimed to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level are associated with North Hawaii County residents' perceptions of the likelihood of achieving REHI45. The determination of the predictive ability of factors

associated with the perception of the likelihood of reaching 100% renewable energy in North Hawaii by the year 2045 reflects an individual or group's judgement regarding environmental health and illness (Powell et al., 2007). The probability assessment of perceived likelihood has been used to measure perceived risk, which in turn can affect preparedness for disastrous events (McNeill et al., 2013) or environmental consequences, including health (Perlaviciute & Steg, 2015). Data derived from the study may inform current residents of North Hawaii County to take timely action for the sake of their own health, and the health and well-being of future generations. Further discussion in this chapter will focus on the study's research design and rationale, methodology, and threats to validity.

Research Design and Rationale

This cross-sectional quantitative study used a nonexperimental design and employed face-to-face, paper and pencil survey research. The study variables and further elaboration on the research design and design choice are as follows.

Study Variables

The predictor variables in this study were collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level. The criterion variable was the perceived likelihood of reaching 100% renewable energy in Hawaii County by the year 2045.

Research Design

As discussed, the nature of the study was quantitative with the use of survey research. Glanz et al. (2008) and Marks et al. (2011) have asserted that quantitative

research can be used to predict the perception of the likelihood of an event, which aligns with research in health psychology. This study utilized constructs used to measure collective efficacy, perceived time urgency, and health literacy to predict the perceived likelihood of REHI45.

The survey research enacted goal monitoring in the target population. One point in time assessments can serve to monitor goals (CDC, 2016; Dora, 2017; Roy et al., 2009). Goal monitoring promotes goal attainment according to a meta-analysis done by Harkin et al. (2015). Monitoring the perceived likelihood of REHI45 may constitute a change in health behavior through raising awareness. Awareness may lead to action to ensure REHI45 or perhaps help expedite 100% renewable energy locally for overall health.

Design Choice Considerations

According to Kikukawa (2017), the Native Hawaiian viewpoint is an important factor when assessing the perceived likelihood of targets that affect health, such as in the case of REHI45 in Hawaii. Sustainable living and taking care of all integrated ecosystems are part of Native Hawaiian traditional beliefs and practices. The Big Island of Hawaii or Hawaii County as a rural location requires this kind of attention for researchers to be context competent (Kikukawa, 2017). Including the distinct Native Hawaiian voice in the research study was deemed important for this reason. In order to access the Native Hawaiian population in rural northern Hawaii County, purposive sampling was required.

Nonprobability purposive convenience sampling was implemented rather than random probability sampling to ensure the inclusion of approximately 50% Native

Hawaiians (NHs) in the study. According to Frankfort-Nachimas and Nachimas (2015), purposive sampling allows researchers the ability to access less accessible populations, in this case, the Hawaiian community. Purposive sampling helped guarantee that the proper quota of Native Hawaiians to non-Native Hawaiians was reached. As a sub-set unit of analysis, ethnic Native Hawaiians were defined as the descendants of the original peoples of Hawaii. For practical reasons, children were not included in this sample in consideration that the survey questionnaire required an adult understanding of the issues.

According to Cozby and Bates (2012), surveys are an important method for researchers to study relationships among variables and how attitudes and behaviors change with time. I administered the face-to-face, paper and pencil, closed question, self-report questionnaire. I developed the survey research questionnaire from reliable and valid instruments and it was reviewed by a panel of experts.

Methodology

Population

The intended sample or units of analysis for this study was composed of adults (18 and older) who are residents (full or part-time) of North Hawaii County (defined as the general area in the vicinity of the towns of Waimea, Honoka'a, Hawi, and Kawaihae). The area encompasses all of Lava Zone 9, the geologically and topographically considered the safest zone on the island for lava flows, together with a small triangulate portion of Lave Zone 8 (second safest) surrounding the town of Honoka'a (see Appendix B). The population of this rural area is estimated to be around 15,000 with approximately 5,000 NHs. This population's health may be impacted by the new REHI45 legislation

(University of Hawaii, 2015), if the goal is achieved in a timely fashion. A sufficient number of NH participants (90 or so) were needed for the data to address the hypothesis regarding NHs. As discussed, NHs are a subset unit of analysis defined as the descendants of the original peoples of Hawaii.

Sampling and Sampling Procedures

The sampling frame consisted of a cross-sectional quantitative design with purposive sampling of adults in North Hawaii County. The survey was implemented in community centers and other appropriate locations in North Hawaii County through non-probability purposive convenience sampling. There was a time and a place for non-probability methods of sampling (Cozby & Bates, 2012). Time and funding constraints may dictate that a researcher be efficient, yet competent at designing a sampling strategy. If an area does not lend itself to random sampling, a rural town or place for instance, then it might be prudent to sample the population through convenience or purposive sampling (Cozby & Bates, 2012).

According to Cozby and Bates (2012), data obtained through a non-probability sampling design, if done right, can sometimes be more reliable and valid than data obtained from probability sampling methods. Despite the risk of bias in non-probability sampling, the benefits, such as obtaining data from a hard to reach population, may outweigh the choice to not do the study at all (Cozby & Bates, 2012). This might be true in social and or psychological research in particular, when pinpointing or crystalizing a problem is the first step toward addressing the problem. Skowronek and Duerr (2009)

claimed that non-probability convenience sampling can be useful in determining a problem that exists.

Procedures for Recruitment, Participation, and Data Collection

Participants were recruited on a voluntary basis through non-probability purposive convenience sampling. This entailed recruitment from public gatherings at one local Town Hall community association meeting, one morning at a local Farmer's Market, one morning at the lanai of the Waimea Preservation Association, and several public parks in North Hawaii County.

To compute the sample size for this study, I used the generally accepted value for power of .80 (80%). In other words, a researcher using a .80 value for power can expect to detect a real (treatment) effect (or mean difference) 80% of the time. Alpha level (Type I error) consists of the chance that a significant (treatment) effect is found when one does not exist. And, the probability of a Type II error increases with power. Thus, 80% power is appropriate for avoiding Type I and II errors (Aron, Coups, & Aron, 2011; Cozby & Bates, 2012; Field, 2013; Frankfort-Nachimas, & Nachimas, 2015; Green, & Salkind, 2014).

Traditionally, two values are used for alpha level, .05 and .01. Choosing a larger value for alpha expands the rejected region. This provides more opportunities to reject the null hypothesis correctly and thus larger values of alpha result in more power. However, in common practice, there usually is no justification for an alpha level greater than .05. Based on the literature a medium effect size of .15 was determined to be appropriate to calculate the sample size (Harkin et al., 2015).

To determine sample size for this research, a G*Power software calculation was run to achieve 80% power with alpha = .05 (Aron et al., 2011; Cozby & Bates, 2012; Field, 2013; Frankfort-Nachimas, & Nachimas, 2015) and effect size of .15 based on the literature. The statistical analysis that appeared to be the best fit to address my research question and hypotheses was simple linear regression. Using G*Power software and the above parameters, an F test for linear multiple regression: Fixed model R^2 deviation from zero with one predictor yields a total sample size calculation of 55. A separate simple linear regression was run for each predictor variable (no covariates) in this research study.

According to Field (2013), when expecting a medium effect (.13 = medium) with a linear regression (power of .80), then a sample size of 160 would suffice for up to 20 predictors. The rule of thumb suggestion from Laerd Statistics (2016), outlining a sample size of 30 participants *(N)* for every independent variable *(IV)* seems ample. Thus, with the seven *IVs* in my study, the total sample size recommended by Laerd would be 210. The total sample size for my quantitative study was projected to range from 225 to 250 participants. A sample of 250 individuals allowed for screening out participants that were not appropriate to include due to missing data and other factors.

A sample size of 250 or a little less was determined be adequate and yet was later revised to 136, which was sufficient. According to Norman (2010), whether to use a small sample size or not is a judgement call, not a statistical issue. However, external validity and distribution need to be accounted for (Norman, 2010). Care was given in the study to ensure an appropriate sample size for statistical power and validity.

Instrumentation and Operationalization of Constructs

The origin of time urgency theory may be traced back to the development of the construct and its measurement in the 1990s. Time urgency theory (Conte, 1995) factored in *time* to behavioral inquiries. According to Landy et al. (1991), time urgency theory supports the development of reliable and valid measures for the construct of time urgency. Considered to be a multidimensional construct, time urgency, which are typically measured through BARS), has important implications for health (Landy et al., 1991). The application of the construct of time urgency in research has been limited since the inception of BARS. Details on the instrumentation and operationalization of constructs measured on the questionnaire are as follows.

Collective Efficacy

Collective efficacy as a construct includes self-efficacy and efficacy in its theoretical framework. According to Wallston (Personal communication, May 22, 2017), there appears to be no consensus on the best way to measure collective efficacy. In the absence of an agreed upon standard measure for collective efficacy, items 1, 2,3, 4, and 6 of the survey questionnaire I developed were adapted from the Neighborhood Collective Efficacy: Community Cohesion and Informal Social Control Scale, Version 10 (PhenX Toolkit, 2009). Permission was given to use the instrument, although none was required as it is in the public domain. Social cohesion (Qs 1-3) and informal social control (Qs 5-6) are considered precursors to collective efficacy. Item 4 considers efficacy more directly; it was written by me in consultation with a panel of experts, including Dr. Kenneth Wallston. Response values range 1 through 4 from “strongly agree” (4) to

"strongly disagree" (1) and "very likely" (4) to "very unlikely" (1). Collective efficacy is scored by summing the scores on the 6 items with higher scores indicating greater collective efficacy.

All questions derived from the Neighborhood Collective Efficacy: Community Cohesion and Informal Social Control scale come from the Project on Human Development in Chicago Neighborhoods (PhenX Toolkit, 2009). Their use in the present study was reviewed by a panel of experts. This scale was selected because it is a widely used, validated protocol with available research documenting its validity, reliability, and association with multiple health-related outcomes. Items from the scale have been incorporated into major studies of neighborhoods and health, including the Los Angeles Family and Neighborhood Survey (Cohen, Finch, Bower, & Sastry, 2006; Cohen, Inagami, & Finch, 2008) and the Fragile Families and Child Wellbeing Study (Burdette, Wadden, & Whitaker, 2006).

Perceived Time Urgency

Based on the theoretical framework of time urgency theory, I adapted one item based on input by qualified research experts and BARS to measure perceived time urgency. Item 7 on the questionnaire related to perceived time urgency regarding the REHI45 goal being achieved and Hawaii Island having 100% renewable energy by 2045. Perceptions of time urgency on this item were scored as follows (2025 or earlier = 5, 2035 = 4**,** 2045 = 3, 2055 = 2, 2065 or later = 1, never = 0). Higher scores meant higher urgency.

Perceived Health Literacy

The Brief Health Literacy Screen (BHLS, Chew, 2008) consists of three items on a 5-point response scale, ranging from 1 to 5 from “never” or “extremely” (5) to “always” or “a little bit” (1), to measure perceived health literacy. According to Wallston (Personal communication August 3, 2016), the BHLS assesses subjective or perceived health literacy, rather than objective health literacy, and is used widely. Permission was given to use the BHLS in the research study, although permission was not required as it is in the public domain. Items 10, 11, and 12 of the survey questionnaire were adapted by me from the BHLS in consultation with a panel of experts, including Dr. Wallston.

Typically, the BHLS has been scored as the sum of the three items resulting in a continuous score that ranges from 3 to 15. “Inadequate health literacy” is generally considered as a score of 9 or less with higher scores indicating higher subjective health literacy (Chew et al., 2008; Wallston, Cawthon, McNaughton, Rothman, Osborn, & Kripalani, 2014). The theoretical framework behind the above measure comes from health education and health promotion theory.

Perception of Likelihood of REHI45

One item (Item 8) was used to measure the criterion variable. It reads as follows: What is the likelihood that Hawaii Island (Hawaii County) will have 100% renewable energy by 2045? Participants choose from Highly Unlikely (1), Unlikely (2), Likely (3), and Highly Likely (4). Higher scores reflected greater perceived likelihood of REHI45.

Sociodemographic Variables

Four items (Items 12-16) were used to collect data on the sociodemographic variables of interest: perceived financial strain, gender, ethnicity, age, and educational level.

Data Analysis Plan

Multiple linear regression was the statistical analysis used for the study. Eight separate linear regression analyses were run using the enter method for each of the eight independent variables. The criterion variable was the perceived likelihood of REHI45 and the predictor variables were collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level. The software used to perform the statistical analysis for the study was IBM SPSS Statistics version 21.0 (2013). Data cleaning and screening procedures as appropriate to the study were performed. Survey questionnaires with missing values were not used. A scatterplot was utilized to determine outliers. According to Van den Broek, Cunningham, Eeckels, and Herbst (2005), the utilization of a 3-step method to clean the data which includes screening, diagnosing, and editing is useful, and this method was implemented.

The research study examined the following research questions and hypotheses:

What factors are associated with North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45?

Null Hypothesis #1 ($H_0 1$): There is no association between collective efficacy and perceived likelihood of reaching REHI45. [H_0: $b_1 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #1 ($H_1$1): There is an association between collective efficacy and perceived likelihood of reaching REHI45. [H_1: $b_1 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #2 ($H_0$2): There is no association between perceived time urgency and perceived likelihood of reaching REHI45. [H_0: $b_2 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #2 ($H_2$2): There is an association between perceived time urgency and perceived likelihood of reaching REHI45. [H_2: $b_2 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #3 ($H_0$3): There is no association between perceived health literacy and perceived likelihood of reaching REHI45. [H_0: $b_4 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #3 ($H_3$3): There is an association between perceived health literacy and perceived likelihood of reaching REHI45. [H_3: $b_4 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #4 ($H_0$4): There is no association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_0: $b_3 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #4 ($H_4$4): There is an association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_4: $b_3 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #5 ($H_0$5): There is no association between age and perceived likelihood of reaching REHI45. [H_0: $b_5 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #5 ($H_5$5): There is an association between age and perceived likelihood of reaching REHI45. [H_5: $b_5 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #6 ($H_0$6): There is no association between gender and perceived likelihood of reaching REHI45. [H_0: $b_7 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #6 ($H_6$6): There is an association between gender and perceived likelihood of reaching REHI45. [H_6: $b_7 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #7 ($H_0$7): There is no association between perceived financial strain and perceived likelihood of reaching REHI45. [H_0: $b_6 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #7 ($H_7$7): There is an association between perceived financial strain and perceived likelihood of reaching REHI45. [H_7: $b_6 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #8 ($H_0$8): There is no association between educational level and perceived likelihood of reaching REHI45. [H_0: $b_8 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #8 ($H_8$8): There is an association between educational level and perceived likelihood of reaching REHI45. [H_8: $b_7$8≠ 0, the 95% CI of the coefficient of the slope does not include 0 (zero)].

A simple linear regression was run for each predictor variable (no covariates). Regression analysis results for the model were utilized to interpret significance or non-significance with *R* and adjusted R_2 values plus *F*-ratios as appropriate. Descriptive statistics were provided as appropriate. The multiple regression analysis alpha level was set at .05, power set at 80%, and effect size medium (.15).

Threats to Validity

Descriptions of Threats to Validity

I developed the survey questionnaire from reliable and valid measures. It was reviewed by a panel of experts. Measures for collective efficacy and perceived time urgency were adapted from the NCE and BARS, respectively, together with input from experts. Perceived health literacy was measured using the BHLS.

Ethical Procedures

First, I obtained Walden University IRB approval (# 02-23-18-0510564) prior to recruitment and data collection. The areas of the present research that possibly could have posed potential ethical concerns were researcher bias, informed consent, treatment of survey respondents, and the secure storage of data. Also, since I reside in North Hawaii, I needed to keep the proceedings formal in the event that any participants were familiar to me. I dealt with these concerns in as professional a manner as possible. Use of a proctor to avoid researcher bias was not determined to be necessary when administering the

survey. Second, I intended to be careful as to health literacy concerns and/or wording to ensure that survey participants understood my questionnaire. This included staying abreast of issues and considerations related to informed consents. My intention was that the informed consent documents be accompanied by no coercion or undue influence, appropriate information, and with survey participants' ability to genuinely assess whether or not to participate. The wording of the questionnaire was important on many levels. According to Palmer (2015), ethical considerations concerning informed consent and treatment of survey respondents is important. This includes issues of health literacy and wording, which according to Sorenson et al. (2013) are essential for respondents understanding of surveys related to health. Third, I intended to treat all survey participants fairly and honestly. This included beneficence, justice, and respect for people. I needed to be culturally sensitive to the local population and word the questionnaire as objectively as possible to not bias the results. And fourth, I followed the American Psychological Association (APA) Ethics Code, and took reasonable precautions to protect confidentiality, and this included data storage.

Data security for my research study was best implemented through anonymous data collection. Even though I intended to collect anonymous data, and take measures to deidentify the data, the storage of data can be challenging. Addressing this challenge entailed more of a financial and time commitment (i.e. password protection, firewalls, etc.), and this was done. Additionally, hard copies (paper) are stored in locked file cabinets in my secured office for seven years. Also, any other requirements from the IRB, plus current ethical guidelines were adhered to.

Summary

To accurately answer the research question posed by this study, a quantitative research approach was taken. Residents of North Hawaii County were purposively sampled and completed a face-to-face, paper and pencil survey questionnaire to measure the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level, and their perceptions of the likelihood of achieving REHI45, By quantifying the factors associated with the perceived likelihood of REHI45 in North Hawaii, policy decisions may be better informed, and citizens' actions could perhaps have a positive effect regarding the 2045 goal of 100% renewable energy. Hawaii represents a vulnerable environment to challenges faced by the continued use of fossil fuels. The vulnerability that Hawaii has to climate change, including dependence on fossil fuel energy, can be buffered through renewable energy independence. In North Hawaii, continued environmental degradation negatively effects human health. Local Hawaii decision makers acknowledge merit pertaining to increased goal monitoring related to REHI45 to ensure successful goal achievement and implementation. In a state that is so isolated, switching from a fossil fuel culture to a renewable energy culture, as soon as possible, improves holistic health, benefits society, and assist in a better quality of life overall.

Chapter 4 follows with the results of the study and how the quantitative data were collected and statistically analyzed to accurately answer the research question.

Chapter 4: Results

Introduction

The purpose of this study was to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level are associated with North Hawaii County residents' perceptions of the likelihood of achieving REHI45. The study's findings provide an understanding of whether or not these factors are associated with residents' perception of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045, referred to as REHI45. These results may inform the design of intervention programs and/or preventative measures to promote overall long-term health and positive social change in North Hawaii County.

The study examined the following research question and hypotheses:

What factors are associated with North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45?

Null Hypothesis #1 ($H_0 1$): There is no association between collective efficacy and perceived likelihood of reaching REHI45. [H_0: $b_1 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #1 ($H_1 1$): There is an association between collective efficacy and perceived likelihood of reaching REHI45. [H_1: $b_1 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #2 ($H_0$2): There is no association between perceived time urgency and perceived likelihood of reaching REHI45. [H_0: $b_2 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #2 ($H_2$2): There is an association between perceived time urgency and perceived likelihood of reaching REHI45. [H_2: $b_2 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #3 ($H_0$3): There is no association between perceived health literacy and perceived likelihood of reaching REHI45. [H_0: $b_4 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #3 ($H_3$3): There is an association between perceived health literacy and perceived likelihood of reaching REHI45. [H_3: $b_4 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #4 ($H_0$4): There is no association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_0: $b_3 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #4 ($H_4$4): There is an association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_4: $b_3 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #5 ($H_0$5): There is no association between age and perceived likelihood of reaching REHI45. [H_0: $b_5 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #5 ($H_5$5): There is an association between age and perceived likelihood of reaching REHI45. [H_5: $b_5 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #6 ($H_0$6): There is no association between gender and perceived likelihood of reaching REHI45. [H_0: $b_7 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #6 ($H_6$6): There is an association between gender and perceived likelihood of reaching REHI45. [H_6: $b_7 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #7 ($H_0$7): There is no association between perceived financial strain and perceived likelihood of reaching REHI45. [H_0: $b_6 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #7 ($H_7$7): There is an association between perceived financial strain and perceived likelihood of reaching REHI45. [H_7: $b_6 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Null Hypothesis #8 ($H_0$8): There is no association between educational level and perceived likelihood of reaching REHI45. [H_0: $b_8 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)].

Alternative Hypothesis #8 ($H_8$8): There is an association between educational level and perceived likelihood of reaching REHI45. [H_8: $b_7 8 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

In this chapter, I will discuss the data collection process followed by the results of the regression analyses. An explanation of the study timeframe and the data collection process are outlined. Demographic information, including ethnicity, age, gender, and education level, as an indication that the sample was representative of the population are given. And, the results and the statistical analyses used to test the research hypotheses are presented.

Data Collection

One hundred and thirty-six participants completed the Health and Environment Survey (see Appendix A) from mid-March 2018 to mid-May 2018 at various public parks in North Hawaii, one local Town Hall community association meeting, one morning at a local Farmer's Market, and one morning at the lanai of the Waimea Preservation Association. The last two locations were added after a limited number of survey responses were obtained from my initially proposed locations, and they were approved by the Walden University IRB (# 02-23-18-0510564). Of the 136 surveys, five had missing or incomplete data. The overall usability rate, total-to-usable surveys completed, was 100%. The amount of my missing data was .003% (6/2,176 or 6 missing participant cell responses divided by the total of 2, 176 participant cell responses rounded up).

The initial sample size of 200-250 participants that was targeted and discussed in Chapter 3 was revised to 110-150 based on an updated a priori power analysis detailed below. Of the 136 usable surveys, one had a missing data point for gender and four surveys had one or two missing responses each for the Brief Health Literacy Screen (BHLS) due to the response option, "Question does not apply" being checked. This

response option is not part of the BHLS, but was added at the recommendation of my committee. According to Wallston et al. (2014), the BHLS is typically scored on the basis of responses to three questions that do not include a “does not apply” option for perceived health literacy values. Therefore, for four respondents, perceived health literacy was calculated as outlined below using mean data for questions answered with the “does not apply” response. Thus, these four participants were included in the analysis. The total sample size used for the statistical analysis was 136 participants.

According to Bannon (2015), the method of mean substitution is a simple and acceptable technique to treat missing data. This is what was applied to four cases for the variable perceived health literacy to use all 136 participants’ data. Collective efficacy scores (Items 1-6) were summed to yield a total score with higher scores reflecting greater collective efficacy. Perceived health literacy scores (Items10-12) were summed to yield a total score with higher scores reflecting higher subjective health literacy. Complete data were required for gender to compute total scores. The gender male was entered for the one participant with missing data based on a visual determination. Use of male or female as nominal data for gender in this case was not found to be germane in that neither selection produced a change in the percentage ratio (rounded up or down) between males and females. Whether marked male or female for this one case, the result would not have affected the outcome concerning the determination of gender as a factor in the perceived likelihood of the achievement of 100% renewable energy on Hawaii Island by 2045. It should be noted that three of the four participants who answered “Question does not apply” to one of the items measuring perceived health literacy had

reached higher (summed) perceived health literacy scores with their responses to two of the three questions. Therefore, adequate perceived health literacy for these three cases was achieved in just two questions for these participants.

Due to inclement weather at outdoor public parks, data collection was slower than anticipated. The initial target of 200-250 participants as discussed in Chapter 3 was revised based on an updated a priori power analysis. To re-determine sample size, a G*Power software calculation was run to achieve 80% power with alpha = .05 (Aron et al., 2011; Cozby & Bates, 2012; Field, 2013; Frankfort-Nachimas, & Nachimas, 2015) and an effect size of .15 based on the literature. Using G*Power software and the above parameters, an F test for linear multiple regression: Fixed model R^2 deviation from zero with eight predictors yielded a total minimum sample size calculation of 109.

The mean score for the dependent variable, perceived likelihood of achieving REHI45, which was scored on a scale of 1 (highly unlikely) to 4 (highly likely), was 2.8 (*SD* = .721) reflecting less perceived likelihood of achieving REHI45. Specifically, 32 participants (23.5%) had a score of “highly unlikely” or “unlikely” (1 or 2, respectively) and 104 participants (76.5%) had a score of “likely” or “highly likely” (3 or 4, respectively). The mean for collective efficacy was 19.45 (*SD* = 2.19), which reflects higher collective efficacy. The mean for perceived time urgency was 3.69 (*SD* = 1.46) reflecting higher perceived time urgency. Mean perceived health literacy was 11.70 (*SD* = 2.18) reflecting higher perceived health literacy and mean perceived financial strain was 2.27 (*SD* = .882) reflecting lower perceived financial strain. Mean age was 49.12

(*SD* = 16.92) and mode for educational level was 3 (*SD* = 1.05). The mode (3) for educational level was some college or associates degree.

Based on census data for North Hawaii from 2010 (U.S. Census Bureau, 2010), the sample was representative of the larger population in the area. The sample was comprised of non-Native Hawaiians (68%), Native Hawaiians (32%), adult males (45%) and adult females (55%) with a mean age of 49 years old. Educational level was also comparatively distributed at percentages for less than high school graduate (2%), high school graduates or GED (17%), some college or associate degree (37%), bachelor's degree (25%), and graduate or professional degree (19%).

Results

A simple bivariate linear regression was run for each predictor variable (no covariates). The statistical results of eight simple (bivariate) linear regression analyses for each predictor variable with the same criterion variable (perceived likelihood of reaching REHI45) and the multiple regression analysis (simultaneous/enter method) for the full model noting differences follow. Regression analysis results for the model were utilized to interpret significance or non-significance with *R* and adjusted *R*2 values.

The separate simple bivariate linear regressions were followed by a multiple linear regression to examine differences on the sample of 136 participants. The results reflect a multiple regression analysis of the single criterion variable regressed simultaneously on all 8 predictors in a single block. According to Norman (2010), whether to use a small sample size or not is a judgement call, not a statistical issue. External validity and distribution need to be accounted for, however (Norman, 2010). As

discussed in Chapter 3, care was given in this study to ensure an appropriate sample size for statistical power and validity.

A higher percentage of participants (76.5%) responded that it was likely that 100% renewable energy would be achieved on Hawaii Island by 2045 compared to those who responded that achieving that target date would be unlikely (23.5%). A higher percentage of participants (79%) responded with greater perceived time urgency for 100% renewable energy on Hawaii Island (2045 or earlier) compared to participants (21%) who responded with less time urgency (2055 or later or no urgency at all).

Scatterplots confirmed the presence of linear relationships between the predictors and outcome variable with the exception of perceived financial strain, which showed no relationship. However, for perceived financial strain there was independence of residuals, as assessed by a Durbin-Watson statistic of 2.060. Scale analysis showed acceptable, although less than ideal, internal reliability and validity for collective efficacy (0.68) and a lower Cronbach's alpha for perceived health literacy (0.58). Considering the non-linear relationship of perceived financial strain and the perceived likelihood of reaching REHI45, together with less than ideal internal reliability and validity for collective efficacy and perceived health literacy, results should be interpreted with caution. There has been a precedent set in the literature for using the BHLS to measure perceived health literacy (Chew et al. 2008, Wallston et al., 2014), and Wallston et al. (2014) reported the following alphas 0.71, 0.76, 0.79, and 0.80 in one study that sampled various populations.

The first null hypothesis stated that there was no association between collective efficacy and perceived likelihood of reaching REHI45. A Pearson's product-moment

correlation was run to assess the relationship between the perceived likelihood of reaching REHI45 and collective efficacy of participants. The results were identical to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from collective efficacy scores, and was statistically significant ($\beta = .241$, $p = .005$). Therefore, the null hypothesis was rejected. [H_0: $b_1 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was an association between collective efficacy and perceived likelihood of reaching REHI45. [H_1: $b_1 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The second null hypothesis stated that there was no association between perceived time urgency and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between the perceived likelihood of reaching REHI45 and perceived time urgency of participants. The results were identical to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from perceived time urgency scores, and was statistically significant ($\beta = .266$, $p = .002$). Therefore, the null hypothesis was rejected. [H_0: $b_2 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was an association between perceived time urgency and perceived likelihood of reaching REHI45. [H_2: $b_2 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The third null hypothesis stated that there was no association between perceived health literacy and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between the perceived likelihood of reaching REHI45 and perceived health literacy of participants. The results were identical

to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from perceived health literacy scores, and was statistically significant ($\beta = .241$, $p = .005$). Therefore, the null hypothesis was rejected. [H_0: $b_3 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)] There was an association between perceived health literacy and perceived likelihood of reaching REHI45. [H_3: $b_3 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The fourth null hypothesis stated that there was no association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between the perceived likelihood of reaching REHI45 and Native Hawaiian ethnicity of participants. The results were identical to the bivariate regression analysis, predicting the perceived likelihood of reaching REHI45 scores from ethnicity scores, and was not statistically significant ($\beta = .048$, $p = .582$). Therefore, the null hypothesis was not rejected. [H_0: $b_4 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was no association between Native Hawaiian ethnicity and perceived likelihood of reaching REHI45. [H_4: $b_4 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The fifth null hypothesis stated that there was no association between age and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between perceived likelihood of reaching REHI45 and age of participants. The results were identical to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from age scores, and was not statistically

significant (β = .124, p = .151). Therefore, the null hypothesis was not rejected. [H_0: b_5 = 0, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was no association between age and perceived likelihood of reaching REHI45 [H_5: $b_5 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The sixth null hypothesis stated that there was no association between gender and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between perceived likelihood of reaching REHI45 and gender of participants. Results were identical to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from gender scores, and was not statistically significant (β = .035, p = .685). Therefore, the null hypothesis was not rejected. [H_0: $b_6 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was no association between gender and perceived likelihood of reaching REHI45. [H_6: $b_6 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The seventh null hypothesis stated that there was no association between perceived financial strain and perceived likelihood of reaching REHI45. A Pearson's product-moment correlation was run to assess the relationship between perceived likelihood of reaching REHI45 and perceived financial strain of participants. Results were identical to the bivariate regression analysis, predicting perceived likelihood of reaching REHI45 scores from PFS scores, and was not statistically significant (β = -.054, p = .531). Therefore, the null hypothesis was not rejected. [H_0: $b_6 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was no

association between perceived financial strain and perceived likelihood of reaching REHI45. [H_7: $b_7 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

The eighth null hypothesis stated that there was no association between educational level and perceived likelihood of reaching REHI45. A Spearman's rank order correlation was run to assess the relationship between perceived likelihood of reaching REHI45 and educational level of participants. Results were nearly identical to the bivariate regression analysis which was $\beta = .075$, $p = .383$, predicting perceived likelihood of reaching REHI45 scores from educational level scores, and the Spearman's rank order correlation was not statistically significant ($\beta = .073$, $p = .401$). Therefore, the null hypothesis was not rejected. [H_0: $b_8 = 0$, the 95% confidence interval (CI) of the coefficient of the slope includes 0 (zero)]. There was no association between educational level and perceived likelihood of reaching REHI45. [H_8: $b_8 \neq 0$, the 95% CI of the coefficient of the slope does not include 0 (zero)].

Table 1 shows the differences between the simple regressions and multiple linear regression betas and probability values.

Table 1

Simple (Bivariate) Linear Regression and Multiple Regression Analyses Predicting Perceived Likelihood of REHI45 from CE, PTU, PHL, Ethnicity, Age, Gender, PFS, and EL

	Simple Regression		Multiple Regression	
Variable	β	*p*	β	*p*
Constant				
Collective Efficacy	.241	**.005***	.138	.110
Perceived Time Urgency	.266	**.002***	.239	**.005***
Perceived Health Literacy	.241	**.005***	.199	**.031***
Ethnicity	.048	.582	.108	.207
Age	.124	.151	.090	.293
Gender	.035	.685	.000	.998
Perceived Financial Strain	-.054	.531	.013	.882
Educational Level	.075	.383	-.097	.239

Note. $N = 136$. $*p < .05$, Key for column headings: β = standardized regression coefficient (i.e., beta, *p* = *p*-value (significance level of *t*-statistic), Perceived Likelihood of Reaching (REHI45), Collective Efficacy (CE), Perceived Time Urgency (PTU), Perceived Health Literacy (PHL)

Table 2 contains the multiple regression correlation matrix of all variables (dummy variables were used for the categorical variable educational level), R^2, *adjusted* R^2, and standard error for the overall multiple regression model. The R^2 indicates that 17.5% of the variance in factors associated with the perceived likelihood of reaching REHI45 can be explained by the linearly combined influence of the eight independent

variables. And, perceived time urgency contributes unique variance (p = .005) in explaining the perceived likelihood of reaching REHI45.

Table 2

Multiple Linear Regression Analyses Predicting Perceived Likelihood of REHI45 from CE, PTU, PHL, Ethnicity, Age, Gender, PFS, and EL

Variable	*B*	SE	β	*t*	95% CI	*p*
Constant						
1st Predictor CE	.045	.028	.138	1.61	[-.010, .101]	.110
2nd Predictor PTU	.117	.041	.239	2.84	[.035, .199]	**.005***
3rd Predictor PHL	.066	.030	.199	2.18	[.006, .125]	**.031***
4th Predictor Ethnicity	.166	.131	.108	1.27	[-.093, .426]	.207
5th Predictor Age	.004	.004	.090	1.05	[-.003, .011]	.293
6th Predictor Gender	.000	.124	.000	-.002	[-.245, .244]	.998
7th Predictor PFS	.011	.073	.013	.148	[-.134, .156]	.882
8th Predictor EL	-.145	.123	-.097	-1.18	[-.388, .098]	.239
					LL, UL	
R^2	.175					
Adjusted R^2	.123					

Note. N = 136. *p < .05, Key for column headings: B = unstandardized regression coefficient, SE = standard error for "*b*", β = standardized regression coefficient (i.e., beta), t = t-statistic (test of significance for b and β), CI = confidence interval, *LL* = lower limit, *UL* = upper limit, p = p-value (significance level of t-statistic), Perceived Likelihood of Reaching (REHI45), Collective Efficacy (CE), Perceived Time Urgency (PTU), Perceived Health Literacy (PHL), Perceived Financial Strain (PFS)

A post-hoc power analysis was run using a G*Power software calculation with a F test for linear multiple regression: Fixed model R^2 deviation from zero with eight

predictors, and total sample size of 136. The analysis revealed 90% power with alpha = .05 and effect size of .15.

Summary

Residents of North Hawaii County were asked to complete a survey to measure factors hypothesized to be associated with the perceived likelihood of REHI45. Simple linear regression and multiple linear regression analyses were run to determine if collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level predicted residents' perceived likelihood of achieving REHI45. Results revealed that collective efficacy, perceived time urgency, and perceived health literacy were significantly related to North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45. Ethnicity, age, gender, perceived financial strain, and educational level were not significantly related to North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45.

The finding that collective efficacy, perceived time urgency, and perceived health literacy are associated with the perception of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045 may help inform interventions or programs in North Hawaii and elsewhere to increase awareness, effect social change, and prompt policy change. These results may also inform the design of preventative measures to promote overall long-term health in North Hawaii County. Chapter 5 presents an interpretation of the findings, limitations of the study, and

describes how individuals, organizations, institutions, cultures, and societies may benefit from the results of this study through the determination of factors that influence the perceived likelihood of achieving REHI45.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Collective efficacy, time urgency, and health literacy have been a focus of research for over four decades. Research has demonstrated that these factors influence health and decision making (CDC, 2016; Conte, 1995; Glanz et al., 2008; Golden & Earp, 2012). Yet, researchers have not established how these factors may be connected to the achievement of policy aims that impact holistic or environmental health. Based on the HBM, social cognitive theory, time urgency theory, health education and promotion theory, Bronfenbrenner's ecological systems theory, and the Meikirch model, the purpose of this quantitative study was to determine if the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and educational level were associated with the perception of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045. Residents of North Hawaii County were asked to complete a survey to measure these factors. Simple linear regression and multiple linear regression analyses were run to determine if collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, and/or educational level predicted residents' perceived likelihood of achieving REHI45.

Results showed that collective efficacy, perceived time urgency, and perceived health literacy were factors associated with North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45. Ethnicity, age, gender, perceived financial strain,

and educational level were not factors associated with North Hawaii County residents' perception of the likelihood of reaching 100% renewable energy in Hawaii Island by the year 2045 to achieve the statewide goal of REHI45.

Interpretation of the Findings

The findings in this study extend knowledge in the discipline through addressing a gap in the literature regarding factors associated with perceptions of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045. Researchers have not addressed the theoretical, empirical, and methodological application of health psychology to climate change. It was not known whether or not the factors of collective efficacy, perceived time urgency, perceived health literacy, ethnicity, age, gender, perceived financial strain, or educational level decrease or increase individuals' perceptions of the likelihood of achieving goals, such as the REHI45 goal in North Hawaii County that will address climate change, which has been called a global emergency (Hansen et al., 2016). Specifically, the results of the current study confirm that collective efficacy, perceived time urgency, and perceived health literacy are factors associated with the perceptions of the likelihood of achieving a local renewable energy target date.

According to Hansen et al. (2016), the mitigation of climate change is a global emergency. Overall human and environmental health rests upon the rapid shift from a fossil fuel culture to a renewable energy culture (Hoffman, 2012; Rockefeller Foundation–Lancet, 2014). Locally, in Hawaii where I reside, there was a need to determine factors associated with the perception of the likelihood of REHI45.

Determining these factors may help achieve the 2045 target date and has implications for expediting the transition from fossil fuel energy to renewable energy in Hawaii County and beyond. Improved health, both locally and globally, may follow through less air pollution and environmental toxicity. Also, being less dependent on fossil fuel importation in Hawaii may increase resiliency to the long-term effects of climate change (Dora et al., 2015; Keim, 2008). The study confirmed that the target population in North Hawaii County concurs with this transition through the finding that perceived time urgency is a significant predictor. This finding extends knowledge in the field.

Resiliency may take many forms including economic and psychological, both of which affect holistic health (Clayton et al., 2016; Das & Horton, 2017; Stern, 2011; Swim et al., 2010). Some argue that it makes economic sense to support a moral imperative that honors moral values that eliminate toxins in the environment that detract from planetary health (Stern, 2018). Resiliency or the ability to thrive under adverse conditions, such as those posed by climate change, is a sign of health. In the practice of integrative or holistic medicine, the patient and health practitioner partner for the achievement of physical, psychological, and spiritual health or well-being. Likewise, current global environmental challenges require a systems approach with a holistic lens (Burke et al., 2017). According to Burke et al. (2017), one of the keys to providing a strategic framework and solutions for the protection of public health and the environment is a holistic approach. The current study empirically aligned with and affirmed this holistic approach.

The continued use of and dependence upon fossil fuel energy, including issues related to climate change, pose negative health consequences (Hansen et al., 2016), yet

Hawaii Island is fossil fuel energy dependent (Hawaii Electric Light Company**,** 2016). Environmental health and human health will benefit from a shift to a renewable energy culture (Hoffman, 2012; Rockefeller Foundation–Lancet, 2014). According to the United States Environmental Protection Agency (U.S. EPA, 2015), the welfare and public health of current and future generations of Americans is at risk due to air pollution and climate change without the continued reduction of conventional air pollutants and greenhouse gases from fossil fuel-based energy production. The current research has determined that collective efficacy, perceived time urgency, and perceived health literacy are significant factors in the perceived likelihood of renewable energy targets for North Hawaii County that would mitigate health risks in this area.

Since the state of Hawaii mandated the goal of 100% renewable energy statewide by the year 2045 (State of Hawaii House of Representatives [HB623], 2015; University of Hawaii, 2015), the local power company has sought to increase the use of renewable energy. For the year 2016, Hawaii Electric Light Company reported for Hawaii County (Island) that 54% of the electricity used by customers was from renewable energy sources. At this time though, the attitudes of the general public among the study's target population of North Hawaii County residents appeared to reflect that REHI45 was not achievable, and this study sought to clarify this assertion. This assertion was affirmed in the finding that the sample of residents' mean score on perceived likelihood of achieving REHI45 was 2.88 (*SD* = .721). Scores ranged from 1 "highly unlikely" to 4 "highly likely" with lower scores (1, 2) equal to lower perceived likelihood and higher scores (3, 4) equal to higher perceived likelihood of achieving REHI45. Specifically, 32

participants (23.5%) had a score of “highly unlikely” or “unlikely” (1 or 2, respectively) and 104 participants (76.5%) had a score of “likely” or “highly likely” (3 or 4, respectively). Residents might have this lower perception for several reasons. These reasons may include the perception of the lack of significant progress to establish a higher percentage of renewable energy on the island to date, beliefs that 100% renewable energy is impossible or undesirable, and low collective efficacy or collective will in the population to achieve the target. Collective efficacy constitutes a groups’ shared beliefs in their ability to produce desired results through collective action. In my study, the group was the target population of residents of North Hawaii County, and collective efficacy was confirmed as a factor in the perceived likelihood of achieving REHI45.

Perceived time urgency and health literacy were also investigated as possible predictors of perceived likelihood. Research has generally supported these constructs as predictors of health (Conte, Mathieu, & Landy, 1998; Menon, Narayanan, & Spector, 2013; Mõttus et al., 2014). Results from this study revealed that perceived time urgency and perceived health literacy were significant predictors of perceived likelihood of REHI45. The target population can be encouraged to put pressure on various levels of government, organizations, institutions, and other entities to help ensure REHI45. This type of social change action might ensure that REHI45 is achieved by 2045 or sooner for overall health in North Hawaii County.

Though increased use of renewable energy and decreased use of fossil fuel energy should benefit global holistic health, there was a gap in the literature pertaining to the theoretical, empirical, and methodological application of health psychology to issues

related to renewable energy goals, climate change, and health. My study addressed this point. Whether or not the factors of collective efficacy, perceived time urgency, health literacy, ethnicity, age, gender, financial strain, or educational level predict a decrease or increase in individuals' perceptions of the likelihood of REHI45 for Hawaii County was an unknown, but now is known. The field of health psychology now has information on these constructs as related to environmental health, something which had not been measured in specific local populations. The determination that collective efficacy, perceived time urgency, and health literacy are significant predictors in the perceived likelihood of reaching REHI45 could play a role as to general health for the residents in this locale.

Perceived Likelihood of Reaching REHI45

Goal monitoring, or the measured identification of discrepancies between a current and desired state, may affect health outcomes. As an activity, goal monitoring reveals the current status of progress toward the outcome of a goal. It assists in decisions on how to apply energy or corrective action to achieve a desired outcome (Harkin et al., 2015). According to a meta-analysis of primarily health studies by Harkin et al. (2015), the literature reflects that goal monitoring promotes goal attainment. The implementation of survey research may constitute goal monitoring in a target population (CDC, 2016; Dora et al., 2017).

Harkin et al. (2015) determined through a meta-analysis that when participants were prompted to monitor progress toward goals, outcomes were affected. This was particularly true for health studies where outcome changes were likelier through

participants monitoring outcomes toward goals versus any specific behaviors of theirs. Research on goal monitoring and health outcomes has included studies that pertain to obesity (Burke, Wang, & Sevick, 2011; Chambers & Swanson, 2012; Oshima et al., 2013; Wang et al., 2012), diabetes (Allemann et al., 2009; Duran et al., 2010; Jennings et al., 2014), heart disease (Blasco et al., 2012; Coen & Curry, 2016), and stress (Logan et al., 2012; Proudfoot et al., 2013; Ralston et al. 2014). Many studies on goal monitoring and health outcomes use biomarkers, such as blood pressure and stress measures, to gauge progress toward wellness or homeostasis. This previous research confirmed the importance of the current research study's assessment of participants perception of the likelihood of achieving REHI45 and how collective efficacy, perceived time urgency, and perceived health literacy are significant factors in those perceptions.

Renewable energy lowers CO_2 emissions for the planet, which increases the likelihood of overall homeostasis in the global system. Residing in a less toxic or polluted environment through a larger percentage of renewable energy use means lower CO_2 emissions and consequently less systemic stress with greater chances of health or wellbeing (Bircher & Kuruvilla, 2014; Watts, 2015).

Goal monitoring of health objectives plays an important role in health outcomes through intervention development and the evaluation of health promotion policies and programs (CDC, 2006; DHHS, 2012; Roy et al., 2009). Goal monitoring was confirmed as an aspect of this research.

Collective Efficacy

This study determined that collective efficacy was a significant predictor of perceived likelihood of achieving REHI45. Collective efficacy can be a factor that makes a difference in goal attainment or achievement, and thus, health outcomes. According to Bandura (2000), collective efficacy is the extent to which we believe that we can work together effectively to accomplish our shared goals. According to Cohen et al. (2008), collective efficacy is best viewed not as simply a "cause", but a construct that incorporates shared environmental aspects that have been connected to positive health outcomes. According to Jugert et al. (2016), collective efficacy influences pro-environmental intentions through the perception that one's group, and therefore one's own self, can effect change.

Carlson et al. (2012) found that interventions that increase awareness may increase collective efficacy, which in turn can have a positive effect on health. Collective efficacy was determined to be a factor in the perceived likelihood of REHI45. Self-efficacy and collective efficacy affect health outcomes, which include health and pro-environmental goal intentions (Barth et al., 2016; Carlson et al., 2012; Jugert et al., 2016; Klockner, 2014; Ludwig et al., 2013; van Zomeren et al., 2008). Collective efficacy, more than self-efficacy, appeared to predict collective climate action and the determination of intentions to participate in reaching community-based pro-environmental goals, such as transitioning from dependence on fossil fuel energy to 100% renewable energy (Homburg & Stolberg, 2006; van Zomeren et al., 2008). In my study, collective efficacy was determined to be a factor in the perceived likelihood of

achieving REHI45, which aligns with Homburg and Stolberg (2006) and van Zomeren et al. (2008), and extends knowledge in this area.

The HBM, which dates to the 1950s (Hochbaum, 1958), embodies many fundamental constructs, including self-efficacy, which predict human behavior patterns to prevent disease or achieve wellness (Glanz et al., 2008). Major theoretical propositions/hypotheses and assumptions of the model are that one's beliefs about health problems affect one's health outcomes. Use of the HBM as a theoretical basis for the current study was confirmed through the determination of collective efficacy as a factor in the perceived likelihood of REHI45.

In the psychology field, self-efficacy predicts health outcomes (DeVellis, 2012; Marks et al., 2011). For some, self-efficacy was best viewed not as the principal indicator of predicting health behavior, but included with similar constructs (Wallston, 2005b). As stated in Chapter 2, in this study, collective efficacy was deemed to be more applicable to the research question in that achievement of REHI45 would constitute a collective rather than individual effort. The application of the HBM in research has been widespread and includes measuring such constructs as self-efficacy and collective efficacy to explain acting or not to improve one's health or the health of a community. Current and ongoing research have utilized the HBM as a major framework in guiding studies. Results revealed that collective efficacy was a significant factor in predicting perceived likelihood of attaining 100% renewable energy on Hawaii Island by the year 2045. This result can be explained by the HBM such that collective efficacy predicts the likelihood of achieving REHI45.

Perceived Time Urgency

Time urgency is the level of urgency ascribed to the performance of a given task and a perceived sense of urgency carries with it an impetus to act (Landy et al., 1991). Time urgency or perceived time urgency (PTU) has implications for health outcomes in that PTU affects behavior (Menon et al., 2013). Regarding health, perceived time urgency can lead a person to act on a disease symptom or not. Or, in the case of health care professionals, PTU affected stress levels and actions taken (Menon et al., 2013; Quan et al., 2013). Regarding health and climate change, perspective taking on the element of time may improve engagement and social action leading to an improved quality of life (Conte et al., 1995; 1998). According to Conte et al. (1995; 1998), more research was needed to link the physiological consequences of time urgency to negative health outcomes. The current research examined and confirmed the interplay between PTU and the likelihood of REHI45. The mean for PTU was 3.69 (*SD* 1.46) indicating higher PTU for the achievement of REHI45.

Temporal dimensions of climate change include ”extension into the future” and “time lag” (Pahl et al., 2014). To many observers, there seems to be a distance between current reality and future projections based on climate change scenarios. Additionally, there appears to be a time lag concerning the effects of carbon emissions today from a distant past plus the impacts to be felt far into the future from current carbon emissions (Pahl et al., 2014). My study indicated that PTU was a significant factor in predicting the perceived likelihood of REHI45. How time urgent a person considers 100% renewable energy to be affects their perception of the likelihood of REHI45 in Hawaii County. This

may be interpreted to mean that lower time urgency has an association with lower scores on the perceived likelihood of reaching 100% renewable energy in Hawaii County by 2045. And, that higher time urgency has an association with a person's greater perceived likelihood of this event. Research on time urgency regarding health, particularly environmental health, which affects individual health, has been limited. My study extended knowledge in this area and future research may shed more light.

Considered to be a multidimensional construct, time urgency has been measured through behaviorally anchored rating scales (BARS), and has important implications for health (Landy et al., 1991). The application of time urgency in research has been limited since the inception of BARS. Time urgency has been studied in the context of Type A personalities (Conte, Schwenneker et al., 2001; Smigelskas et al., 2015; Wright & Schmidt-Walker, 1990; Wright et al., 1992) and in the health field pertaining to what individuals perceive to be emergencies or imperative tasks (Menon et al., 2013; Quan et al. 2013; Wright et al., 1995). In the business arena, time urgency has been included as an attribute contributing to stakeholder salience (Mitchell et al., 1997). As such, urgency was not deemed a steady-state attribute, but rather capable of variance depending on relationships over time.

According to Mitchell et al. (1997), regarding stakeholders, time urgency is met when the nature of a relationship or claim is time sensitive and when the relationship or claim is important or critical. Attending to time urgency serves legal and moral interests of stakeholders (Mitchell et al., 1997). I considered perceived time urgency to be a variable that might predict the perceived likelihood of achievement of REHI45. Pahl et

al. (2014) claimed that the consideration of time is integral to understanding climate change. The temporal context, in their view, has essential implications for addressing climate change responses.

Major theoretical propositions/hypotheses and assumptions for time urgency pertained to how the factor of time urgency influences decision making and behavior. The rationale consisted of observations and evidence that suggested how time matters to thinking and behavior. Links to current research span many disciplines including sociology, economics, health, and others. Time urgency was confirmed theoretically and empirically to relate to the study since the variable perceived time urgency was a factor that predicted the perceived likelihood of achieving REHI45.

Medical emergencies demand quick assessments of the relative perceived time urgency to attend to the medical issue at hand. Transposing the same imperative to the perspectives regarding issues of renewable energy and climate change shifts according to location (Blunden & Arndt, 2016). Hawaii has been considered to be one of the places most vulnerable to the overall adverse effects of climate change, including compromised health from drought, food and water shortages, and superstorms (“State of the Climate in 2015,” 2016). Being energy independent rather than fossil fuel dependent should help buffer these effects. The determination of perceived time urgency as a factor in the target population to the perceived likelihood of REHI45 may help elucidate how to best approach ways to ensure achievement of the REHI45 goal. It has become a regular occurrence in the United States for elected officials to declare states of emergencies in preparation for and in the wake of increasingly severe hurricanes and floods due to

human caused climate change. These environmental emergencies are taking a toll in lives lost and homes destroyed. We are in crises. The current study confirmed that participants perceived time urgency was associated with the perceived likelihood of achieving REHI45.

Perceived Health Literacy

Underlying this study was functionalism, an old and dominant approach in the social sciences (Merton, 1968). Functionalism includes the application of the scientific method to observable phenomena and the organic unity of social systems (Durkheim, 1915). Social systems from a functionalist perspective work to maintain balance or homeostasis. A healthy society manifests positive functionality supporting balance, while a dysfunctional society demonstrates behavior that does not lead to homeostasis (Merton, 1968). The determination that collective efficacy, perceived time urgency, and perceived health literacy were factors demonstrated the alignment of functionalism.

An influence on this balance or positive functionality is the environment in all its aspects. A healthy environment thus supports healthy societies and individuals. Four nested environmental systems that influence health were outlined by Bronfenbrenner's (1979) ecological systems theory (EST). Families, schools, and neighborhoods comprise the microsystem level. The macrosystem level at the top concerns political philosophy and social policy. The macrosystem level pertained most to the social change issue REHI45, since macrosystems concern environmental conditions and pollution, which in turn affect human health. According to Bronfenbrenner (1979), all four-level systems discussed in Chapter 2 (microsystems, mesosystems, exosystems, and macrosystems) are

interconnected. Local community health action, which emphasizes the importance of healthy environments, may engender positive ways to approach the global challenges faced by climate change, ecosystem collapse, and resource depletion. My study aligned theoretically with EST and expanded knowledge in this area.

The Bronfenbrenner model can provide a theoretical framework for examining the political and practical reasons why health initiatives fail (Dooris, 2013). Through the application of the Bronfenbrenner model, social initiatives that promote health while taking into account the macrosystem may improve holistic health for an area. It then follows that localized community health that champions healthy environments may predict positive ways to handle the global challenges faced by climate change, ecosystem collapse, and resource depletion (Dooris, 2013; Mahoney et al., 2009). Localized community health would include resilience as an aspect of health. The current study's determination that collective efficacy, perceived time urgency, and perceived health literacy are associated with the perceived likelihood of achieving REHI45 confirmed the Bronfenbrenner's model of a macrosystem approach.

A significant assumption of systems theory, which is dated back to Aristotle, is that the whole can be understood by examining emerging properties of smaller units or parts (Corning, 2014). According to Corning (2014), a focus on the interplay of dynamics, biology, ecology, and the bioeconomics of living systems with their artifacts was called for to progress scientific understanding. Bronfenbrenner's ecological systems theory examines smaller systems within the whole yet emphasizes the interconnectedness of all the systems. EST can be viewed as an overlapping configuration of interconnected

ecological systems (Neal & Neal, 2013). It has been suggested that EST can be mapped onto the research process as a representation of qualitative, quantitative, and mixed methods research and thus applicable to the health, social, and behavioral fields (Onwuegbuzie et al., 2013). Ecological systems theory was confirmed as a theoretical component of this research study.

New models attempt to integrate a more holistic view in order to understand not just the specifics of life, but the totality of the interconnectedness of being. Building on the work of Bronfenbrenner and others, the Meikirch model of health (MMH) was developed (Bircher & Kuruvilla, 2014) to address the integrative nature of health.

The MMH established a framework for connecting social and environmental determinants of health with individuals' potentials and the demands of life, along with collective action for health. In the model, "Environment", meaning the environmental determinants of health, corresponds to Bronfenbrenner's macrosystem. The model incorporates elements of perceived time urgency and collective efficacy as they relate to environmental health and health as defined in Chapter 1. Ecological systems theory and the Meikirch model of health were confirmed as theoretical frameworks for this study.

Health education and promotion theory is based on ecological models and supports a functionalist approach. Ecological models utilize an approach concerning health and behavior that emphasizes environmental influences. According to Golden and Earp (2012), health education and promotion theory was based on ecological models. Ecological models utilize an approach concerning health and behavior that emphasizes environmental influences (Golden & Earp, 2012). According to Glanz et al. (2008),

health education and promotion underlie health literacy, which pertains to the ability to process information regarding health enabling an individual to make decisions about treatment and prevention. According to Mottus et al. (2014), health literacy predicts poor health, yet reflects overall cognitive ability and educational and or occupational levels that affect health beyond simple numeracy and reading skills. Perceived health literacy was determined to be a factor in the perceived likelihood of REHI45. The mean for perceived health literacy among participants was 11.70 (*SD* = 2.18), reflecting higher perceived health literacy. Thus, health education and promotion theory was confirmed as a theoretical basis for the study.

Health literacy factors into health outcomes. According to Serper et al. (2014), health literacy is an indicator of health. Education can elevate health awareness, which may promote someone to take action to benefit their health. Conversely, low health literacy may adversely affect health (Kobayashi et al., 2014). Health literacy is an evolving concept (Nutbeam, 2008). My study included perceived health literacy as a precursor to environmental health literacy. Perceived health literacy was determined to be a factor in the perceived likelihood of REHI45 which confirmed the inclusion of this construct as a predictor.

According to Fraser, Gupta, and Krasny (2015), there are tools available for environmental education practitioners to address critical social and environmental issues. However, it is important for environmental education researchers to maintain an open mind to the diversity of perspectives and be sensitive to using shared language (Fraser et al., 2015). This study aligned with the research that Finn and O'Fallon (2017) have called

for and confirmed perceived health literacy as a possible precursor to environmental health literacy. The knowledge base concerning research in this direction was extended through my study.

Sociodemographic Variables

Sociodemographic variables can contribute to health outcomes. In the present study, results revealed that ethnicity (Native Hawaiian or non-native Hawaiian), age, gender, educational level, and perceived financial strain did not predict participants' perceptions of the likelihood of REH145. These five sociodemographic variables were not factors and this extends knowledge in the field relative to use of these constructs in predicting the likelihood of renewable energy targets locally and globally.

Limitations of the Study

Study limitations may include sample bias and generalization to other communities. Sample bias could have been the case due to the self-report survey method. Self-report is an issue because it is a subjective measure and the participants may not have answered honestly. To address this possible limitation, no personal identifying information (e.g., name) was collected from participants. Using a rural target population, as opposed to an urban target population, limits generalizability because rural locations, such as North Hawaii County, appear to have less resources available (including funding) to ensure compliance to the REHI45 legislative mandate. Also, roughly a third of the participants were Native Hawaiian and this likely would not be the case in other locations.

Another weaknesses or limitations of the research study is related to selection (non-probability sample). A non-probability sample is a potential limitation because of possible researcher bias in choosing study participants and the lack of generalizability beyond the study's target population (Acharya et al., 2013; Bornstein et al., 2013; Etikan et al., 2016). The rural location of Hawaii County necessitated attention to considerations of culture and for research to adopt a holistic lens for context competency (Kikukawa, 2017). For this reason, inclusion of the Native Hawaiian perspective as host culture in the present study was considered important. Purposive sampling was required to adequately access the Native Hawaiian population for the research.

An item to measure collective efficacy was adapted from the Neighborhood Collective Efficacy: Community Cohesion and Informal Social Control survey (PhenX Toolkit, 2009). An item to measure perceived time urgency was adapted from the BARS and input from experts. Adapting items from these existing instruments might have been a limitation. According to Creswell (2009), the modification of an instrument may compromise validity and reliability. The survey questions were taken from the original measures (except for BHLS) but tailored to the New Hawaii State goal of REHI45 and the research hypotheses (see Appendix A). To address this possible limitation, a panel of experts were consulted to maintain the integrity of the research. The use of the shortened measure of subjective health literacy (the BHLS), might have been a limitation because the measure might not have accurately reflected perceived health literacy. According to Wallston (personal communication August 3, 2016), the BHLS has been used to assess subjective or perceived health literacy (a construct like self-efficacy), rather than

objective health literacy, and is used widely, so validity and reliability should not have been compromised.

Recommendations

Further research is recommended in regard to goal monitoring, which may increase progress monitoring (Tuckey, Brewer, & Williamson, 2002). Tuckey et al. (2002) have called for research on goal monitoring to be done outside of organizational contexts. Further research is needed to understand the determinants of monitoring outside organizational contexts and how features of the focal goal, the situation, and the person combine to influence progress monitoring (Tuckey et al., 2002). It might also be important to identify the most effective way to monitor goal progress in various contexts, including policy change. This is especially true regarding REHI45 as volcanic eruptions have affected progress toward 100% renewable energy on Hawaii Island (HPR, 2018).

It should be noted that for approximately two years the local power company had been including renewable energy updates in monthly newsletters that went out with electric bills. At the time of the survey, renewable energy on Hawaii Island was about 55% (Hawaii Electric Light Company [HELCO], 2018b). After the survey, the Kilauea volcano erupted and forced the temporary and possibly permanent shut-down of geothermal energy, which had been supplying approximately 25% of the island's renewable energy (Hawaii Public Radio [HPR], 2018; HELCO, 2018c). How this event will affect the perceived likelihood of REHI45 and goal progress remains to be seen. Currently, fossil fuel energy has compensated for the geothermal energy generation loss and renewable energy is supplying about 30% of the total output on Hawaii Island

(HELCO, 2018c & d). The island of Kauai has now become the most progressive toward the state's renewable energy goals with approximately 50% renewable energy. Perceived time urgency for renewable energy among North Hawaii residents may have increased since the survey due to the change of circumstances because of the ongoing volcanic eruption. The president of the island wide power company publicly stated his dismay at the loss of geothermal power from renewable energy power sources on the island (HPR, 2018).

Perceived time urgency may be high among participants in this study, but governmental action may be slow toward goal achievement. An encouraging development was that on June 22, 2018, the Hawai‘i Public Utilities Commission ("PUC") issued a landmark ruling requiring Hawaiian Electric Company ("HECO"), Hawai‘i's largest electric utility, to partially share in the costs of fossil fuels it uses to generate electricity, rather than its traditional practice of passing 100% of the costs onto its customers. This ruling should give the utility a direct financial incentive to accelerate the shift from imported oil to cheaper renewable energy sources (State of Hawaii Public Utilities Commission [PUC], 2018). However, given that scientists have called climate change a global emergency and local North Hawaii resident's perceptions indicate their urgency for action on this issue, it now seems imperative that collective political will and positive social change action work to step up the pace of a shift to 100% renewable energy in Hawaii County.

Implications

Raising awareness or raising consciousness has been considered important in the earlier stages of measuring a readiness to quit smoking (Beiner and Abrams, 1991). Prochaska et al. (1988) cited consciousness raising as the first step in changing health behavior related to smoking cessation. Monitoring the perceived likelihood of REHI45 has implications that may lead to a change in health behavior through raising awareness in North Hawaii. By monitoring the perceived likelihood of REHI45, this study may lead to a change in health behavior. Any behavior change that helps lower CO_2 emissions, greenhouse gases, or toxic air pollution would be welcomed as beneficial to the environment and overall health in the region. Raising awareness is a pertinent first step (Beiner & Abrams, 1991). The act of bringing awareness to people on matters related to climate change are communications that may foster collective efficacy, which are important to increasing pro-environmental actions (Jugert et al., 2016). Collective efficacy was determined to be a factor in the perceived likelihood of REHI45 and may affect pro-environmental engagement locally for the sake of health. Goal monitoring was explored in this study and indications were that this study helped raise awareness in the target population of REHI45. I encountered several participants who were unaware that the target of 100% renewable energy in Hawaii by the year 2045 was mandated by the state in 2015 (University of Hawaii, 2015). According to Harkin et al. (2015), goal monitoring promotes goal achievement and even a one-time assessment can make a difference (Haque et al., 2017). The act of bringing REHI45 related awareness to the target population in this research study appeared to have potential health benefits in that it

might promote goal attainment as outlined by Biener and Abrams (1991) and Prochaska et al. (1988) regarding health targets. In my study, the perceived likelihood of renewable energy progress was measured via a self-report survey, rather than a biomarker. Monitoring the perceived achievement of REHI45 may improve health outcomes locally and extends knowledge in this area.

The survey acted as a means for raising awareness in participants who were less informed regarding REHI45 and focusing attention for those who were informed. Whether this would prompt increased goal monitoring or feedback seeking both individually and collectively is an open question. Tuckey, Brewer, and Williamson (2002) found that a desire for useful information was associated with increased feedback seeking, and on the other hand, the desire to protect one's ego and defensive impression management were associated with reduced levels of feedback seeking on performance levels.

Environmental health literacy (EHL) has been defined as an understanding of the connection between environmental exposures and human health (Finn & O'Fallon, 2017). EHL may be a factor in health outcomes related to the environment. Morrone et al., (2001) devised a metric to measure environmental literacy and some research has been done on public health literacy, but no specific standard instrument had been developed for environmental health literacy. Finn and O'Fallon (2017) called for the measurement and development of interventions that addressed a person's understanding of the connection between environmental exposures and human health. New tools to promote EHL were needed according to Cleary et al. (2017). Some of these tools might

incorporate the climate mitigation actions outlined by Wynes and Nicholas (2017). EHL was not included as an independent variable in the present study; however, possible future health literacy and environmental health literacy interventions may be developed in tandem.

Conclusion

According to Landrigan et al. (2017) in the Lancet Commission on pollution and health, pollution has been determined to be the largest environmental cause of disease and premature death globally. An estimated 9 million premature deaths in 2015 (16% of all deaths globally) stemmed from diseases caused by pollution (Landrigan et al., 2017). Unhealthy and unsustainable development, including the use of fossil fuel energy sources, leads to pollution (Neira et al., 2017). The establishment of targets and timetables for healthy development, including the shift to renewable energy sources, are needed to ensure healthier environmental and social conditions worldwide (Dora et al., 2015; Landrigan et al., 2017; Neira et al., 2017). The continued use of fossil fuel energy sources impacts health negatively globally, particularly in vulnerable locations such as Pacific islands (Hansen et al, 2016; Landrigan et al, 2017; Neira et al., 2017). A report from the American Psychological Association (2018) on climate and health indicated that climate change is a health emergency and that health professionals have an obligation to discuss the issue with patients, peers, and elected officials at every level.

More research was needed to determine internal and external factors that contribute to the capacity and willingness to adopt renewable energy systems (Hong et al., 2015). Psychology research has been limited in the assessment of various populations

regarding constructs related to environmental health, which might impact individual health (Bircher & Kuruvilla, 2014; Freedman et al., 2014; Hoover, 2015; Wickens, 2015). Collective efficacy, perceived time urgency, and health literacy were deemed to be such constructs or factors and have been empirically validated through this study. Determining the factors associated with the perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045, referred to as REHI45, was aligned with the direction of research called for by Bircher and Kuruvilla (2014), Freedman et al. (2014), Hoover et al. (2015), and Wickens et al. (2015).

Intervention programs and/or preventive measures might possibly be designed based on this research to promote overall long-term health in North Hawaii County. The determination that the factors of collective efficacy, perceived time urgency, and perceived health literacy are associated with the perception of the likelihood of reaching 100% renewable energy in North Hawaii County (Hawaii Island) by the year 2045 may help tailor education, interventions, or programs in North Hawaii and elsewhere to increase awareness, effect social change, and prompt policy change. Individuals, organizations, institutions, cultures, and societies may benefit from the results of this study through its ability to raise awareness of factors that influence the perceived likelihood of achieving REHI45.

There was a gap in the literature regarding human environmental health issues pertaining to renewable energy, climate change, and the shift from a fossil fuel culture to a renewable energy culture. The literature had not adequately elucidated links between health, renewable energy, and climate change. Studies examining connections between

holistic health, health education and promotion, preventative health, renewable energy goals, and goal monitoring had not been adequately explored. Specifically, studies related to predictors of the likelihood of achieving 100% renewable energy under state mandates. This study fills a gap in the literature by using an empirically based research methodology to determine the factors associated with residents' perception of the likelihood of reaching 100% renewable energy on Hawaii Island (Hawaii County) by the year 2045.

According to Singer et al. (2017), through an in-depth energy analysis, the world could meet all its energy needs with renewable energy only by 2050. To do so, individuals, communities, and businesses, not simply governments, need to urgently implement change now (Landrigan et al., 2018). Doing so will help mitigate climate change, bring about less pollution, increase energy security (this may be a critical factor in Hawaii), and improve health globally (Landrigan et al., 2018; Singer et al., 2017).

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Appendix A: Health and Environment Survey

Please check the box after each question or statement that best reflects your response or position. There are no right or wrong answers.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. The area of North Hawaii is a close-knit (tight) community.	☐	☐	☐	☐
2. People in North Hawaii generally do not get along with each other.	☐	☐	☐	☐
3. Overall, people in the North Hawaii area do not share the same common values.	☐	☐	☐	☐
4. North Hawaii is a place where people work well together in groups to achieve goals.	☐	☐	☐	☐

5. If the police were unable to control a group of children who spray-painted graffiti on local buildings, how likely do you think the North Hawaii community would work together to do something about it?

Very Likely	Likely	Unlikely	Very Unlikely
☐	☐	☐	☐

6. If there were insufficient funds to rebuild your local library after an earthquake, how likely do you think the North Hawaii community would work together to raise money and rebuild it?

Very Likely	Likely	Unlikely	Very Unlikely
☐	☐	☐	☐

7. By what year should 100% of Hawaii Island's energy come from sources other than fossil fuel?

☐ 2025 or earlier ☐ 2035 ☐ 2045 ☐ 2055 ☐ 2065 or later ☐ never

8. What is the likelihood that Hawaii Island (Hawaii County) can achieve for itself the state of Hawaii's goal of 100% renewable energy by 2045?

□ Highly Unlikely □ Unlikely □ Likely □ Highly Likely

The next items are about finances and medical issues.

9. How difficult is it for you (and your family) to pay your monthly bills?

□ Not at all difficult □ Not very difficult □ Somewhat difficult □ Very difficult

10. How often do you have problems understanding information about your health and health services?

□ Never □ Occasionally □ Sometimes □ Often □ Always

11. How confident are you filling out medical forms?

□ Extremely □ Quite a bit □ Somewhat □ A little bit □ Not at all

□ Question does not apply (I have not filled out medical forms.)

12. How often do you have someone help you read hospital or other medically related materials?

□ Never □ Occasionally □ Sometimes □ Often □ Always □ Question does not apply

The next items are about gender, ethnicity, age, and education.

13. What is your gender?

□ Male □ Female

14. Are you Native Hawaiian?

□ Yes □ No

15. What was your age on your last birthday? _____ (please fill in the blank).

16. Please check the box that reflects your educational level.

- ☐ Less than high school graduate
- ☐ High school graduate (includes equivalency)
- ☐ Some college or associates degree
- ☐ Bachelor’s degree
- ☐ Graduate or professional degree

Appendix B: Island of Hawaii Lava-Flow Hazard Zones Map

The Wright et al. (1992) U.S Department of the Interior, U.S. Geological Survey lava-flow hazard zone scale ranges from 1 (most dangerous/active) to 9 (safest/least active). The area of North Hawaii roughly corresponds to lava-flow hazard zone number 9 shown in the U.S Department of the Interior, U.S. Geological Survey Map below. A triangular portion of North Hawaii that borders Highway 19 between the towns of Waimea and Honokaa is within lava-flow hazard zone number 8 as shown in the inset Google Maps [Kawaihae] (2017). North Hawaii is north (upward) from Highway 19 on the inset map.