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Honors Thesis

EDUCATIONAL INTERVENTION ON
RHEUMATIC HEART DISEASE IN SAMOA

by
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Submitted to Brigham Young University in partial fulfillment of graduation requirements
for University Honors

Department of Public Health
Brigham Young University
June 2021

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ABSTRACT

EDUCATIONAL INTERVENTION ON RHEUMATIC HEART DISEASE IN SAMOA

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Bachelor of Science

This paper reviews the impact of rheumatic heart disease (RHD) in Samoa and assesses the effectiveness of a caregiver education intervention by using data collected during the 2019 Rheumatic Relief Program trip. A pre- and post- survey collection tool was used to evaluate the effectiveness of current educational efforts among Samoan child caregivers. Dr. Richard Gill and Dr. Lori Allen, who are both BYU Department of Biology professors and Rheumatic Relief directors, participated in the creation of this program evaluation and completion. This project aims to assess the current caregiver education intervention program used in Rheumatic Relief and provide clear and actionable program recommendations for the Rheumatic Relief caregiver education intervention using the seven phases of the *Evidence-Based Planning Framework for Public Health*. Results of evaluation indicate caregivers have a high level of understanding regarding causes of strep throat and proper treatment of strep throat,

resulting in only modest gains of knowledge as a consequence of existing caregiver understanding. Nevertheless, the aforementioned results create an opportunity to continue refining health education approaches among caregivers and develop quality and groundbreaking health education interventions for Samoan caregivers resulting in increased knowledge and self-efficacy of Samoan caregivers as they improve their child's environment, prevent or treat strep throat infections and seek medical care for their children.

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Introduction

Rheumatic Heart Disease as a Global Health Problem

Public health is an art and science dedicated to preventing disease, prolonging life and promoting health. Ensuring children are protected throughout their childhood development from infectious disease is a public health priority that is an essential part of making a long and healthy life possible. Within global health, common childhood infections, such as strep throat, are connected to the development of noncommunicable diseases such as rheumatic heart disease (RHD). Noncommunicable disease, such as RHD, strip children of numerous years of healthy living. Furthermore, childhood infectious such as strep throat, are now controlled and treated regularly in higher income countries, such as the United States, but regularly effect children of lower income countries which leads researchers to believe RHD is a disease amplified by impoverished environments and highlights a preventable health inequality (Cannon et al., 2017). Public health and medical professionals are becoming increasingly concerned about the dual presence of infectious and non-communicable diseases in low and middle income countries because of the burden it can place on individual lives and medical care systems (Remais et al., 2013). Researchers also indicate there are straightforward solutions available to prevent infectious and non-communicable diseases at relatively low cost, but they must be developed and researched to fit the target population (Remais et al., 2013).

Rheumatic heart disease rates in the Pacific Islands of Samoa are a concern for global health workers because it is the most common cause of heart related illness in individuals under 25 years of age (Saxena et al., 2017). Furthermore, research indicates

RHD exists at an annual incidence rate of about 66 per 100,000 and prevalence rate of 3 per 1,000 (Viali, 2006). More recent evaluation conducted in 2017, indicated RHD related mortality among Samoan children is disproportionately high, impacting 10 out of every 1000 children (M. Allen et al., 2017). Using a standardized rate of comparison, in 2017, Years of Life Lost (YLLs) due to rheumatic heart disease in Samoa was 78.66 per 100,000 (*GBD Compare*, n.d.). The global rate of RHD YLLs is 25.09 per 100,000 (GBD Compare, 2019) and within the United States the RHD YLLs rate is about 3.59 per 100,000 (GBD Compare, 2019).

While regular data updates regarding RHD rates in Samoa are not available and there is no systematic screening system for RHD on a national level, health professionals are convinced RHD rates in the country remain underestimated because RHD positive individuals remain undiagnosed until disease progression is fatal (Marijon et al., 2012). From a public health standpoint, RHD prevention interventions would be the ideal solution to decreasing the incidence and prevalence of RHD, however, there are few academically evaluated resources available that explore methods of health education and RHD prevention among children or their caregivers (L. Allen et al., 2017). The evaluation of the Rheumatic Relief caregiver education intervention will help researchers understand the consequence of health education efforts and provide data driven logic for future health education among Samoan caregivers.

Rheumatic Relief Public Health Education Intervention

Rheumatic Relief began in 2009 as a nonprofit organization in cooperation with, first, Utah Valley University and subsequently with Brigham Young University. This program functions using an interdisciplinary approach consisting of public health,

Samoa culture, cardiology, genetics, and microbiology experts to alleviate the incidence and prevalence of RHD in Samoa through prevention and primary medical attention. This program works in conjunction with the Samoan Ministry of Health and Samoan Ministry of Education to provide community supported medical care and education for children attending primary school. Over the past 12 years, the program has flourished into a viable clinical, educational and research program providing experiential learning opportunities for health professional students and saved the lives of hundreds of Samoan children fulfilling their mission statement to:

“Reduce the burden of childhood Rheumatic Heart Disease through:

1. Health Promotion & Education

2. Echocardiographic Screening

3. Follow-up and Genetics Research (Rheumatic Relief, 2021)”

The genesis of the Rheumatic Relief program is based upon proven need for improved clinical protocol and prevention interventions related to RHD. To date, the Rheumatic Relief program has served over 11,000 children in Samoa while contributing to essential breakthroughs in program planning and evaluation of RHD conditions. The future of this program is dependent upon ongoing collaboration with the Samoan Ministry of Health and Rheumatic Relief program innovation in order to address root causes of RHD among Samoan children. The Rheumatic Relief program is dedicated to evaluation efforts facilitating the improvement of health education efforts. The objective of evaluation regarding the caregiver education intervention is to improve the next year of caregiver health education provided by the Rheumatic Relief Program.

Evidence-based Program Planning Framework

Public Health professionals use program planning frameworks to guide effective program creation because frameworks offer logical and adaptable steps to take during the program planning process. Frameworks are a reliable method for program development because each phase can help facilitate the creation of programs that help improve health outcomes (Washington University of Prevention Research Center, 2015). The Evidence-based Planning Framework (EBPF), while not a developed planning model per se, contains many similar elements of different planning models, such as MAPP or the Generalized Planning Model, and remains a viable structure of seven phases that can be used by public health professionals (Washington University of Prevention Research Center, 2015). The strengths of the EBPF are associated with the commonalities it has with the most common and basic elements of any planning model while allowing for program specific modification promoting fluidity, flexibility, and functionality. In this framework, a program is evaluated sequentially from phase 1 through phase 7, providing actionable items that can be used to modify and improve a public health education program.

In this evaluation, phase 1–4 of the Evidence-based Planning Framework for Public Health will be presented as summarized sections containing relevant background information regarding RHD and the Rheumatic Relief health promotion and education. The Rheumatic Relief caregiver health education intervention will be presented using phase 5–7 of the Evidence-based Planning Framework for Public Health. For a summarized explanation of each phase of the Evidence-based Planning Framework see Table 1.

Evidence-Based Planning Framework for Public Health		
Phase 1	Community Assessment	Understanding the community context, characteristics and circumstances that define the community to know how to implement programs most effective to them.
Phase 2	Quantifying the Issue	Use of descriptive epidemiology derived from surveillance systems and other secondary data sets.
Phase 3	Developing a Concise Statement of the Issue	Summarizes an analysis of root causes of the most significant health problems in the community.
Phase 4	Determining What is Known Using Scientific Literature	Identify evidence-based solutions related to the root causes and related problems identified in the statement of the issue.
Phase 5	Developing and Prioritizing Program and Policy Options	Prioritize specific interventions or action steps.
Phase 6	Developing an Action Plan and Implementing Interventions	Goals and objectives are developed and action strategies are planned.
Phase 7	Evaluating the Program or Policy	Planners take measures to improve the existing program or policy.

Table 1 Evidence-based Planning Framework for Public Health Washington University of Prevention Research Center, 2015

Phase 1: Community Assessment

Location & Natural Environment

Samoa is nestled south of the equator within the South Pacific Ocean. Samoa consists of two main islands, Savai'i and Upolu with a consistent tropical and humid climate providing the ideal climate for lush inland



Figure 1 Map of Samoa Islands

rainforests (*Samoa*, n.d.). Annual mean precipitation in Samoa is 3000 to 6000 millimeters with a mean annual temperature of 78.8 – 87.8 degrees Fahrenheit and humidity level of about 80% or above (*CLIMATE OF SAMOA*, n.d.). The combination of high temperature, precipitation and humidity provides an ideal environment where bacteria, in particular Strep A, can incubate.

Social Context

Villages are often founded on traditional governance systems known as Fa'amati and a national European-style parliamentary system where public services are overseen by a ministry system. The structure provided by the two governance systems, has influenced the creation of a public healthcare and education system (*Ministry of Health Samoa*, n.d.). Samoa has graduated from the United Nations list of Least Developed countries within the past five years, however, it remains an economically developing

country (Country Classification, 2014). The estimated population of Samoa in 2015 was 193,483 with 76% of the population living on the island of Upolu and 24% in Savai'i (Ministry of Health Samoa, n.d.).

Samoa families are considered an essential part of personal and community life and highly influence decisions made on an individual level (Norris et al., 2009). According to the Samoan Bureau of Statistics, 47% of the population is in age dependent groups (Ministry of Health Samoa, n.d.). Data from the World Bank suggests life expectancy at birth to be trending upward, from 56.9 years in 1960 to 73.3 years in 2019 (Samoa | Data, n.d.). Anthropologically, Samoan culture is based on foundational values of respect, hospitality, and faith. Along with the strong foundational values, child caregivers, who are typically biological parents or a close family relative, play a large role in supporting children to successfully attain and maintain a healthy lifestyle. It is common for mothers to walk children to school and wait in small groups near the school while children complete their school day. Parents and caregivers who stay at school with children also provide them with lunch during class breaks, watch the children as they play during recess, and interact with school staff, such as principals, on a regular basis.

Healthcare Access & Attitudes

According to most recent data sets provided by the World Bank, in 2007 there was 1 hospital bed available per 1,000 people (World Bank- Samoa, 2007). In 2016, there was less than 1 doctor available per 1,000 people (World Bank- Samoa, 2007). There are currently 12 hospitals and healthcare centers located within the two main islands of Samoa that attempt to deliver services within home and community settings (Ministry of Health Samoa, n.d.) There is no set number of hospitals recommended by

organizations such as the World Health Organization (WHO), or World Bank, for a country, but the WHO and World Bank do indicate that within public and private settings there should be about 5 hospital beds available per 1,000 inhabitants in a population (*Indicator Metadata Registry Details*, n.d.).

Currently, Samoans are known to use a combination of traditional medicine, often relying on herbal remedies, and Western Medicine (Krosch, 2010; Norris et al., 2009). Although some Western medicine is implemented within Samoa, native Samoans often seek alternative medical care through a traditional Samoan healer providing massage or herbal remedies (Krosch, 2010). Additionally, an important cultural practice to note is the importance of families. Families in Samoa are tight knit units with significant care and support offered by a mother, or motherly figure. As previously mentioned, parents or caregivers of children help support the attendance of children at school. Similarly, decisions about medical treatment are at times made on an individual level while being influenced on a family level by individuals such as mothers, or caregivers (Krosch, 2010).

Phase 2: Quantifying the Issue

Researchers concur rheumatic heart disease is a major health problem and hazard to developing countries (Kumar & Tandon, 2013; Viali, 2006). The World Health Organization (WHO) estimates that ARF and RHD affects 12 million people in developing countries, with the majority of incidence occurring within children 5 to 15 years of age (Viali, 2006). The Samoan Ministry of Health has been concerned with the prevention and control of RHD since the early 1980s (Viali, 2006). They also admit

noncommunicable diseases are the biggest health challenge in Samoa (*Ministry of Health Samoa*, n.d.).

RHD research efforts indicated 48% of heart related diagnoses were associated with RHD in 2004 and 52% of heart related diagnoses were related to RHD in 2005 (Viali, 2006). According to evaluation conducted in 2006, the main cause of death in Samoa between the years 1997-2000 were circulatory/cardiovascular diseases and caused about 30% of annual deaths (Viali, 2006). Between 2004 and 2005, there were 118 new cases of RHD identified, giving an annual incidence rate of RHD of about 66/ 100,000 and prevalence rate of 3 per 1,000 (Viali, 2006). Recent evaluation conducted in 2017, indicated RHD related mortality among Samoan children is disproportionately high, impacting 10 out of every 1000 children (M. Allen et al., 2017). In 2017, Samoa's rate of Years of Life Lost (YLLs) due to rheumatic heart disease was 78.66 per 100,000 (*GBD Compare*, n.d.). This rate remains above the global rate of 25.09 per 100,000, and the United States rheumatic heart disease rate of 3.59 per 100,000 (GBD Compare, 2019).

Phase 3: Developing a Concise Statement of the Issue

Samoa has a high incidence and prevalence rate of RHD. The issue is in part due to the lack of medical treatment offered during childhood cases of acute strep A infection. The lack of treatment at an early stage allows for a treatable infectious disease to progress to an insidious undetectable autoimmune disease that usually becomes apparent to medical professionals at a stage when surgery is the only possible intervention. While Samoan health professionals recognize RHD as a noncommunicable disease of concern, there are currently no evidence-based health education interventions available that fit the

cultural context of countries such as Samoa and teach parents and caregivers about prevention approaches.

Phase 4: Determining What is Known using Scientific Literature

Strep throat & Rheumatic Heart Disease

Group A streptococcus is connected to a number of human infections but is commonly associated with cases of sore throats (Marijon et al., 2012; Zühlke et al., 2017). Incidence of group A streptococcus and acute rheumatic fever (ARF) peaks between 5 and 15 years of age but, while considered a rare occurrence, has been known to occur in humans over the age of 30 (Zühlke et al., 2017). Acute rheumatic fever often occurs 3 weeks after initial infection with group A streptococcus (Marijon et al., 2012). Acute rheumatic fever is the precursor disease to many cases of rheumatic heart disease because it can cause permanent valve damage and heart failure due to recurrent bouts of rheumatic fever (Marijon et al., 2012).

Rheumatic heart disease is often overlooked by media and policy makers, but causes most of the cardiovascular morbidity and mortality in young adults and children globally (Liu et al., 2015; Marijon et al., 2012). Researchers believe most rheumatic heart disease patients remain asymptomatic until the age of 20–50 years of age when many experience symptoms such as onset of shortness of breath, or complications, specifically related to the heart (Marijon et al., 2012). Researchers also remain concerned about the RHD because of investigation indicating 66% of patients diagnosed with RHD had no previous diagnosis of Rheumatic Fever (Beaton et al., 2017). This type of information may indicate that patients with Rheumatic fever either did not seek medication attention for their condition or they were mis-diagnosed (Beaton et al., 2017).

Rheumatic heart disease is difficult to detect in countries such as Samoa because permanent damage brought on by the RHD condition is not visibly detectable. Samoan patients who are diagnosed with RHD are usually in the late stages where patients have arthralgia (sore joints), debilitatingly painful arthritis and severe symptoms of heart failure (Viali, 2006). Unfortunately, many patients are who are symptomatic require invasive heart surgery to correct the heart valve damage caused by RHD (M. Allen et al., 2017; Saxena et al., 2017). Sonography has been a proved method among children to help identify pre-clinical cases (Liu et al., 2015; Saxena et al., 2017). Monthly penicillin shots are also a proven method for treating RHD using a non-evasive approach (Liu et al., 2015).

Current Recommendations & Gaps of RHD Prevention & Treatment

RHD is a disease of the developing world that can be easily treated. Guidelines often emphasize intervention methods such as penicillin and antibiotic prophylaxis to prevent recurrent episodes of acute rheumatic fever as feasible and cost effective methods of treatment (Marijon et al., 2012). Early detection and planned treatment is recommended for areas in which rheumatic heart disease is endemic and where screening is possible (Marijon et al., 2012). While RHD treatment exists, what researchers seem to lack are evaluated and effective approaches to RHD prevention. Furthermore, while RHD remains more prevalent within developing nations, prevention efforts need to take into consideration aspects of program development that address cultural relevancy.

The United Nations Millennium Development Goals support global health efforts working to progress child-health-focused education among healthcare professionals in order to lower the occurrence of death among children (Jones et al., 2016; Viali, 2006).

While primary level treatment is essential to decrease RHD infections, early treatment of strep throat can also help prevent cases of RHD. Strep throat, often referred to as a sore throat, is a common condition among children, but within Samoa it is usually left untreated. Caregivers may not realize the relation between a sore throat infection and later life complications with RHD. Education efforts among caregivers can help prevent early childhood strep infection among children and adolescents thus curbing later cases of RHD and years of disability.

Specific Aims of Rheumatic Relief Caregiver Intervention Analysis

Based on the results presented in phase 1– 4 of the Evidence-based Planning Framework for Public Health, the Rheumatic Relief Caregiver intervention was evaluated based on phases 5 – 7 of the Evidence-based Planning Framework for Public Health.

Phase 5: Develop and Prioritize Program Options

To complete phase 5, data from a community assessment was integrated into the design of the caregiver health education intervention to provide scientifically guided reasoning regarding the intervention approach of public health education delivered by primary school principals.

Phase 6: Develop Action Plan and Implement Intervention

To achieve the aim of phase 6, an educational delivery protocol was created to include details regarding the design, visuals, translation and delivery of health education among Samoan caregivers.

Phase 7: Evaluation of Program— Analysis of Pre-/ Post- Caregiver

In this phase, data was collected during the 2019 medical trip from caregivers who attended caregiver education meetings at the schools visited by the Rheumatic Relief program following the previously created health education protocol. Data was considered with the perspective provided by phase 1–6 of the Evidence-based Program Planning framework.

Methods

Phase 5: Identifying Primary School Principals

An assessment aimed at identifying how often principals interacted with caregivers and evaluating the caregiver perceptions of principals was conducted during a prior trip to Samoa. This information was evaluated and used to make a culturally conscious decision regarding the designated instructor for the health education intervention.

Phase 6: Educational Plan Development—Design, Visuals, Translation, Delivery

Each primary school principal was introduced to a decision-making model focused on teaching caregivers about the signs, symptoms and treatment procedure for strep throat. Each principal was given instruction for about 5-10 minutes prior to a caregiver meeting. Instruction was given by a public health student and/or professor, and translator. Principals assisted the Rheumatic Relief team in the distribution of the pre-survey to caregivers attending the meeting. After completion of the pre-survey caregivers were given a 30-minute lesson following the decision-making model for rheumatic heart disease prevention and treatment. This phase of the study was to determine whether, or not, attitudes changed and if RHD knowledge was gained by determining the immediate

efficacy of principal-run health education meetings material within 30 minutes of the presentation.

Phase 7: Evaluation

Data Collection Methods

A seven-item *pre survey* asked for the name (which was changed into an identification number to match pre and post responses), age, and gender of each participant. Participants were asked a question on attitude towards their child's healthcare (I trust doctors and nurses/ I do not trust doctors and nurses/ I trust doctors and nurses but prefer a village healer), if a sore throat was a serious medical condition (yes/no), whether or not their child had a sore throat (yes/no) and if so, what would they do for the child (take them to a doctor for medicine/take them to a village healer/ give them lemon juice/nothing, let it pass), and if they had ever heard of RHD (yes/no) or known anyone with RHD (yes/no).

A five-item *post survey* asked for names of participants, in order to be matched with pre- response. Caregivers were then asked the following questions again to see if responses changed after the principal-run meeting: attitude towards their child's healthcare (I trust doctors and nurses/ I do not trust doctors and nurses/ I trust doctors and nurses but prefer a village healer), if a sore throat was a serious medical condition (yes/no), and what would they do for their child if they had sore throat (take them to a doctor for medicine/take them to a village healer/ give them lemon juice/nothing, let it pass). A last question was asked to determine mode of transportation to the nearest hospital or medical clinic (walking/driving/bus).

At the end of the presentation, after post- surveys were collected, caregivers were given time to ask follow-up questions about the presented information. Each parent was given an informational card with location information about medical clinics on each of the islands. It is important to note that only caregivers who attended the whole meeting were asked to complete a survey. Caregivers who came halfway through the principal's informational meeting or left early were not asked complete the survey.

Data Analysis Methods

This program analysis is conducted using the Evidence-based Program Planning model as a guide to understand factors effecting RHD rates in Samoa as well as justification of health education efforts among Samoan caregivers. Phase 7 of the Evidence-based Program Planning Model was used to highlight the caregiver health education intervention. R software was used to analyze responses given on the pre- and post- survey of the 2019 Rheumatic Relief trip. Each of set of survey question responses were separated and analyzed for counts and proportions. This data was then used to create constructive caregiver health education recommendations.

Rheumatic Relief Caregiver Health Education Intervention Evaluation

Results

Phase 5: Developing and Prioritizing Program and Policy Options

Initial efforts of the Rheumatic Relief health promotion program focused on child health education. After conducting evaluation, there was evidence of child health education effectiveness and potential for improving child health outcomes by also

educating parents (L. Allen et al., 2017). An initial survey of perceptions of community members also revealed authority of principals in the community.

Phase 6: Developing an Action Plan and Implementing Interventions

Caregivers were selected from the two main islands of Upolu and Savaii pertaining to a total of 21 pre-selected schools. Participants qualified to participate in the study by being an invited caregiver of a child who attended the chosen primary school. Schools were chosen through an ongoing agreement with the Samoan Ministry of Health. All schools participating in the program this year were government run schools apart from a Seventh-day Adventist school. Caregivers participated in the study on a voluntary basis. Caregivers who were invited to participate in this evaluation had a child enrolled in a participating school between the age of 5-15 years of age. Compensation was provided in the form of a free program pen, and auscultation from a program doctor for each caregiver at the end of their participation.

Phase 7: Evaluating the Program or Policy

Results. The caregiver parent health education evaluation was conducted using a total of 283 responses, 246 (86.9%) of which were female and 37 (13.1%) Male. Caregiver age ranged from 16 to 78 with 59.9% of participants ranging from age 25-44. Within the sample of 283 respondents, 70.1% responded that they had heard of rheumatic heart disease. When asked if they knew someone with rheumatic heart disease, 69.6% of respondents indicated they did not know someone with rheumatic heart disease.

Over 80% of participants responded correctly on the pre-intervention survey before the caregiver health education intervention (Table 2).

	Pre-Survey	
	Counts	Proportions
Attitude	230	0.836
Serious	267	0.950
Treatment	248	0.882
Heart	248	0.876

Table 2 Caregiver Pre- Intervention Survey Results

To evaluate for strong impediments to using western medicine solutions to treat strep throat infections, participants were asked about their attitude toward medical professionals and treatment, 230 (83.6%) responded I trust doctors and nurses, 11 (4%) responded I do not trust doctors and nurses, and 34 (12.4%) responded I trust doctors and nurses but prefer a village healer. When asked if a sore throat is a serious medication condition, 267 (95%) responded Yes and 14 (4.98%) responded No. Participants were also asked about preference in treatment, 248 (88.3%) participants responded take them to a doctor for medicine, 12 (4.3%) responded take them to a village healer, 21 (7.5%) responded give them lemon juice and 0 (0.0%) responded nothing, let it pass. When asked if a sore throat can cause a life-threatening heart disease, 248 (87.6%) responded Yes and 35 (12.4%) responded No.

Over 90% of participants responded correctly on the post-intervention survey after the caregiver health education intervention was presented (Table 3).

	Post Survey	
	Counts	Proportions
Attitude	262	0.922
Serious	272	0.951
Treatment	269	0.947
Heart	274	0.965

Table 3 Caregiver Post- Intervention Survey Results

Each question of the pre- Caregiver Health Education Intervention was asked again to test for change in response after the health education intervention. When asked if a sore throat is a serious medical condition, 272 (95.1%) responded Yes and 14 (4.9%) responded No. When asked if a sore throat can cause a life-threatening heart disease, 274 (96.5%) responded Yes and 10 (3.5%) responded No. When participants were asked again to respond regarding preference in treatment, 269 (94.7%) responded take them to a doctor for medicine, 4 (1.4%) take them to a village healer, 11 (3.9%) responded give them lemon juice and 0 (0.0%) responded nothing, let it pass. To evaluate for strong impediments to using western medicine solutions to treat strep throat infections, participants were asked about their attitude toward medical professionals and treatment, 262 (92.3%) responded I trust doctors and nurses, 6 (2.1%) responded I do not trust doctors and nurses and 16 (5.6%) responded I trust doctors and nurses but prefer a village healer. A final question asked about access to transportation, 33 (11.6%) responded walk, 210 (73.7%) responded drive, and 42 (14.7%) responded bus.

Participation in the caregiver health education intervention resulted in an increase of correct responses post- caregiver health education intervention (Table 4).

	Count Comparison		
	Pre Survey	Post Survey	Difference
Attitude	230	262	+ 32
Serious	267	272	+5
Treatment	248	269	+21
Heart	248	274	+26

Table 4 Caregiver Intervention Pre-/Post- Count Comparison

It is important to note that participants began with a high level of RHD–related understanding (80% of participants responded correctly) on the pre- intervention survey. This resulted in minor increases in knowledge as indicated on the post- intervention survey and based on proportion comparisons (Table 5).

	Proportion Comparison		
	Pre Survey	Post Survey	Difference
Attitude	0.836	0.922	+0.086
Serious	0.950	0.951	+0.001
Treatment	0.882	0.947	+0.065
Heart	0.876	0.965	+0.089

Table 5 Caregiver Intervention Pre-/Post- Proportion Comparison

Discussion. The combination of Samoan foundational values, health practices and the socio-political system of Samoa has led to the creation of Rheumatic Relief health education programs developed around the social-ecological model (See Figure 2). The social-ecological model, comprised of an individual, interpersonal, community and policy domain, provides a theoretical foundation from which to interpret evaluation results (The Social-Ecological Model, 2019). Each of the five domains of the social-ecological model contain areas

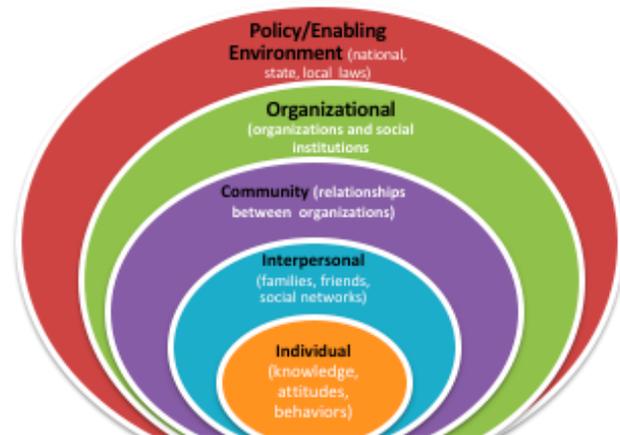


Figure 2 Socio- Ecological Health Behavior Model

where health promotion efforts can be focused to promote increased health of Samoan children, caregivers, and communities. The social-ecological model is supported by other health behavior theories such as the social cognitive theory and health belief model. The social cognitive model recognizes the importance of allowing individuals to feel in control of their skill development (Bandura, 1998) while promoting positive change through social expectations and learning opportunities. Finally, the health belief model is a theoretical health model proven to successfully target health issues within populations and help individuals adopt new health practices (Ayres & Pontes, 2018; Bandura, 1998; Janz & Becker, 1984).

Using the socio-ecological model provides a hybrid explanation of health behavior combining individual and social level influences into one model allowing health professionals to provide health education interventions using a behavior change model founded on the assumption that human behavior shapes and is shaped by multiple levels of influences such as their families, social networks and organization in which they participate or are unofficially a part of (Langille & Rodgers, 2010; *The Social-Ecological Model*, 2019). While initial health education efforts— health education of primary school children— focused on the individual level; this second phase of research moves the focus of health education and intervention to the interpersonal level— focusing on caregivers. Based on assessment research, the Rheumatic Relief program decided to develop a teaching method to be used among adult caregivers based on the potential influence caregivers can have on the health outcomes of their children (L. Allen et al., 2017).

There is limited research available regarding effective teaching models used to teach adults regarding RHD. There is also a large gap regarding teaching methods used among caregivers living in an Asian or Polynesian country. After careful evaluation of available literature, program directors decided on using a decision-making matrix as the caregiver teaching tool in combination with school principals as the instructor to teach about RHD prevention.

In order to interpret results, the use of the social-ecological theory and phases of the Evidence-based Planning Framework were used to scaffold the intervention creation and interpretation of findings for this evaluation. The use of this particular behavior theory model and the use of the Evidence-based Planning Framework provide an armchair walk through regarding the public health intervention methodology and the RHD health issue effecting Samoan children. Furthermore, evaluation provides a paradigm from which to view the Samoan population being educated by current work done by the Rheumatic Relief health education interventions. To influence the success of education on the interpersonal level, the Rheumatic Relief program utilizes strong community-level connections in Samoa.

Among those involved in child education leadership, the almost-daily contact school principals have with children designates principals among the most influential individuals of a Samoan village and within a school. In an effort, to broaden preventative interventions for RHD, the BYU Rheumatic Relief team hypothesized that primary school principals in Samoa are well positioned in Samoan villages to influence the caregivers of RHD at-risk children. This hypothesis is based on research done in similar

situations where health screenings were implemented using a school-based program (Langille & Rodgers, 2010; Perelini et al., 2015).

Before continuing with interpretation and implication discussion, it is important to note that there are other statistical data analysis and interpretation opportunities presented by 2019 Caregiver Intervention data that could provide another perspective on the effectiveness of the current health education protocol used among caregivers. Nonetheless, the modest gains of knowledge discovered in this count and proportion evaluation could be practically relevant and statistically significant, assuming that the response data is free of confounding influences. For example, if a high proportion of caregivers demonstrated a clear understanding of RHD seriousness, treatment, and attitude toward medical professionals during the pre- and post- intervention survey this could be an indication that parents are prepared to receive information regarding other aspects of RHD prevention such as medical care or hygiene habits that may be interfering with strep throat infection and treatment.

Based on the results of the caregiver health education pre- and post- intervention survey, over 80% and 90% of participating adults seem to have a strong understanding of the severity of RHD and prefer to take their children to a medical doctor rather than a village healer. Previous research done by other RHD-focused organizations indicated 66% of patients diagnosed with RHD had no previous diagnosis of rheumatic fever (Beaton et al., 2017). The count and proportion information from the caregiver intervention survey, when combined for inference purposes, with past research leads to a conclusion that strep throat or rheumatic fever positive patients remain at risk for either

being misdiagnosed by healthcare professionals or not seeking treatment due to unconcerned caregivers. Another possibility is that caregivers who are surveyed may know and refer to RHD using a different term or phrase in Samoan than what was used in the pre- and post- health education survey.

The effort to address root causes of RHD in Samoa continues to be an investigative process. Past research information has only suggested primary care approaches such as screening and penicillin treatments for individuals with strep throat as methods of prevention (M. Allen et al., 2017; Yacoub et al., 2017). Screening is currently a focus of the overall Rheumatic Relief program. From a health promotion perspective, Rheumatic Relief organization also understands the importance of a primordial approach that could prevent RHD infection through changes in socioeconomic or environmental domains. Efforts to identify root causes of RHD in Samoa are currently based on identifying future health education efforts among caregivers based on the results of the aforementioned community assessment completed using the Evidence-based Program Planning model and Social-Ecological health behavior theory. Other relevant and potential root causes of high RHD rates in children could be related to child caregiver skills in areas such as personal hygiene (i.e. regular hand washing) or regular cleaning of shared objects (i.e. cups, utensils). These skills could be taught to caregivers in order to avoid strep infection while still addressing the interpersonal level of social relationships (L. Allen et al., 2017).

Use of another health behavior model such as the Transtheoretical health behavior model could also provide guidance for the implementation of education protocol and

evaluation. Parents may benefit from improved access or understanding of medical care available to them on the two main Samoan islands of Savaii and Upolu. Further research and revision of the pre- and post- survey is needed to evaluate the needs of Samoan caregivers. It is recommended that the pre- and post- survey used among caregivers be adapted to include questions asking about other social determinants of health such as access and quality of healthcare, or neighborhood conditions and built environment. Integration of these topics into the survey could facilitate changes in the Rheumatic Relief health promotion approach allowing root causes to be address on the interpersonal level. Additionally, the survey could be adapted to ask information such name of a caregiver's village, age of child in school, number of family members or children in the household. Changing the Samoan parent health education branch of the program into a mixed methods effort could also allow qualitative data to be collected for foundational understanding of root causes and barriers for caregivers in relation to attitude toward RHD and medical care.

The overall process of this evaluation was done using the Evidence-based Program Planning Framework. When selecting a program planning model, it is often important to consider the flexibility, functionality and fluidity of a model in relation to the program being implemented and evaluated (Washington University of Prevention Research Center, 2015). The Evidence-based Planning Framework, in this evaluation process, has proven useful and provided essential steps and phases for program development and future Rheumatic Relief caregiver intervention development. The continued use of this model is recommended as a way of supporting further intervention innovation in response to the needs of Samoan children and caregivers.

In summary, results of the caregiver health education intervention indicated that caregiver instruction is important and principals are community influencers who can serve as health education instructors. This is supported by past research regarding school-based health education approaches and use of health behavior theory among caregivers (L. Allen et al., 2017; Langille & Rodgers, 2010). Health education efforts in the future could focus on teaching caregivers how to describe their concerns regarding RHD, developing RHD program teaching procedures or addressing RHD prevention on a different level, such as the community level, of the Social-Ecological model. Changes in the focus of the caregiver instruction would also result in changes to the teaching protocol used among caregivers, perhaps adapting content in the education protocol to help Samoan caregivers understand the purpose of western medicine, strep throat treatments and the importance of RHD prevention. Similarly, future evaluation of the health education intervention could include a revised pre-/post- test allowing for the collection of data regarding island, village, and age of the participating caregiver's child. Changes made to the survey would benefit from theoretical support provided by the theories such as the Health Belief Model or Transtheoretical Model. Development of a long-term evaluation program is also needed to record the advancement and influence of the parent health education intervention.

Limitations

The thesis approval and collaboration efforts to evaluate the Rheumatic Relief Caregiver Intervention occurred after the 2019 Rheumatic Relief trip resulting in methodological limitations. These limitations were recognized as experiential learning opportunities and were viewed as a constructive collaboration effort to facilitate growth

of the Rheumatic Relief health education program using data-driven approaches to ensure program reliability and validity. The Rheumatic Relief program addresses the proven health issue of RHD using available evidence-based recommendations and continually seeks to implement new evidence-based interventions while recognizing the limitation presented by the current lack of resources available in the research community.

In relation to the caregiver intervention evaluation, it is recognized that methodological limitations related to the pre- and post- survey could potentially explain the modest gains obtained in the caregiver education intervention. Not being a part of the creation of the pre- and post- survey constructs and content limits the researcher's understanding of the face validity related to the pre- and post- survey questions and behavior change theory or theories used in the methodological design of the study. Additionally, while count and proportion analysis provide some level of understanding, further statistical analysis, such as a multivariate analysis, could better contextualize the results and prove that modest gains during the pre- and post survey could prove to be statistically significant.

Finally, while the pre- and post- survey provides researchers with information regarding changes in caregiver response immediately after being given the caregiver education intervention, there is not a current evaluation step available to provide long term consequences of the caregiver education intervention. Long-term evaluation of the caregiver education intervention would suggest needed coordination with the Samoan Ministry of Health and Education to provide data collection among caregivers at times

when the Rheumatic Relief program is not present in Samoa in order to measure the long-term change in behaviors and beliefs among Samoan caregivers.

From a survey protocol standpoint, while data collected during the pre- and post-caregiver health education intervention provided informative data, there is also bias based on the presence of healthcare professionals as the survey was being conducted. Future bias within the survey tool could be limited among Samoan caregivers through the use of back-translating of survey questions to ensure the validity and accurate understanding of the questions among participants. There is also reason to believe that, out of respect, participating Samoan caregivers do not want to give a negative response as their children are receiving care from Rheumatic Relief personnel. Rheumatic Relief health promotion researchers know the number of schools and location of schools where Rheumatic Relief data was collected, however, the specific correlation between survey participants and village is unknown. This is a limitation because only general analysis can be done on responses rather than analysis conducted using more specific breakdowns of data such as analysis based on island, village, or school.

Future Caregiver Intervention Research Opportunities

Based on the results of the initial caregiver intervention evaluation, upcoming Rheumatic Relief work among caregivers could focus on three different areas of research. First, analysis focused on the development of a holistic interpretation of the needs, knowledge and experiences of Samoan caregivers can help facilitate the adaption of the caregiver protocol currently used among caregivers. This can be accomplished through inclusion of a qualitative portion of research seeking to understand multiple factors,

experiences and concerns of Samoan caregivers that may promote an increase in the prevalence of RHD in Samoa.

Second, assessing the inclination of caregivers toward sanitation measures or standards of care associated with the diagnosis and management of RHD could be conducted using health belief theories, such as the Transtheoretical Model, to guide question creation and evaluation. Third, incorporation an RHD education module in the Samoan primary school curriculum or using a peer-to-peer/ parent-to-parent teaching approach using a multisectoral and multimodal approach could facilitate long-term incorporation and evaluation opportunities of health education efforts among Samoan caregivers.

Conclusions

Development of a caregiver health education intervention can help improve health outcomes among Samoan children. Development of this intervention can help direct health promotion resources and research regarding RHD in Samoa, which could be adapted and implemented in other low- and middle-income Polynesian countries. Further research and evaluation of the caregiver intervention can help innovate the current health promotion approach used to teach knowledge and skills to caregivers and help keep Samoan children healthy and RHD-free.

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