The Role of Unrealistic Optimism in Explaining Preventive Behaviors in High Versus Low Endemic Malaria Settings in Belize

Daniel G. Handysides

Follow this and additional works at: https://scholarsrepository.llu.edu/etd

Part of the Epidemiology Commons, and the Public Health Education and Promotion Commons

Recommended Citation
https://scholarsrepository.llu.edu/etd/1039

This Dissertation is brought to you for free and open access by TheScholarsRepository@LLU: Digital Archive of Research, Scholarship & Creative Works. It has been accepted for inclusion in Loma Linda University Electronic Theses, Dissertations & Projects by an authorized administrator of TheScholarsRepository@LLU: Digital Archive of Research, Scholarship & Creative Works. For more information, please contact scholarsrepository@llu.edu.
THE ROLE OF UNREALISTIC OPTIMISM IN EXPLAINING PREVENTIVE BEHAVIORS IN HIGH VERSUS LOW ENDEMIC MALARIA SETTINGS IN BELIZE

By

Daniel G. Handysides

A Dissertation in Partial Fulfillment of the Requirements for the Degree of Doctor of Public Health in Health Education

August 2010
Each person whose signature appears below certifies that this dissertation, in her opinion, is adequate in the scope and quality as a dissertation for the degree of Doctor of Public Health.

Helen Hopp Marshak, PhD, MS, CHES, Chair
Associate Professor, Health Promotion and Education

Patti Herring, PhD, MA, RN
Associate Professor, Promotion and Health Education

Naomi Modeste, DrPH, CHES
Professor, Health Promotion and Education
ABSTRACT OF THE DISSERTATION

The Role of Unrealistic Optimism in Explaining Preventive Behaviors in High versus Low Endemic Malaria Settings in Belize

by

Daniel Handysides

Doctor of Public Health in Health Education

School of Public Health, Loma Linda University, 2010

Helen Hopp Marshak, PhD, MS, CHES, Chair

Background: Of all the diseases an individual can encounter in the world, malaria is one of the most destructive. Simple measures like sleeping under a bednet would greatly reduce the burden (Abeku, 2007). When people estimate their risk relative to others, they are most often unrealistically optimistic, which may explain why those at risk often fail to perform behaviors, such as using a bednet that will reduce their risk. However, one study showed that people at high risk for malaria held pessimistic perceptions of their risk for the disease, but the reasons for this finding are unclear (Morrison, Ager, & Willock, 1999).

Purpose: In this study I examined risk perceptions about malaria, specifically absolute and comparative risk for the disease, and the role such perceptions play in encouraging or discouraging preventive behavior in areas with high (>50 cases/1,000) and low (<1 case/1,000) rates of endemic malaria. In addition, I tested the accuracy
hypothesis (Brewer, Cuite, Herrington, & Weinstein, 2004) between perceived risk of malaria and engaging in the preventive behavior of using a bednet.

**Method:** This study used a cross-sectional, non-equivalent group comparison observational design and was conducted in Belize, Central America. The data were collected using both self-reported surveys and personal interviews from residents of 20 selected villages across the country with high (n = 10 villages) and low (n = 10 villages) endemic malaria. A minimum of 15 people per village were recruited, for a total sample size of 300 people, with approximately equal numbers of males and females. The survey assessed absolute and comparative risk perceptions, based on the recommendations by Brewer et al., as well as perceived control and risk behaviors related to malaria, and standard demographics.

**Results:** More people in the high risk area had ever had malaria compared to those in the low risk area (42.7% vs. 8.8%, p<.001). Average perceived risk of ever getting malaria was 48.4%, with no significant difference between the high (51%) and low (46%) areas; however, those in the high area who had ever had malaria reported a significantly higher risk of ever getting malaria in the future (mean=59% vs. 45% chance, p=.003), indicating a fairly accurate perception among those in the high risk area but pessimism among those in the low risk area. However, participants in both high and low risk areas were most likely to show an optimistic bias for comparative risk items. When compared to others in their town, 47.1% thought they were below average, 32.5% average, and 20.3% above average risk (with no differences between high and low areas). Bednet use varied, with 40.7% of those in the high, and only 2.0% of those in the low, risk area always using a bednet (p<.001); those who had a history of malaria in the high risk area
were more likely to always use a bednet than those who have no history of malaria (50.0% vs. 33.7%, p<0.05). There was no evidence for the accuracy hypothesis: greater perceived risk regarding malaria was not associated with regular bednet usage. However, perceived control was significantly correlated with preventive behavior (r=0.236, p<0.001).

Conclusions: These results show both pessimistic and optimistic biases regarding risk of malaria, depending on the type of risk assessed (absolute vs. comparative risk), actual risk of malaria (high vs. low risk areas), and perceptions of control. However, risk perceptions regarding malaria were not reliably associated with preventive behavior, unlike that found by other researchers, although it is unclear why this is so. Future studies should be longitudinal in nature, to determine if risk perceptions and perceived control are related to future behavior. These studies must use standardized measures of risk perceptions to adequately examine risk-behavior hypotheses.
TABLE OF CONTENTS

List of Tables ........................................................................................................................................... ix

List of Figures ............................................................................................................................................... x

Acknowledgements ....................................................................................................................................... xi

CHAPTER 1 - INTRODUCTION

A. Statement of the Problem ......................................................................................................................... 1

B. Purpose of the Study .................................................................................................................................. 8

C. Research Questions ...................................................................................................................................... 8

D. Theoretical Justification ............................................................................................................................... 9

E. Significance to Health Education ............................................................................................................... 12

CHAPTER 2 - LITERATURE REVIEW

A. Overview ................................................................................................................................................... 15

B. Major Infectious Diseases Including Malaria ............................................................................................. 16

C. Malaria a Major Infectious Disease ............................................................................................................ 17

D. Perceived Risk of Malaria ........................................................................................................................... 18

E. Seasonal Changes Effect on Perceived Risk ............................................................................................... 21

F. Unrealistic Optimism and Risk ..................................................................................................................... 22

1. Unrealistic Optimism Verses Pessimism Regarding Malaria ................................................................... 25

G. Preventive Behavior for the Reduction of Malaria Transmission ............................................................... 26

1. Compliance with Preventive Behaviors ....................................................................................................... 28

2. Community Knowledge about Malaria ...................................................................................................... 29

H. Conclusions ............................................................................................................................................... 30

vi
CHAPTER 3 – METHOD

A. Design ................................................................................................................. 32
   1. Setting ........................................................................................................... 32

B. Description of Participants ............................................................................. 33
   2. Inclusion/Exclusion Criteria ...................................................................... 34

C. Procedures ....................................................................................................... 34
   1. Recruitment ................................................................................................ 36
   2. Consent ........................................................................................................ 36
   3. Data Collection ............................................................................................ 36

D. Variables ........................................................................................................... 37
   1. Independent Variable ............................................................................... 37
   2. Dependent Variables ................................................................................. 37

E. Instrumentation/Measuring Tools/Data Management ..................................... 38
   1. Demographic Variables ............................................................................ 38
   2. Perceived Health Status .......................................................................... 38
   3. Risk Perceptions ......................................................................................... 39
     a. Absolute Risk .......................................................................................... 39
     b. Comparative Risk .................................................................................. 40
   4. Preventive Behaviors .................................................................................. 40

F. Data Analysis ..................................................................................................... 40

G. Research Questions .......................................................................................... 41

H. Power Analysis .................................................................................................. 44

I. Strengths and Limitations .................................................................................. 44

vii
LIST OF TABLES

CHAPTER 1- METHOD
Table 3.1 Analyses of Research Questions with Statistical Test, Variables and Sample Size........................................................................................................43

CHAPTER 4- FIRST PUBLISHABLE PAPER
Table 4.1 Characteristics of Study Sample by High and Low Risk Endemic Areas....64
Table 4.2 Absolute and Comparative Risk Perceptions across High and Low Malarial Risk Area Groups.............................................................. 65

CHAPTER 5- SECOND PUBLISHABLE PAPER
Table 5.1 Characteristics of Study Sample by High and Low Risk Endemic Areas......87
Table 5.2 Preventive Behaviors of Study Sample by High and Low Risk Endemic Areas......................................................................................................... 88
LIST OF FIGURES

CHAPTER 1- INTRODUCTION

Figure 1.1 Areas with Endemic Malaria.................................................................2

Figure 1.2 Map of High Southern Malaria Rates versus Lower Northern Rates in Belize ...........................................................................................................3

Figure 1.3 Theoretical Framework of Components Compromising Perceived Threats to Malaria .........................................................................................10
ACKNOWLEDGEMENTS

In the process of writing this dissertation there have been a number of individuals whose help and support was vital to my success.

Without the constant support and love of my wife, Sandra, I would not have been able to gather the strength to hold the course. Her words of encouragement and deeds of kindness made the many long nights possible. Sandra, I simply adore you!

Dr. Helen Hopp Marshak (your name is written in full, to ensure “elaboration” is not required) I could not have asked for a better Chair. Your guidance, patience, humor, and wisdom, ensured my success. I am forever in your debt. Thank you.

To my simply amazing committee of Dr. Modeste and Dr. Herring. You have both been instrumental in my development as a Health Educator. Dr. Modeste, as my advisor you have guided me through the doctorate with wisdom and caring. Thank you for the journey and get memories. Dr. Herring, your passion for teaching is simply inspirational. If I can be half the health professional you are, I will be a huge success.

To my whole family, especially, Dad and Mom, Rob and Beth! Thanks for believing I could do it. You have always been there for me, and I have been spoiled the entire way. I love you all.

Finally, I could not have done this without God! Through His never ending love he has set the path of service for me, and I look forward to the journey ahead.
A. Statement of the Problem

Of all the diseases an individual can encounter in the world, malaria is one of the most destructive. More than 500 million people are at risk for this disease ("Malaria," 2009). Malaria is a vector disease caused by protozoan parasites, which is spread by female Anopheles mosquito and hosted within humans. Of the human malaria cases there are four types of parasites: *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium falciparum* (Gogtay, Kshirsagar, & Vaidya, 2006). *Plasmodium falciparum* is responsible for the majority of deaths associated with malaria ("Malaria," 2009). The fact that malaria is spread by mosquitoes limits its range to tropical and subtropical areas such as Central and South America, sub-Saharan Africa, and Asia where Anopheles mosquito populations can live throughout the year. The vast majority of cases are seen in sub-Saharan Africa; approximately 90% of all malaria cases occur in Africa (Sachs, 2007). This high burden of disease in Africa does not, however, mean that other regions can be ignored. In countries that have tropical weather year round the transmission of the disease continues. Many of the subtropical regions suffer from seasonal outbreaks. The distribution of endemic malaria can be seen in Figure 1.1.
Central and South America have been plagued with malaria for many years. Over 800,000 cases of the disease are reported yearly (Mirabello & Conn, 2006). Compared to areas with low risk of malaria like the United States, Central America had a relative risk of 37.8 in the period of 2000 through 2002 (Freedman, 2008). The higher risks of malaria seen in Central America are still much lower than the levels found in Sub-Saharan Africa. For malaria, natural ecological advantages of warm weather and high levels of rain fall found in Central American countries have unfortunately being coupled with local civil wars and abject poverty to provide a fertile ground for the disease to become endemic in the area.

The local conditions in Central American countries such as Belize are ideal for mosquito growth (Hakre, Masuoka, Vanzie, & Roberts, 2004). The nation of Belize is a geologically and environmentally varied region. The annual rainfall varies drastically across the country from high level of 4,000 millimeters in the south to 1,200 millimeters...
received in the north (Hakre, et al., 2004). The elevation of Belize varies from 0 meters at
the shores and swamp forests of the coastal areas to 1,124 meters of the high Maya
Mountains. The seasons are quite pronounced with the months of January through April
considered the dry season, and June through November the wet season (Hakre, et al.,
2004). As mosquito populations use standing water as the medium for their larva to
mature, levels of rain fall are directly related to increase in mosquito populations, which
in turn produce a larger number of vectors to carry malaria. Due to the elevation and
warm, wet weather areas like the south of Belize are faced with the threat of malaria
almost constantly.

The geography and weather of Belize has created an environment where in the
south of the country malaria cases are high and in the north the burden of disease is
lower.

Figure 1.2 Map of High Southern Malaria Rates versus Lower Northern Rates in Belize
(Hakre, et al., 2004).
The threat of malaria to human health is abundantly evident. The number of deaths related to the disease demand action; over 5,000 deaths a day worldwide is not acceptable (Sachs, 2007). Simple measures like sleeping under a bednet or allowing for indoor spraying of insecticides would greatly reduce the disease burden (Abeku, 2007). However, the threat of illness and death does not always result in actions being taken to reduce or eliminate the problem. The failure of populations to use preventive measures to reduce the impact of the disease is an issue which researchers have been studying for many years. The failure to use preventive measures begins when people lack a level of knowledge about the link between vectors and malaria (Walther & Walther, 2007). Even when people have the knowledge and decide to use preventive tools, they often fail to maintain the tools (i.e., bednets). In one study, over 40% of the bednets were damaged (Enato & Okhamafe, 2006). In some areas people delay seeking treatment for malaria and this can increase the risk of death. It is still worth asking what causes individuals to not engage in preventive measures even when preventive tools are available.

Human life is filled with constant threats to health and safety. These threats from diseases like malaria force decisions onto the daily lives of individuals. These decisions are often not clear cut but rather complex in nature. In order to handle these complex decisions, humans have developed a number of coping strategies. One strategy utilized by people seeking to reduce their risks is the act of making daily judgments based upon comparisons to others. According to Weinstein, one of the most important processes involved in making self-judgments regarding risk is social comparison (Klein & Weinstein, 1997). When people compare themselves to others they most often do not do it accurately (Clarke, Lovegrove, Williams, & Machperson, 2000; Neil D. Weinstein,
1982; N. D. Weinstein, 1987), which in turn leads people to either under- or overestimate their personal risk. Researchers report that when people estimate their risk relative to others, they are most often unrealistically optimistic. This underestimation of risk can lead to a decrease in preventive behavior (Schwarzer, 1994).

Weinstein reports that there are two distinct ways people can be unrealistically optimistic. First they can underestimate their absolute risk of a problem, or the perceived likelihood they will develop a health problem, such as malaria, in their lifetime. This has been called “absolute unrealistic optimism”. The second method is when people incorrectly believe their risk of a health issue to be lower than that of others. This is called “comparative unrealistic optimism” (Neil D. Weinstein, 1982).

Researchers report that unrealistic optimism is present in risk perceptions related to many health problems such as breast cancer, cancer from smoking cigarettes, and personal injuries resulting from failing to use appropriate protection (Dewberry, Ing, James, Nixon, & Richardson, 1990; Dillard, McCaul, & Klein, 2006; Klein, Geaghan, & MacDonald, 2007; Li-Jun, Zhiyong, Usborne, & Yanjun Guan, 2004; Madey & Gomez, 2003; Rutter, Quine, & Albery, 1998; Sjoberg, Holm, Ullen, & Brandberg, 2004; Wendt, 2005).

Not all researchers agree that unrealistic optimism is present for all health issues. Some feel that specific diseases like malaria cause people to show a pessimistic outlook, but it is unclear what characteristics of the disease determine this (Morrison, et al., 1999). One researcher found that fearful people were pessimistic about their personal risk of disease, compared to angry people who tended to be optimistic (Lerner
& Keltner, 2001). Other than the study by Morrison et al., there is limited literature on any disease that presents a pessimistic outlook.

Morrison and colleagues stated that malaria presents a risk where people feel "unrealistically pessimistic" (Morrison, et al., 1999). In their study, people in rural regions of Malawi were asked to rate their risk of malaria compared to others. Morrison and colleagues found that people presented a pessimistic outlook, overestimating their risk compared to others. Morrison et al. did not use the traditional comparison in their study, rather they asked the participants what "proportion of people living here do you think will get malaria." This question does not address a true comparison between self and others; instead it asks the participant's perception of risk for the population. One possible reason for Morrison, et al.'s results could be the endemic nature of malaria and the constant threat that it presents to people living in these areas. By facing a threat that never goes away, people living in regions of malaria may simply believe that infection is inevitable. Morrison et al. stated that when people face an endemic threat such as malaria, they may acknowledge some level of personal risk (Morrison, et al., 1999). This would decrease the likelihood of unrealistic optimism being present.

Although the pessimistic outlook regarding malaria found by Morrison and colleagues is possible, it is counter to the majority of the evidence on unrealistic optimism. Furthermore, it is unclear whether such pessimism is related to behavior. The questions asked as part of the Morrison study were worded in a unique nature. When assessing comparative unrealistic optimism, the standard method is to ask the participant to rate their personal risk compared to a second person. Morrison et al.
asked individuals what proportion of people living in their area would get malaria. The concept of proportions, is complex and does not truly compare to the standard method. These concepts are difficult to translate to a population that has lower education levels and this can lead to threats of internal validity. In addition, as previously stated, the comparative assessments of Morison et al. were not true comparisons of the participants risks compared to others but rather simply participant’s perception of the proportion of the disease in the village.

The discrepancy between Morrison et al. and the majority of the literature on the perceptions of risk associated with malaria raises questions about our understanding of the relationship between beliefs about susceptibility compared to others (unrealistic optimism or pessimism) and how such perceptions relate to preventive behaviors to reduce risk of malaria. According to the health belief model, if perceived susceptibility for a disease such as malaria is high, people are more likely to engage in preventive behaviors (Lai & Hamid, 2000). Because malaria is often endemic to a particular area, residents of that area may hold more pessimistic perceptions about their risk of the disease, compared to a less frequently occurring disease such as breast cancer about which people have an unrealistically optimistic view of risk. People who live in areas where there are lower levels of endemic malaria may hold views more like those of breast cancer victims, in that they may are unrealistically optimistic about their risk of contracting malaria. There are no data to clearly suggest how high or low levels of malaria will change individual’s perceptions of risk, and how such perceptions are related to preventive behavior.
B. Purpose of the Study

The purpose of this study was to examine risk perceptions, specifically unrealistic optimism or pessimism, regarding malaria in an area where the disease is endemic, and the role such perceptions play in encouraging or discouraging preventive behavior. By focusing on absolute and comparative unrealistic optimism with regards to malaria it was expected that the discrepancy in the literature can be explained. In addition, the link between levels of optimism and preventive behaviors was examined. The expectation was that a higher level of optimism would be associated with lower levels of preventive behaviors.

C. Research Questions

1. Do people who live in areas of Belize with high rates of endemic malaria show greater levels of perceived absolute risk and/or comparative risk with regards to acquiring the disease than those in low endemic areas?

2. Do people who living in areas of Belize with high rates of endemic malaria and who show higher levels of perceived risk for acquiring malaria, engage in more preventive behaviors than those with lower levels of perceived risk, or among those who live in low risk areas? (Brewer, et al., 2004)

3. Do people living in areas of Belize with either low or high endemic malaria, who feel they have higher levels of control over preventing malaria infection, show greater levels of optimism?

4. Do people living in areas of Belize with either low or high endemic malaria, who feel they have higher levels of control over preventing malaria infection, engage in more preventive behaviors than those present low levels of control?
D. Theoretical Justification

It is important to determine why people fail to engage in beneficial behaviors that are known to promote their health and well-being. There are two main perspectives on how to address this issue. The first is to draw from a theory of health behavior, with one of the oldest of these theories being the health belief model (HBM) (Rosenstock & Kazdin, 2000). The second is to utilize a theory of risk perception, which includes unrealistic optimism. See Figure 1.3 for a visual depiction of the proposed addition of unrealistic optimism to the health belief model. The health belief model is described below.

Based on the HBM, behavior is thought to be a result of the subjected value people place on an outcome (Rosenstock & Kazdin, 2000). According to the model, if a person’s perception of the severity or their personal susceptibility is low, they are less likely to have intentions to act out a behavior. How people personally perceive malaria as a threat relative to other people’s risk was one question I examined in my study.

The health belief model (HBM) was developed in 1966 by Rosenstock and colleagues. Using this model helps explain differences in preventive health behaviors based on perceptions about the behavior. By looking at the processes that occur before a behavior is undertaken, we can use the HBM constructs to predict the likelihood of individuals engaging in a specific behavior. According to the HBM, when an individual is confronted by a health issue, such as malaria, two main thought processes occur. In the first process, individuals engage in threat appraisal, whereby they determine their level of risk for contracting the disease, a product of perceived susceptibility and perceived severity; this is referred to as risk perception by Weinstein and others (Rosenstock &
Kazdin, 2000). The second process is coping appraisal; Rosenstock called this a cost/benefit analysis. In this second process the benefits of a behavior and the barriers to engaging in the behavior are assessed by the individual. If the benefits outweigh the barriers, the individual is more likely to engage in the action. This process was not assessed in this study. As seen in Figure 1.3 below, these two appraisals together with perceived control determine the likelihood of action. With malaria, these actions would be preventive behaviors such as sleeping under a bednet and reducing mosquito habitat around the home.

**Figure 1.3** Theoretical Framework of Components Comprising Perceived Threats to Malaria.

Perceived seriousness and perceived susceptibility combine with cues to action and perceived control to determine the perceived threat presented by a specific problem like malaria. Cues to action for malaria might include health education programs that
inform the community on the nature of malaria infection. These programs are often combined with bednet distribution and occasionally with indoor insecticide spraying. Health messages about reducing mosquito habitat are often encouraged over media like radio. Unrealistic optimism is hypothesized to play a major role in determining perceived susceptibility, which in turn affects the overall perceived threat of disease. Perceived threat, in turn, affects whether or not someone will take action to reduce that threat. Thus, holding unrealistically optimistic beliefs about risk of malaria will make it less likely that someone will take preventive action to reduce their risk, such as using a bednet.

Perceived control also plays a role in determining whether individuals will choose to engage in preventive behaviors. Researchers have found that an individual’s perception of control plays a role in the utilization of preventive measures (Rodgers, Conner, & Murray, 2008).

Unrealistic optimism is when individuals perceive their risk as lower than those of similar people in the same situation. Risk perceptions may be unrealistic, realistic, or pessimistic at the individual level, but if collectively most member of the group perceives their risk to be less than those of the group, then the phenomenon is called unrealistic optimism (Dillard, et al., 2006). Unrealistic optimism is found in relation to a series of negative threats to health, such as with alcohol and automobile accidents, or it can be found in a single risk behavior, such as smoking, or in this case malaria (Dillard, et al., 2006; Klein, et al., 2007; Rutter, et al., 1998; Sjoberg, et al., 2004; Wendt, 2005).

Unrealistic optimism is broken down into two types. The first is absolute unrealistic optimism; the second is comparative unrealistic optimism. Absolute
unrealistic optimism is an individual’s absolute risk of a problem, or the perceived likelihood they will develop a health problem, such as malaria, in their lifetime (Neil D. Weinstein, 1982). The comparative unrealistic optimism is the second method when people incorrectly believe their risk of a health issue to be lower than that of others. As Figure 3 shows, absolute and comparative unrealistic optimism can affect perceptions of susceptibility for a disease, and overall threat of the disease, which ultimately may decrease performance of risk-reducing behaviors.

E. Significance to Health Education

In the field of health education, one of the major challenges is finding a way to engage the public in positive behavior changes. Some behaviors such as smoking or the use of illegal drugs are detrimental to health, and the goal is to decrease the occurrence and effect of these behaviors. Other behaviors are beneficial to health and are encouraged by health educators. With malaria there are a number of proven preventive measures that individuals can utilize to reduce their risk of infection. The primary preventive measure for malaria is the use of insecticide treated bednets (ITBN’s). These nets, normally sold presoaked, simply need to be regularly hung and slept under to offer protection. Other behaviors involve reducing the suitable habitat for mosquitoes around the home or village. Examples of these behaviors are eliminating standing water, by inverting buckets and filling in boggy or swampy areas of land and keeping grasses trimmed also reduces the habitat. Some behaviors require individuals to work with health officials to reduce risks. The World Health Organization recommends an indoor residual spraying of DDT, which is effective but requires special training and is often implemented by national
health organizations (Schapira, 2006). Indoor spraying of DDT properly implemented has minimal risks to health.

Encouraging new behaviors is a complex task. Behavior changes are not always easy and resistance to change is often present (Ahorlu, Koram, Ahorlu, de Savigny, & Weiss, 2006). This resistance to new behaviors may be due to a number of factors including financial barriers and local beliefs. Individuals may not even perceive the risk of a specific health problem as affecting him or her personally. The public perceptions of personal risks play a prominent role in how successfully a health program is received. Without an accurate perception of risk, individuals will have no desire to decrease a negative behavior or increase engaging in preventive measures (Rutter, et al., 1998).

By understanding the comparative risk perceptions of people affected with malaria and how those perceptions are related to behavior, health educators will be able to develop more effective prevention programs to reduce the spread of malaria. Having knowledge of how risk perceptions relate to preventive behaviors is fundamental to developing successful health programs. People who do not view themselves to be at risk are less likely to seek out treatment or engage in preventative behaviors (Neil D. Weinstein et al., 2007). In the past, program planners have encouraged behaviors that would reduce the risk of health problems in the target population, but one of the drawbacks of this approach is that if the target population does not see the specific health topic as an issue or risk, they will not see a need to maintain learned behaviors. As health educators understand the risk perceptions of a population, we can help create programs that better address those perceptions in order to correct the perceptions that are more
realistic in nature. With accurate risk perceptions people will be able to correctly evaluate their risk which can help them make and maintain health behavior changes.
CHAPTER 2
LITERATURE REVIEW

A. Overview

Infectious diseases continue to extract a terrible toll on human life. Diseases like malaria can be prevented through behaviors such as the use of bednets and indoor residual spraying of dichlorodiphenyltrichloroethane (DDT), and yet they continue to kill thousands of individuals a day (Walther & Walther, 2007). It is unclear why people fail to engage in preventive behaviors that will reduce their risk of disease. One possibility is that the perception of risk is not sufficient to warrant action (Brewer et al., 2007; Neil D. Weinstein, et al., 2007). Individuals facing a health risk overwhelming report lower risk than others facing the same situation. This perception of false security has been coined as unrealistic optimism (Neil D. Weinstein, et al., 2007).

Unrealistic optimism poses a problem for health educators who are trying to encourage behavior change. A clear understanding of how optimism is related to behavior in different settings, such as high versus low endemic areas with malaria, will help researchers better understand the conditions under which unrealistic optimism is most likely to affect specific preventive behaviors. This will guide health educators to create more effective programs and interventions. In this literature review, I examine the effect of infectious diseases, like malaria, on health and how perceptions of the risks associated with the diseases can lead to unrealistic optimism. In turn, research related to unrealistic optimism is reviewed to discern the role it plays in encouraging or discouraging preventive behaviors.
B. Major Infectious Diseases Including Malaria

Even in today's modern medical era of technology, simple infectious diseases cause many of the problems faced by humanity. In the developing nations of the world, these diseases kill thousands every day. The most common infectious disease in the world is Hepatitis B, with over 2 billion people infected ("Hepatitis B," 2009). The fact that Hepatitis B is the most common disease does not mean that it is the most lethal. Over 50% of all infectious disease deaths occur each year from just three diseases: malaria, AIDS, and tuberculosis. Infectious diseases are caused by pathogenic microorganisms, such as parasites, viruses, bacteria or fungi. Infectious diseases can be spread both directly and indirectly.

The most common vector borne infectious disease is malaria. Viewed strictly from a monetary standpoint, malaria is currently among the top three problems worldwide (Mandelbaum-Schmid, 2004). In countries with high rates of malaria, economic growth is reduced by up to 1.3% ("Malaria," 2009). Aside from a monetary standpoint, infectious diseases cause other major inconveniences. One of the most common symptoms of many infectious diseases is diarrhea. Both travelers and non-travelers suffer from this significant health burden. However, the likelihood of experiencing diarrhea increases greatly when traveling to developing nations (Wilson, 2005). Due to the increase in risk in acquiring a disease while traveling to these developing nations, a number of studies have been conducted to examine the risks of acquiring a disease while traveling. The evidence shows that when traveling, prophylactic health measures may not only benefit the individual but the population as well (van der Werf & Borgdorff, 2007). It is important to know that preventive measures for many
infectious diseases are known and widely available, but as we will see later, they are not always utilized.

A number of studies show that travelers do not always follow the available health advice (Gagneux, Blochliger, Tanner, & Hatz, 1996; Laver, Wetzel, & Behrens, 2001). This failure to adhere to recommended prophylactic and preventive health measures will be discussed later in this review. The infectious disease malaria, like tuberculosis or HIV/AIDS, causes widespread damages to both health of individuals and the structure of societies as a whole (Sachs, 2007). Sadly, however, preventive measures are often ignored or not implemented as intended. Possible reasons for this lack of action will be discussed further in this chapter, along with the implications for preventive behavior to decrease risk of malaria.

C. Malaria a Major Infectious Disease

The current estimates for malaria reveal that it is a major infectious disease that is ravaging our world. According to Sachs (2007), 3 million children died from malaria in 2007, or roughly 7,000 per day (Sachs, 2007). Although the exact number worldwide is simply a rough estimate, a range of 200 to 300 million cases per year has been reported by the World Health Organization (WHO, 2008). Several researchers argue that these statistics greatly underestimate the burden of the disease. Snow et al. (2005) reported an estimate of 515 million episodes of *P. falciparum* malaria in 2002. Based on this, global estimates would be up to 50% higher, and areas outside of Africa would be 200% higher than those reported by the WHO (Snow, Guerra, Noor, Myint, & Hay, 2005). The majority of malaria reporting comes from passive national reporting. With passive reporting, countries voluntarily provide the rates of malaria within their boundaries. This
type of reporting can be flawed for a number of reasons. First, rural areas, which often have the highest rates of malaria, are often incompletely sampled for malaria rates, if they are sampled at all. A second reason for error is that some countries underreport malaria to encourage tourism. Snow et al. (2005) believe the increase in malarial rates is due to the fact that the WHO relies on passive national reporting, and that unless informed studies on the cartography of malaria risk are conducted, the global extent of the disease will continue to be underestimated.

Secondary data show many examples of the destructive nature of malaria. Malaria is associated with a reduction in the number of days of school attendance by appropriately aged children living in endemic areas (Sachs, 2007). Sadly, many of the people directly faced with the disease do not always perceive this threat in the same manner. Often individuals confuse malaria for a common fever and fail to seek medical attention (Asenso-Okyere, 1994; Ibidapo, 2005).

In the following section, I discuss the perceptions of risk regarding malaria held by a number of different groups. The first group are visitors to endemic areas. These people have little to no exposure to the actual disease. This limits their knowledge about the true risks of infection. The second group are those who live in endemic areas. This group has high exposure and are expected to have greater knowledge about malaria risks. Finally, the changes that seasonal variations bring to risk perceptions will be examined.

D. Perceived Risk of Malaria

The perception of malaria risk by locals compared to visitors in endemic areas has been examined by several researchers In one study, 25% of travelers visiting high-risk areas had false perceptions as to the malarial risk (Van Herck et al., 2004). Travelers
often believe they were at risk for malaria in a certain area, even when actual rates for that area were low. Alternatively, visitors to high risk areas often incorrectly assumed they were safe. Of those going to an area with no risk, 20% felt the risk was high; in contrast, of those going to areas with known high risk, 18% felt the risk was low with 3% believe the risk to be no present at all (Van Herck, et al., 2004). These perceptions of risk were assessed through brief self-administered questionnaires. The same study found that 50% of those going to a non-risk area expressed concerns about malaria, such as infection, indicating that perceptions of risk were not based on true estimates of risk. Travelers who sought out medical advice prior to traveling or those who were visiting family and friends had much more accurate risk assessments compared to other visitors who were often traveling for business reasons and had not properly prepared for the trip.

This lack of realistic perception of risk often leads to a failure to practice preventive measures such as bednet use and preventive medicine, especially when people underestimate their likelihood of contracting a disease (Laver, et al., 2001). The lack of realistic perceptions can also lead to avoiding safe areas as a result of overestimating the risks of malaria. When education is provided to travelers prior to a vacation in which they will be entering areas with endemic malaria, there is a more accurate perception of the risk and higher use of methods of prevention such as taking medicine and using bednets (Teodosio, Goncalves, Atouguia, & Imperatori, 2006). These research findings help build the case that health education in rural communities can improve the health of the local population by refining their perceived risk and behaviors.

For individuals who live in endemic malarial areas, perception of risk varies. In places such as Ghana, Tanzania, Myanmar, Nigeria, and Delhi, where malaria is endemic,
perceptions play a major role in the utilization of preventive tools (Adongo, Kirkwood, & Kendall, 2005; Comoro, Nsimba, Warsame, & Tomson, 2003; Ibidapo, 2005; Kyawt Kyawt & Pearson, 2004; Onwujekwe, Akpala, Ghasi, Shu, & Okonkwo, 2000; Rasania, Bhanot, & Sachdev, 2002). Adongo et al. found that although people recognized malaria to be an issue, most found that bednets were only useful to reduce the nuisance of the mosquito but not as a preventive tool to fight malaria (Adongo, et al., 2005). Rasania et al. found that people who understood the lifecycle of malaria, would engage in bednet use (Rasania, et al., 2002). Some people do not feel the need to use “western medicine” and instead seek out the treatment from local traditional healers (Comoro, et al., 2003). This perception that malaria is a “tradition” or local-only disease reduces the use of new preventive behaviors among certain populations. This hesitance to utilize preventive measures can be found most in cultures that have high levels of distrust of foreign and nontraditional methods. In some areas like sub-Saharan Africa, preventive tools like bednets are seen as a “nuisance” reducer but not as a preventive tool for the decrease of malaria morbidity (Adongo, et al., 2005). The idea of using a bednet as a tool to keep insects and bugs at bay is readily accepted within rural areas; however, this does not mean that a complete understanding about the transmission of malaria has been achieved.

Perceptions of risk can be influenced from factors such as a person’s experience with the disease, and whether the individual is a visitor to the area or a permanent resident. Another factor that can affect perceived risk includes seasonal changes in disease risk, which I discuss next.
E. Seasonal Changes Effect on Perceived Risk

Seasonal weather has a direct effect on the actual risk of acquiring an infectious disease like malaria. As mosquitoes use standing water the means of reproduction, there is a rapid increase in their populations during the rainy seasons (Hakre, et al., 2004; Hoek, Konradsen, Perera, Amerasinghe, & Amerasinghe, 1997). Between 1989 to 1999, the highest malaria incidence for Belize was in the month of June for the Stann creek district, and highest in August for the Toledo district (Hakre, et al., 2004). Both districts are found in the southern portions of Belize. For the national trends between the years of 2002 and 2006, June, July, and August had the highest rates of malaria. These rates were 0.34 per 1000 in June, 0.51 per 1000 in July and 0.39 per 1000 in August (Hakre, et al., 2004). This increase in vectors (i.e., mosquitoes) is directly related to an increase in malaria cases. In Belize the highest rates of malaria always occur shortly after the rainy season begins (Hakre, et al., 2004).

Other countries have a sharp distinction between wet and dry seasons: malaria is all but absent during the dry months (Abdel-Muhsin et al., 2004; Abdel-Wahab et al., 2002; Hoek, et al., 1997). Countries like the Sudan and Sri Lanka are examples of this variation. The Sudan has an absence of mosquito infected malaria during the dry season (Abdel-Wahab, et al., 2002). Individuals will often self-diagnose an illness based on the circumstances in which they fell sick, such as whether or not it is during the rainy season, rather than on the actual symptoms (Winch et al., 1994). These findings imply that during the rainy season, people will be more likely to view malaria as a greater threat (i.e., greater perceived risk) than during the dry season. However, there currently are no studies that have tested this assumption, and it was not tested in this study. Nevertheless,
it was important to examine risk perceptions during the rainy season when risk of malaria is highest.

Despite the factors discussed that play a role in the generation of risk perception, there is still a missing link between why risk perceptions do not always lead to preventive behaviors. Unrealistic optimism may help explain that discrepancy.

**F. Unrealistic Optimism and Risk**

The majority of research shows that people tend to be overly optimistic about their chances of experiencing positive events and avoiding negative ones (K. M. Klein & N. D. Weinstein, 1997). Researchers suggest that unrealistic optimism helps a person maintain a normal mental outlook as one deals with stress (Schneider, 2001). When an individual faces a threat to their health from a disease, this places them under mental stress. To reduce this stress, the individual may change the behavior causing the risk, such as quitting smoking; or they may simple reduce the threat by reducing its apparent application to them personally. This can be done by downgrading the likelihood of risk or by denying that the risk is real. Weinstein, a prominent researcher in the area of unrealistic optimism, suggests that in real life, unrealistic optimism may hinder people in their perception of actual risks and not allow them to respond appropriately (Neil D. Weinstein, 1982). In the context of a health issue such as smoking, Weinstein found that people are falsely optimistic in their beliefs that smoking will negatively affect their lives. This results in a failure to reduce their risk by quitting smoking (Neil D. Weinstein, 1999). With smoking, the risks appear to be too far in future to affect new smokers; thus, there is little motivation to quit smoking. Influenza vaccination behavior has also been examined for risk perceptions (Neil D. Weinstein, et al., 2007). Risk perceptions of
contracting the flu predicted whether or not an individual would obtain a flu vaccination. The way people feel about a specific risk is important to and predictive of whether or not they engage in a particular protective measure to reduce their risk.

In real world settings, individuals do not make judgments alone and in an isolated setting; rather these judgments about risks are made in environments that include scrutiny from others, behavioral examples of others, and both positive and negative feedback. These decisions are often made in order to avoid social embarrassment. Teenagers will often fail to seek out condoms and engage in other protective behaviors if their circle of friends or an authority figure speaks negatively about the condoms. This can be seen in many Central and South American countries where the Catholic Church is held in high regard (Philpott, 2004). These findings indicate that social comparison is one of the most important components of self-judgment (K. M. Klein & N. D. Weinstein, 1997). The manner in which social comparisons are made may influence perceptions of risk, and encourage unrealistic optimism. For instance, a smoker may compare themselves to their circle of friends who are a similar age, sex and ethnicity. The smoker then believes that their friends smoke even more than they do. The smoker may then lower their perceived “risk” and falsely assume that they are better off than their peers.

When it comes to health issues, social comparison is most often downward compared to others (K. M. Klein & N. D. Weinstein, 1997). This means that individuals tend to focus on the risky subgroups within their peers and compare themselves favorably. A monogamous heterosexual will compare him or herself to other heterosexuals with multiple partners when assessing personal risk of sexually transmitted infections.
According to Klein and Weinstein (1997), there are two methods in which individuals demonstrate unrealistic optimism. The first of these is *absolute unrealistic optimism bias*. In this form, people underestimate their objective or absolute risk of a specific problem (e.g., cancer, AIDS, malaria) (K. M. Klein & N. D. Weinstein, 1997). An example of this is a potential cancer victim who believes his risk of developing prostate cancer is below 15%, even when his family background indicates his risk to be over 50%. The second type of unrealistic optimism is that of *comparative unrealistic optimism bias*. In this form of the bias, people falsely perceive their risk of having a health issue as lower than that of their peers (someone similar in age, gender, or socioeconomic status). This is the most commonly studied form of the optimistic biases (Rothman A. J., W.M., & D., 1996). This form of the bias is generally referred to as just *unrealistic optimism*.

Unrealistic optimism has been found in all age groups, and does not seem to be limited to any particular age, education, occupation, or sex (K. M. Klein & N. D. Weinstein, 1997). In past research, it has been extremely unusual to find a sample that is comparatively pessimistic; this holds true even when the sample population is at high risk. One example of the pessimistic outlook will be discussed in the next section. There is a large body of evidence that most people, on the whole, are unrealistically optimistic about their comparative risks regarding a variety of negative outcomes, and this holds true across a wide variety of demographics (Klein & Weinstein, 1997; N. D. Weinstein, 1987).
1. Unrealistic Optimism Verses Pessimism Regarding Malaria

In 1999, Morrison and colleagues published an article that showed evidence of unrealistic pessimism in a population of Malawian individuals (Morrison, et al., 1999). The 119 participants were drawn from two rural locations in Malawi and were living in areas with high rates of malaria. In the Morrison et al. study, perceptions of personal risk for contracting malaria as well as the perceived risk of others contracting malaria were assessed. Personal risk was assessed using a numerical scale of 0 to 100, with 0 indicating they will never contract the disease, and 100 they were certain to contract the disease. Participants were asked to make the judgments for themselves and for others in the locality, by asking participants the following questions “How likely do you think it is that you will get malaria in the next year? What proportion of people living here do you think will get malaria next year?” (Morrison, et al., 1999). The difference between Morrison’s and Weinstein’s measures is important to note. For absolute risk assessment, they use similar wording, but for the comparative risk assessment, they are completely different. Weinstein and the majority of researchers on the topic have the participant compare themselves to others. This comparison can be done locally or involve a larger comparison (a country). The comparison always involves perceptions of self and others. Weinstein simply asked the participants what proportion of the village they felt would be affect by malaria. This is not comparative in its truest sense.

The findings of this one study run counter to the majority of the literature on risk perceptions which show that people rate their personal risk as lower than that of others. The participants in the Morrison et al. study viewed their risk of contracting malaria as more likely than the risk of others. In the first town, Ngabu, a score of 65.3 and in
Mponda, a score of 96.7, showed that people believed that they were more at risk than the rest of the population. It is unknown whether the findings represent a different perspective about malaria perceptions or whether there were internal threats to validity in the Morrison study design that lead to inappropriate conclusions regarding the perception of risk. These conclusions were based on the faulty use of proportions as a measure of comparative risk. Further investigation of this discrepancy, and whether or not these perceptions differ depending on the rate of malaria in a particular area and more importantly, how comparative risk is defined, was needed to determine if the Morrison et al. findings were representative of risk perceptions regarding malaria among those in endemic areas with high rates of malaria, or a unique finding specific to that population and study. It was also not known whether the pessimistic risk perceptions in the Morrison et al. study was related to a higher rate of preventive behavior to reduce malarial risk, as would be expected since behavior was not examined in their study. Perceptions about malaria have also been examined in other countries, most recently in Tanzania (Warsame et al., 2007).

G. Preventive Behavior for the Reduction of Malaria Transmission

Malaria transmission is influenced by a number of factors. Among these factors are sanitary conditions, the availability of medical care in the form of drugs or pesticides, level of outdoor activities, and, knowledge and attitudes towards the disease (Asenso-Okyere, 1994). Knowledge and attitudes about malaria are important for the success of preventive behaviors for a number of reasons. First, if the target population does not see a link between the vector mosquito and the risk of contracting malaria, the introduction of a tool like a bednet will not be received with effectiveness. The perceived risk of
contracting malaria is important, due to the fact that if the individual does not feel threatened by malaria, they will not see a need for prevention. As the knowledge and risk perceptions of the population at risk change and people become more aware of and concerned with the threat of malaria, there are a number of successful and common preventive practices that can and should be employed (Brentlinger et al., 2007; Campbell, 2008; Shanks & Edstein, 2005; Singh et al., 2006; Sochantha et al., 2006). The measures fall under three overarching categories: vector control, personal protection, and preventive treatment with anti-malarial drugs.

The first category, vector control, includes a number of methods. The first form is source reduction, or control of the larval levels of mosquitoes. This can be achieved through a number of methods. Mosquito fish are an effective measure in larger bodies of water (Singh, et al., 2006). Oils can be applied to the surface, which suffocates the larvae. The oils are rapidly biodegradable and so do not do long term damage to the environment. Source reduction is the ideal solution to mosquito control; however, it is not always possible to implement because often the larval habitats are small and dispersed.

The second category, personal protection, is achieved through the use of insecticide-treated bednets (ITNs) (Sochantha, et al., 2006). This form of protection greatly reduces the mortality and disease in endemic regions (Goodman & Mills, 1999; Sochantha, et al., 2006). Personal protection also comes in the form of using insect repellents, screening windows and doors of homes, and by wearing long sleeved protective clothing during high feeding times (dusk and dawn). Each of these personal protections relies on a person’s choice to engage in the behavior. There is no special training or skills needed to engage in any of these preventive behaviors. There is a small
limiting factor in that screens and repellents do carry an intrinsic cost that may limit their availability to the poor. The third category is preventive drug use. The majority of drugs used in treatment against malaria work against the parasite while it is in the blood (Peters, Thigpen, Parise, & Newman, 2007). Many drugs are used in treatment, including Chloroquine, quinine, sulfadoxine-pyrimethamine (Fansidar®), mefloquine (Lariam®), doxycycline, atovaquone-proguanil (Malarone®) (Brentlinger, et al., 2007; Cisse et al., 2006; Peters, et al., 2007; "Revised WHO treatment recommendations for malaria," 2006; Rieckmann, 2006; Shanks & Edstein, 2005; Tripathi, Mishra, Dwivedi, Tewari, & Verma, 2005). The type of drug and the course of treatment will depend on a number of factors including the type of parasite (species), whether the area has drug-resistant parasites, whether the person is pregnant, or has any predisposing conditions such as sickle cell. Perceptions play a role in the use of preventive drugs. Some groups still rely on traditional methods such as herbal remedies. However, researchers found that modern medicine is now the preferred choice among many at risk communities. Unfortunately, treatment is still often delayed because of lack of funding or other contributing factors, which often results in death (de Savigny et al., 2004).

1. Compliance with Preventive Behaviors

Even with the two personal forms of prevention, personal protection and preventive drug use, people still fail to participate in the actions will decrease their risk of disease. If travelers perceive their destination to be a high risk area, they will be more likely to engage in preventive measures then if they perceive the region to be low risk (Laver, et al., 2001). This higher level of engagement occurs regardless of the actual risk of malaria present. On the other hand, studies on the effective use of bednets in the rural
setting show that residents fail to use this preventive tool (Hamel, Odhacha, Roberts, & Deming, 2001). In one study, only 14% of a control group in a high risk area reported using bednets the night before (Sochantha, et al., 2006). Possible reasons for low use of bednets are the failure for at risk populations to perceive the link between malaria and mosquito bites. However, researchers have found that people often do have high levels of understanding regarding modes of malaria transfer (Onwujekwe, et al., 2000). Health education can provide a clear link between the mosquito and malaria, and many rural communities have learned and internalized these facts. Researchers report an increase in the recognition of the link between malaria and mosquitoes in at risk populations. In some areas, which have received extensive health education, there has being an increase in understanding about the lifecycle of the malaria. The population often understands the linkage but does not always see the benefit of using preventive tools like insecticide treated bednets, or indoor spraying. I believe what is lacking is the prioritization of the disease as a threat by those at risk for the disease. This could be due, in part, to an unrealistic view of the risk.

2. Community Knowledge about Malaria

Rural communities differ in their knowledge of malaria and its transmission and prevention, and results differ from region to region. There are still many areas of the developing world that do not have access to health education and for those regions malaria is still a mysterious disease. In areas where extensive health education about malaria transmission and protection has taken place, like Ghana, the majority of people understand the link between mosquitoes and malaria, although they still may not take action to reduce their risk of the disease through the consistent use of preventive
measures, such as ITNs (Adongo, et al., 2005). There is clearly a missing link between knowledge and practice. Perceptions of risk fit directly into this void and could help explain these disparities.

H. Conclusions

Understanding risk perceptions and the presence of unrealistically optimistic beliefs about risk is critical in understanding why people at risk for contracting malaria do not engage in effective preventive behaviors to reduce their risk. Failing to engage in preventive behaviors comes down to the individual level. If the war on malaria is to be won, people at risk for the disease must actively engage in preventive behaviors. A “top-down” approach will not work with this disease because malaria is most often associated with poverty (Worrall, Basu, & Hanson, 2005). It is easy for outside agencies and governments to come into an area at risk and handout bednets and give classes on the importance of malaria prevention. But if the local at risk population fails to engage in these behaviors or if they do not see malaria as a threat, then this “top-down” approach will fail. If risk perceptions are addressed and individuals at risk feel the need for prevention the programs will be much more successful. The people who need to engage in preventive behaviors are the villagers and rural populations. Having the perception that they have control over the risk is also very important. Understanding unrealistic optimism will aid in the success health education measures for malaria. In turn, health education is fundamental to the successful treatment and prevention of malaria (Montgomery, Mwengee, Kong'ong'o, & Pool, 2006). Health education helps individuals accurately
address risk perceptions and can provide encouragement to engage in behaviors that would reduce risk.
A. Design

This study used a cross-sectional, non-equivalent group comparison observational design. The two groups were selected based on the malaria prevalence rate (high, low) in different areas of Belize.

1. Setting

The study was conducted in Belize during October and November of 2009. At the time of the study the population of this Central American nation was approximately 320,000 people. Belize has a national rate of malaria of about 2.8 per 1,000 cases (Ruthig, Chipperfield, Bailis, & Perry, 2008). The nation of Belize has a very well defined split of malaria rates with the southwestern areas of the country having consistently higher rates than the northern areas (Hakre, et al., 2004). The southwestern areas of Belize contained 90.8% of all reported cases within the country between the years of 2002-2007 (Ruthig, et al., 2008). Cayo, Toledo, and Stann Creek are the districts which make up this region. Of the cases in southwestern Belize, a full 68% came exclusively from Stann Creek and Toledo districts. In Stann Creek malaria rates reached levels of more than 20 per 1,000 cases, compared to the district of Belize where the rates were almost always less than 1 per 1,000 cases (Ruthig, et al., 2008). The three districts of Orange Walk, Belize, and Corozal had the lowest rates in the country with less than 5 per 1,000 in 2007 as seen in Figure 1.2 (Ruthig, et al., 2008). One study group was selected from the high endemic area and a second group from the low endemic area, in
order to examine differences in risk perceptions and preventive behavior related to malaria.

The first group (High) was recruited from the southwestern area of Belize where the rates of malaria are consistently higher. The second group (Low) lived in the northern areas of the nation where the rates are lower. Data from both groups were collected during the rainy season months of October and November of 2009. During the rainy season, rates of malaria increase across the country due to the increase in breeding habitat for the mosquitoes. Even with the increase in malaria rates across the country, there was still a clear divide between the high risk south and low risk north. These differences in malaria rates were expected to provide a natural comparison in perceptions of risk. The months June through November are historically regarded as the rainy season. Data collection occurred during October and November. This allowed for the longest possible time for malarial rates to increase and risk perceptions to become pronounced.

Quantitative data were collected primarily through face-to-face interviews and conducted in each of the selected villages. Approval to conduct research with human participants was obtained from the Institutional Review Board at Loma Linda University prior to conducting any recruitment or data collection procedures.

B. Description of Participants

Participants in each of the two study areas were selected from preselect villages across the nation of Belize. The villages were selected based on in country discussions with Dr. Polanco, and Dr. Marenco of the Ministry of Health. These discussions occurred at the national level with the ministry and then at regional level with the local district directors. Ten villages within the highest rates of malaria were selected based on the most
current (unpublished) rates of malaria from 2009: Trio/Bladden, Bella Vista, Red Bank, Maya Mopan, Independence, Tam Bran, Golden Stream, Indian Creek, Hicatee Creek, and Corazon Creek. Another 10 villages, within the area of the country with the lowest malaria rates, were selected: Maskall, Belize City, Hattiville, Burrell Boom, Gardenia, Sand Hill, Crooked Tree, Ladyville, Lords Bank, and Biscayne. From within these villages, participants were selected using a convenience sampling strategy.

1. Inclusion/Exclusion Criteria

The requirements for participation in the study were that individuals be 18 years of age or older, currently living in Belize and self-identify as a Belize national. Participants were also required to provide verbal consent and complete the survey or interview in English. The participants were recruited from a wide range of urban to rural settings. This selection was done to ensure heterogeneity within the sample population.

C. Procedures

The first step in this study was to make contact with a local health leader. The Seventh-day Adventist development and relief agency (ADRA) director Dr. Ranju served as this primary contact. With 18 years of experience working in Belize, she was connected with all of the needed health officials. Upon contact with her, and on her advice, the Ministry of Health was contacted and three primary individuals agreed to assist in the research, Dr. Jorge Polanco, Dr. Jose Marenco, and Mr. Kim Bautista. The Belize Ministry of Health, located in Belmopan, Belize, is the primary source of access to health in the country. After communicating with the three gentlemen, plans were laid to then meet with local district leaders to clear the study in each of the needed districts. This
was conducted and permission granted. The local district leaders offered to send regional health workers into the sites as a visible symbol of their participation.

Prior to the start of the main data collection, a pilot study was conducted in Ladyville, and Lords Bank villages. This pilot study surveyed 30 participants; however, only 27 surveys were completed. During the pilot study it became clear that two of the questions needed to be edited. The first involved splitting the Mayan ethnic group into Maya Mopan and Maya Kechi. The second question addressed knowledge of the symptoms of malaria. It was initially worded “How do you know if you have malaria?”, but this lead to answers like “The doctor tells you”. The question was changed to “What are the symptoms of malaria?”

The actual village visits were done in coordination with both the Ministry of Health and with help from the local Seventh-day Adventist church member named Denfield Borland. The data collection occurred primarily through one-on-one interviews in each of the selected villages. If a church or school was present in the village then this was the starting point for the data collect. However in most villages, house-to-house canvassing was conducted. Interviews were conducted primarily during the early morning and evening to ensure that the adult population would have ample time to participate and not disrupt work activities. Data collection occurred in the previously mentioned 10 villages with high endemic malaria rates and 10 villages with low endemic malaria rates. These villages were selected based on the known rates of malaria. Completion of the surveys began in the northern area of the country (low burden of disease) and then moved to the southern tip of the country (high burden of disease); from there the data collection moved back towards the capital and completion of the study. The
majority of the villages selected were along major highway corridors. In each village a minimum of 15 people was sampled.

1. Recruitment

Recruitment was accomplished through two primary methods. The first used the Seventh-day Adventist church network to spread word throughout the communities of the study. This method was used in the north of the country with good results of community participation. In addition to this, the local health leaders spread word of the research study in the community and encouraged participation. This second method was used in both the south and the north. A small incentive was provided to participants. This incentive was a small flashlight with batteries. This incentive generated great interest within the study population and allowed for expedited collection of the data.

2. Consent

Consent was obtained orally from each participant as no personal identifiers were obtained or recorded. During the consent process, the purpose and procedures of the study were explained. The participants were informed that no identifying information was to be collected or recorded and that their answers were completely confidential.

3. Data Collection

The data collection took place via two methods. The primary method was one-on-one interviews. In the one-on-one situations, I read the questions to the participants and allowed them to select from the answers available. The wording and cues for response were standardized through all the interviews. The secondary method was
used when a group of participants wished to complete the questionnaire at the same time.
In these situations the instructions and consent was process was conducted for the group as a whole. Each participant was rewarded with a small token of thanks upon completion of their respective survey.

D. Variables

1. Independent Variable

The independent variable in this study was the location of the participant village in either a high or low endemic area (i.e., the study group), based on the rate of malarial infections.

The levels of malaria were gathered from the National Malaria Epidemiological Profile 2002-2007 (Ruthig, et al., 2008). These levels were compared to unpublished data obtained through discussions with the Ministry of Health. The two data sets were compared to ensure that the levels have not significantly changed. This national database is maintained and updated through the Ministry of Health and was used to calculate the actual rates of malaria in each of the selected villages. These rates were then compared to the perceived risks to deduce whether the participants are optimistic or pessimistic.

The independent variable was named location or study group (High, Low).

2. Dependent Variables

The dependent variables were assessed via self-reported surveys and oral interviews. A sample of the questionnaire is found in Appendix A. The following is a list of the dependent variables assessed: the demographic variables of age, gender, ethnicity, education, self-reported health and the history of malaria for self and family. The primary dependent variables were risk perceptions; in particular, absolute unrealistic optimism,
comparative unrealistic optimism, perceived control and perceived seriousness of acquiring malaria. Finally, the preventive behaviors of bednet use, keeping living area free of standing water, and the use of bug spray were assessed in the survey.

E. Instrumentation/Measuring Tools/Data Management

The survey questions on unrealistic optimism were validated. This was done through the small pilot study discussed earlier.

1. Demographic Variables

General demographics including age, gender, ethnicity, and educational level were collected. The top four ethnic choices provided comprise the majority of the Belize population, and are Mestizos, Creole, Maya, Garinagu. A fifth option of “other” was provided to ensure every participants group is included. After the pilot study, the Maya was split into Maya Mopan and Maya Kechi based on feedback from the population. Educational level was assessed through the highest form of schooling attended. The options were the three levels of education offered primary, secondary, and tertiary, followed by the primary levels of which there were 6 standards available. In secondary, there were four forms available. And finally, tertiary level was included as an acceptable answer.

2. Perceived Health Status

General health information was also gathered. This included a self report on current health ranging from very poor to excellent with five options. In addition, the last time the participant saw a doctor was assessed, with five options of “Have never seen a doctor” to “Less than a month ago”. The participants were asked if they have ever had malaria in their lifetime. This item was on a 3-point scale with “yes, no, do not know” as
the options. If they were currently sick with malaria they were instructed to answer “yes.” Finally, they were asked if anyone in their family had ever had malaria. This was assessed on the same 3-point scale of “yes, no, do not know” as the options. When it came to malaria, two questions were asked about the perceived seriousness of the disease. These questions were assessed on a 7-point Likert-type scale. The first question asked “how serious a threat is malaria?” The scale ranged from 1 “no threat” to 7 “extreme threat”. The second question compared the seriousness of malaria to that of “a cold or flu”. This question was scaled with a 1 “not as bad” to a 7 “much worse”.

Three questions addressed the perception of control the individual feels they have over malaria. All three questions were scored on the same 7-point scale, were 1 equaled “no control” and 7 was “complete control”. The first of question asked “How much control do you feel you have when it comes to avoiding malaria?” The second asked about “preventing a mosquito from biting you” and the third ask about control over “reducing mosquito breeding grounds”.

3. Risk Perceptions

a. Absolute Risk Absolute unrealistic optimism was measured using two items. The first addressed the perceived susceptibility of malaria during the year. The question “What do you feel is your risk?” was used as researchers had found it to have higher predictive value (Neil D. Weinstein, et al., 2007). Weinstein et al. also found that a 7-point response scale was the most effective in assessing risk perceptions. The second question assessing absolute unrealistic optimism was focused on the long term. Again it was asked as “what do you feel” is the likelihood you will get malaria in your life time.
b. **Comparative Risk** Comparative unrealistic optimism was measured by three questions. Individuals were asked to compare their personal risk of malaria to their community, their country, and a person of the same age. All three questions used the same 7-point Likert scale. This scale ranged from 1 = “Much below average”, to 7 = “Much above average”, with 4 = “Average for a person like me”. In addition to the standard Weinstein comparative assessment, Morrison et al.’s items were also assessed and included. The Morrison et al. item was worded “On a scale of 0 to 100, what proportion of people living in your village will get malaria this year?” The scale was show in percent, ranging from 0% to 100% in 10% steps.

4. **Preventive Behaviors**

The preventive behaviors were assessed through three questions. These questions looked at bednet use, the elimination of standing water, the cooperation with health officials using DDT. All items used the same 4-point (ordinal) scale, which ranged from “Never” to “Always”.

F. **Data Analysis**

All data were entered into a SPSS database from the hard copies of the surveys and interview forms and then stored digitally in multiple places to ensure the data were not lost or corrupted. Double entry was used which ensured that correct values were used and that missing data were handled properly. Missing data were given a predetermined value of “9” except for age, which was left blank. This practice helped reduce errors related to missing values.
SPSS-17 software was used to perform all statistical tests and analyses. Basic descriptive analyses of the demographic variables involved calculation of the averages of age and educational levels, and proportion in each ethnic groups and gender category.

G. Research Questions

1. Do people who live in areas of Belize with high rates of endemic malaria show greater levels of perceived absolute risk and/or comparative risk with regards to acquiring the disease than those in low endemic areas?

The first question addressed was whether people who live in areas of Belize with high endemic malaria show greater levels of absolute unrealistic optimism and comparative unrealistic optimism with regards to acquiring the disease than those in low endemic areas of Belize. This question was answered utilizing an independent sample t-test will be used between study groups. See Table 3.1 for a summarization.

2. Do people who living in areas of Belize with high rates of endemic malaria and who show higher levels of perceived risk for acquiring malaria, engage in more preventive behaviors than those with lower levels of perceived risk, or among those who live in low risk areas?(Brewer, Cuite, Herrington, & Weinstein, 2004)

The second question was whether people living in both the high and low areas of Belize with endemic malaria, who show higher levels of absolute and/or comparative unrealistic optimism for acquiring malaria, engage in fewer preventive behaviors than those who do not show such a bias. For this question, correlations between risk perceptions and behavior score were utilized. Chi-square analyses between comparative
group (pessimistic, average, optimistic) and behavior, were run to determine the association between risk perceptions and preventive behavior.

3. Do people living in areas of Belize with either low or high endemic malaria, who feel they have higher levels of control over preventing malaria infection, show greater levels of optimism?

For the third question of whether people living in areas of Belize with endemic malaria, who feel they have higher levels of control, show greater levels of optimism, the test was a correlation.

4. Do people living in areas of Belize with either low or high endemic malaria, who feel they have higher levels of control over preventing malaria infection, engage in more preventive behaviors than those present low levels of control?

The fourth question was whether people living in areas of Belize with endemic malaria, who feel they have higher levels of control, engage in more preventive behaviors than those with low levels of control? This research question was answered using correlation.

Table 3.1 provides a combined view of the variables and specific statistical tests used to answer the proposed research questions.

All of the previous statistical tests were selected based on the assumption that the variables will be answered in a way that provides continuous data. This assumption remained true during the analysis. Some questions were recoded into non-parametric measure to identify further details of the nature of perceptions. In that event, the non-
parametric equivalent tests were utilized.

**Table 3.1** Analyses of Research Questions with Statistical Test, Variables and Sample Size

<table>
<thead>
<tr>
<th>Question</th>
<th>Variables</th>
<th>Power Analyses</th>
<th>Statistical Test</th>
</tr>
</thead>
</table>
| 1        | Independent variable: Location HIGH/LOW | Power: 0.80  
Effect size: 0.5  
Alpha: 0.05  
Missing data: 10% | Independent sample t-test |
|          | Dependent variables: Likelihood of malaria: Year/Life  
Comparative Risk: General/Personal | Sample size per group: 112 |
| 2        | Independent variable: | Power: 0.80  
Effect size: 0.15  
Alpha: 0.05  
Missing data: 10% | Correlation |
|          | Likelihood of malaria: Year/Life  
Comparative Risk: General/Personal  
Location HIGH/LOW | Sample size: 60 |
|          | Dependent variables: Bednet  
Standing Water  
Indoor Spraying | |
| 3        | Independent variable: Control of malaria | Power: 0.80  
Effect size: 0.15  
Alpha: 0.05  
Missing data: 10% | Correlation |
|          | Dependent variables: Likelihood of malaria: Year/Life  
Comparative Risk: General/Personal | Sample size: 60 |
| 4        | Independent variable: Control of malaria | Power: 0.80  
Effect size: 0.15  
Alpha: 0.05  
Missing data: 10% | Correlation |
|          | Dependent variables: Bednet  
Standing Water  
Indoor Spraying | Sample size: 60 |

43
H. Power Analysis

For all of the research questions, G*Power 3 was used to calculate the required sample size (Faul, Erdfelder, Lang, & Buchner, 2007). After selecting the correct statistical test, the program requires that you manually select the settings to determine the sample size. First, the power is set to 0.80. Next, a medium effect size was selected, which for the multiple linear regressions was 0.15 and 0.05 for the independent t-test. Finally, the alpha level was set at 0.5. The G*Power 3 program then calculated a sample size, to which I added 10% to account for missing data. The final total for all tests was 260 participants. For the sake of simplicity, the target sample size was 300.

This target sample size was achieved by having a minimum of 15 samples per village. With 10 villages in each of the two settings (High/Low Endemic Malaria) a minimum of 300 participants was sampled. This gave me a buffer zone, in the event that non-parametric tests were needed.

I. Strengths and Limitations

There were a number of limitations to the study. The first limitation is that all the data relied on self-reports, which could be a source of bias. If the participants tried to answer in a way they perceive to be desired it could skew the results. In order to reduce the potential for this bias, clear instructions were provided that there was no correct answer to any question, and that all answers are of equal value. The participants were reminded that their answers were completely confidential and that their honesty is fundamental to the success of the research.

Language barriers may also lead to limitations in understanding the questions and this could create a threat to internal validity. Although the majority language in Belize is
English, Spanish is also spoken. In some of the rural areas the levels of English literacy could have been an issue. This however was not found to be a major problem. The literacy levels were addressed through the use of oral interviewing.

There were a number of strengths to this study. The first is the nature of the data collection. By using a standard assessment of perceptions of risk that has been validated, we controlled for biases. A single point of interaction means that there was no need to track and locate participants at post-data collection. In addition, the study was not attempting to change or modify any behaviors; rather it was focused on understanding perceptions. The comparison across the country from high and low risk areas was useful for controlling of external threats to validity. Finally in-person interviews helped address low literacy barriers. Combined, these strengths greatly enhanced the study.

J. Research Ethics

It is vital that with any research project, ethical concerns are addressed up front. The three main areas addressed are respect for persons, beneficence, and justice. In this study all three were accounted for.

The respect for persons was handled by clearly giving each participant the information they needed to decide if they wished to participate. By making every participant join voluntarily, the investigator ensured that no one was pressured or forced against their will. All information was kept confidential and no identifying variables such as names were collected or recorded.

Due to the design of this study, there was very little chance for harm to be done to the participants. Still the study kept beneficence in mind, and informed participants of
any event that may cause undue stress. The results of the study will also be shared with the Ministry of Health to improve participant’s lives and health.

Justice was achieved by allowing anyone who wished to join the study and met the minimum requirements to freely participate in the survey.
CHAPTER 4

FIRST PUBLISHABLE PAPER

Title:
The Role of Unrealistic Optimism in Explaining Preventive Behaviors in High versus Low Endemic Malaria Settings in Belize, Central America

Authors:
Daniel G. Handysides, DrPH(c), MPH, CPH, CHG, School of Public Health, Department of Health Education and Promotion, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 254-3720
Fax: (909) 558-0471
E-mail: dhandysides@llu.edu

Helen Hopp Marshak, PhD, MS, CHES, School of Public Health, Department of Health Education and Promotion, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: hhoppmarshak@llu.edu
You should move Dr. Herring’s name up to coincide with the next page
Naomi Modeste, DrPH, MPH, CHES, School of Public Health, Department of Health Education and Promotion, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: nmodeste@llu.edu

Patti Herring, PhD, MA, RN, School of Public Health, Department of Health Education and Promotion, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: pherring@llu.edu

What about Moreno? He is listed on the following page.

*For Submission to Psychology, Health & Medicine*
The Role of Unrealistic Optimism in Explaining Preventive Behaviors in High versus Low Endemic Malaria Settings in Belize, Central America

D. Handysides¹, H. Hopp Marshak¹, P. Herring¹, N. Modeste¹, J. Moreno²

¹Health Promotion and Education, Loma Linda University School of Public Health, Loma Linda, United States of America. ²Ministry of Health, Belmopan, Belize, Central America

Address for correspondence: H. Hopp Marshak, School of Public Health, Loma Linda University, Loma Linda, CA, 92354, USA. Tel: 909-558-4741 E-mail: hhoppmarshak@llu.edu

Abstract

Of all the diseases an individual can encounter in the world, malaria is one of the most destructive. Simple measures like sleeping under a bednet or allowing for spraying of insecticides would greatly reduce the burden (Abeku, 2007). Individuals at risk often fail to engage in preventive behaviors such as regular use of a bednet. Researchers show that when people estimate their risk relative to others, they are most often unrealistically optimistic. Not all researchers agree that unrealistic optimism is present for all health issues. Some feel that specific diseases like malaria cause people to show a pessimistic outlook (Morrison, et al., 1999). This study examined the risk perceptions, specifically unrealistic optimism or pessimism, regarding malaria, and the role such perceptions play in encouraging or discouraging preventive behavior. This study used a cross-sectional, non-equivalent group comparison observational design and was conducted in Belize, Central America. The data were collected using both self-reported surveys and personal interviews from residents of selected villages across the country where there is high (n = 10 villages) and low (n = 10 villages) endemic malaria. A total of 20 villages across the country were sampled, with a minimum of 15 people per village, for a total sample size
of 300 people. The survey assessed risk perceptions, perceived control and risk behaviors related to malaria, as well as standard demographics. More people in the high risk area had ever had malaria compared to those in the low risk area (42.7% vs. 8.8%, p<.001). Average perceived risk of ever getting malaria was 48.4%, with no significant difference between the high (51%) and low (46%) areas; however, those in the high area who had ever had malaria reported a significantly higher risk of ever getting malaria in the future (mean=59% vs. 45% chance, p=.003), indicating a fairly accurate perception among those in the high risk area but pessimism among those in the low risk area. However, participants in both high and low risk areas were most likely to show an optimistic bias for comparative risk items. When compared to others in their town, 47.1% thought they were below average, 32.5% average, and 20.3% above average risk (with no differences between high and low areas). Bednet use varied, with 40.7% of those in the high, and only 2.0% of those in the low, risk area always using a bednet (p<.001); those who had a history of malaria in the high risk area were more likely to always use a bednet than those who had not had malaria (50.0% vs. 33.7%, p<.05). There was no evidence for the accuracy hypothesis: greater perceived risks regarding malaria were not associated with regular bednet usage. However, perceived control was significantly correlated with preventive behavior (r=0.236, p<0.001). By understanding the comparative risk perceptions of people affected with malaria and how those perceptions are related to behavior, health educators will be able to develop more effective prevention programs to reduce the spread of malaria.

**Keywords:** unrealistic optimism; risk perceptions; malaria; Belize
Background

Of all the diseases an individual can encounter in the world, malaria is one of the most destructive. More than 500 million people are at risk for this disease ("Malaria," 2009). Malaria is a vector-borne disease caused by protozoan parasites, which is spread by female Anopheles mosquitoes and hosted within humans. The fact that malaria is spread by mosquitoes limits its range to tropical and subtropical areas such as Central and South America, sub-Saharan Africa, and Asia where Anopheles mosquito populations can live throughout the year. The vast majority of cases are seen in sub-Saharan Africa; approximately 90% of all malaria cases occur in Africa (Sachs, 2007). This high burden of disease in Africa does not, however, mean that other regions should be ignored.

Central and South America have been plagued with malaria for many years. Over 800,000 cases of the disease are reported yearly (Mirabello & Conn, 2006). Compared to areas with low risk of malaria like the United States, Central America had a relative risk of 37.8 in the period of 2000 through 2002 (Freedman, 2008). For malaria, natural ecological advantages of warm weather and high levels of rain fall found in Central American countries have unfortunately been coupled with local civil wars and abject poverty to provide a fertile ground for the disease to become endemic in the area.

The local conditions in Central American countries such as Belize are ideal for mosquito growth (Hakre, et al., 2004). The nation of Belize is a geologically and environmentally varied region. The annual rainfall varies drastically across the country from high level of 4000 millimeters in the south to the lowly 1200 millimeters received in the north (Hakre, et al., 2004). The elevation of Belize varies from 0 meters at the shores and swamp forests of the coastal areas to 1124 meters of the high Maya Mountains. The
seasons are quite pronounced with the months of January through April considered the dry season, and June through November the wet season (Hakre, et al., 2004). As mosquito populations use standing water as the medium for their larva to mature, levels of rain fall are directly related to increase in mosquito populations, which in turn produce a larger number of vectors to carry malaria. Due to the elevation and warm, wet weather areas like the south of Belize are faced with the threat of malaria almost constantly. The geography and weather of Belize has created an environment where in the south of the country malaria cases are high and in the north the burden of disease is lower.

The threat of malaria to human health is abundantly evident. The number of deaths related to the disease demand action; over 5,000 deaths a day worldwide is not acceptable (Sachs, 2007). Simple measures like sleeping under a bednet or allowing for indoor spraying of insecticides would greatly reduce the disease burden (Abeku, 2007). However, the threat of illness and death does not always result in actions being taken to reduce or eliminate the problem. The failure of populations to use preventive measures to reduce the impact of the disease is an issue which researchers have been studying for a while. The failure to use preventive measures begins when people lack knowledge about the link between vectors and malaria (Walther & Walther, 2007). Even when people have the knowledge and have decided to use preventive tools, they often fail to maintain the tools (i.e., use of bednets). In one study, over 40% of the bednets were damaged (Enato & Okhamafe, 2006). In some areas people delay seeking treatment for malaria and this can increase the risk of death (Amuge et al., 2004). What causes individuals to not engage in preventive measures is an important question worthy of study.
Human life is filled with constant threats to health and safety. These threats from diseases like malaria force decisions into the daily lives of individuals. Decisions that are often not clear cut but rather complex in nature. In order to handle these complex decisions humans have developed a number of coping strategies. One strategy utilized by people seeking to reduce their risks is the act of making daily judgments based upon comparisons to others. According to Weinstein, one of the most important processes involved in making self-judgments regarding risk is social comparison (Klein & Weinstein, 1997). When people compare themselves to others they most often do not do it accurately (Clarke, et al., 2000; Neil D. Weinstein, 1982; N. D. Weinstein, 1987), which in turn leads people to either under or overestimate their personal risk. Researchers report that when people estimate their risk relative to others, they are most often unrealistically optimistic (Neil D. Weinstein, 1982). This underestimation of risk can lead to a decrease in preventive behavior (Schwarzer, 1994).

There are two distinct ways people can be unrealistically optimistic. First they can underestimate their absolute risk, or the perceived likelihood they will develop a health problem, such as malaria, in their lifetime. This is termed “absolute unrealistic optimism” (Neil D. Weinstein, 1982, pg. 369). The second method is when people incorrectly believe their risk of a health issue to be lower than that of others. This is called “comparative unrealistic optimism” (Neil D. Weinstein, 1982).

Unrealistic optimism is present in the risk perception related to many health problems such as breast cancer, cancer from smoking cigarettes. Unintended pregnancies and sexually transmitted infections, as well as personal injuries resulting from failing to use protection such as helmets and seat belts are also examples of
unrealistic optimism found in the literature. (Dewberry, et al., 1990; Dillard, et al., 2006; Klein, et al., 2007; Li-Jun, et al., 2004; Madey & Gomez, 2003; Rutter, et al., 1998; Sjoberg, et al., 2004; Wendt, 2005).

However, not all researchers find that unrealistic optimism is present for all health issues. Some feel that specific diseases like malaria cause people to show a pessimistic outlook, but it is unclear what characteristics of the disease determine this (Morrison, et al., 1999). One researcher found that fearful people were pessimistic about their risk of the problem in question (i.e. malaria, cancer), compared to angry people who tended to be optimistic (Lerner & Keltner, 2001). Other than the research of Morrison et al. there is limited literature on any disease that presents a pessimistic outlook.

Morrison and colleagues (1999) reported that malaria presents a risk where people feel "unrealistically pessimistic". In their study, people in rural regions of Malawi were asked to rate their risk of malaria compared to others. Their findings were probable based on their method of assessment, which will be discussed shortly. Furthermore they found that people presented a pessimistic outlook, overestimating their risk compared to others. One possible reason for their result was the endemic nature of malaria and the constant threat that it presents to people living in these areas. By facing a threat that never goes away, people living in regions of malaria may simply believe that infection is inevitable. A second reason for their findings is the found in the way Morrison et al. (1999) defined and operationalized comparative risk. Instead of using having the participant compare their likelihood of malaria to someone else, Morrison asked participants what proportion of the village would get malaria. This is
not a true comparative risk assessment. Morrison et al. proposes that when people face an endemic threat such as malaria, they are more likely to acknowledge some level of personal risk. This would decrease the likelihood of unrealistic optimism.

Although the argument for a pessimistic outlook presented by Morrison and colleagues is possible, it is counter to the majority of the evidence supporting an unrealistic optimism bias. Furthermore, it is unclear whether such pessimism is a product of the disease malaria or simply a result of poorly worded questions. The questions asked during the Morrison study were worded in a rather complex nature. Some of the questions involved concepts like proportions, concepts which are difficult to translate to a population with lower education levels. An example of this type of question is “What proportion of people living here do you think will get malaria next year?” (Morrison, et al., 1999, pg. 364). Proportions are not easily conceptualized particularly in a rural population in Africa. In addition proportions do not reflect the standard way of assessing comparative optimism.

The discrepancy between Morrison et al. (1999) and the majority of the literature on the perceptions of risk associated with malaria raises questions about the relationship between beliefs about susceptibility compared to others (unrealistic optimism or pessimism) and how such perceptions are related to preventive behaviors to reduce risk of malaria. According to the Health Belief Model (HBM), if perceived susceptibility for a disease such as malaria is high, people are more likely to engage in preventive behaviors (Brewer, et al., 2004; Lai & Hamid, 2000). If malaria is endemic to a particular area, this may lead to pessimistic perceptions about risk, compared to a less frequently occurring disease such as breast cancer about which people are more
likely to hold an unrealistically optimistic view of risk. People who live in areas where there are lower levels of endemic malaria may hold views more like those of breast cancer victims, in that they may be unrealistically optimistic about their risk of contracting malaria because it is relatively rare in the area in which they live. There are no data to clearly suggest how living in an area with high versus low levels of malaria affects perceptions of risk, and how such perceptions relate to preventive behavior.

Aims

In this study, we examined perceptions of risk of malaria in Belize, a country where the disease is endemic, and the role that perceptions may play in encouraging or discouraging preventive behavior. We also sought to compare our findings with those of Morrison et al. (1999) and to research which utilized wording recommended by Weinstein (Neil D. Weinstein, et al., 2007) for assessing absolute and comparative risk.

Methods

The study used a cross-sectional, non-equivalent group comparison observational design and was conducted in Belize. The study was completed through the use of both self-reported surveys and personal interviews. The data were primarily collected through oral interviews to assure consistency in how the questions were posed. The data were collected from villages across the country where there is high and low endemic malaria. These villages were selected based on direct discussion with the Ministry of Health and the local health workers and on the most recent rates of malaria available. A total of 20 villages were sampled, with a minimum of 15 people per village, for a total goal sample size of 300 people; however, in reality, only 298 people completed the survey, and of these, 160 participants or 53.5% were female. Participants were
recruited on an opportunistic basis in the course of a transect through the villages. To gain access to the remote rural villages, a 4-wheel drive truck was utilized. Upon entering a village the truck was parked at a central location, normally a school or church. The surveys would often begin with adults at this central location. If insufficient numbers of participants were present, then a search of the village took place using a door-to-door method, and inviting villagers to participate in the study. To ensure a wider sample of the village no more than two people per house were selected.

A pilot test of the instrument, recruitment and data collection procedures occurred with a sample of 20 people from the Ladyville/Lords bank area (Low Risk for malaria). These people were selected by convenience from local markets and meeting places. The survey assessed risk perceptions, perceived control over malaria and risk behaviors related to malaria, as well as standard demographics, history of malaria, and perceived health and use of health care services. The study was approved by the Loma Linda University Institutional Review Board.

**Procedure**

The student investigator introduced himself to the potential participant, and explained the study. This included a detailed description of the participant’s role, including the facts that the data would contain no names and would be completely confidential. If the participant was interested in participation and verbal consent was provided, the interview would commence. The participants were interviewed in English; the interviews were standardized and consisted of reading the survey and providing the available response options to the participant. Upon completion of the survey, a small token (flashlight) of appreciation was provided to the participant.
Measure of Absolute Perceived Risk  On the survey instrument, five items were used to measure absolute perceived risk. The first three items differed only in the time frame of the risk (i.e., “If you do not use a bednet, what do you feel is the chance that you will get malaria ... this season, this month, your lifetime”). The scale for each of these items was a 7-point scale anchored with 1 being “no chance” and 7 being “certain to happen”. The fourth and fifth items were worded and based on the items used in the Morrison et al. study. These questions were scales of 0 to 100 percent with anchors of 0 = will never contract the disease, 100 = certain to contract the disease (i.e., “What is the likelihood of you getting malaria ever?” and “What proportion of people living in your village will get malaria this year?”). The first four questions looked at the likelihood of contracting malaria. The fifth question looked at the perceived proportion of the village that would acquire malaria that year and is not a standard way of assessing personal absolute risk.

Measure of Comparative Perceived Risk  Three questions assessed comparative perceived risk. These questions compared the individual to their community, their country, and finally a person of the same age. The first two questions were based on a 7-point scale where 1 = “Much below average”, 4 = “Average for a person like me”, and 7 = “Much above average”. An example of these questions is “Compared to other people in your town, your chances of getting malaria are:” Only the underlined section changed between the first two questions; in the second question people compared their chance to “in the entire country of Belize”. The third question addressed the same concept but was worded as follows: “Compared to a person your age, your chances of getting malaria are:” This question utilized a 7-point scale as well, with the anchors of 1
= "Much below my friends chances", 4 =" About the same as my friends chances”, and 7
"Much above my friends chances.”

In order to be able to compare my findings with those found by Morrison et al., I included their comparative question: “On a scale of 0 to 100, what proportion of people living in your village will get malaria this year?” This question as shown is not truly a measure of comparative perceived risks, however, I used it to compare with Morrison’s research.

**Measures of Seriousness and Control** The perceived seriousness of malaria was measured using two questions, both of which relied on a 7-point scale. The first question asked “In your opinion, how serious a threat is malaria?” For this question 1 = “No threat” and 7 = “Extreme threat”. The second question compared the seriousness of malaria to a more common disease, the cold or flu. This question was worded “Compared to a cold or flu, how serious is malaria?” The anchors for this question were 1 = “Not as bad”, 4 = “About the same”, and 7 “Much worse”.

Three questions measured perceived control. All three utilized the same 7-point scale with the anchors of 1 = “No control” and 7 = “Complete control”. These questions were worded as follows: “How much control do you feel you have when it comes to avoiding malaria?”, “How much control do you have at preventing a mosquito from biting you?”, and “How much control do you have over reducing mosquito breeding grounds?”

**Analyses**

The statistical tests used to compare the locations in terms of absolute risk perceptions were independent sample t-tests. For comparative perceptions of risk, the
data were collapsed into categorical variables with “Much below average”, “Below average” and “A little below average”. For these analyses, correlations were utilized. For all three questions concerning comparative risk perceptions, these categorical variables were used to run nonparametric tests to determine differences in optimistic and pessimistic risk regarding malaria between the two study groups. The nonparametric tests included Chi-square analysis.

**Results**

There were demographic differences for age, ethnicity and education between the high and low risk groups; as expected, there were no differences due to gender (because of the stratified sampling by gender in each study group). The high risk group was significantly younger with a mean age of 31.19 compared to 38.27 in the low risk group. The groups also differed on ethnicity with the majority of the low risk sample being Creole (77.2%), while in the high risk group, the majority was made up of Maya (Kechi 43.0%) and Mopan (30.2%). The high risk sample represents the more diverse population who inhabit this geographical area. The low risk population had a higher level of education; only 10.3% of the high risk sample had tertiary education compared to 33.6% in the low risk area. In addition, personal history of malaria was significantly different, with 42.7% of the high risk group and less than 10% in the low risk group reporting ever having had malaria. Due to this difference, personal history of malaria was included in subsequent analyses to determine if the differences between the high and low endemic areas were still present after controlling for history of malaria.

[PLACE TABLE 4.1 HERE]
For absolute risk perception, there were differences in perceived likelihood between the high and low risk areas (for season, lifetime, and month) but not for the Morrison (0-100) scale where those in the high risk population was reasonably accurate (based on the number who had ever had malaria), but those in the low risk group were pessimistic. Using the same “criteria” for pessimism that Morrison, et al. used, both high and low risk groups were pessimistic because they viewed their own likelihood has higher than others. When looking at “this season,” the mean for the high risk group was 4.13 and the low risk group was 3.60 (p =0.004). When looking at “this month” the means were 3.23 for the high, and 2.81 for the low (p = 0.047) groups. This effect was exaggerated for perceived lifetime risk; respondents perceived they were at greater risk in the high risk area (4.82) than a low risk area (4.26) (p = 0.001). When absolute risk was assessed using the Morrison et al. wording and scale, there were no differences between study groups. When asked the “likelihood of getting malaria ever” the mean responses were 50.87 for the high and 45.93 for the low group.

All of the comparative risk items showed optimistic bias for both high and low risk areas. There was no statistical difference for the comparative risk item means between the high and low risk areas except when participants were asked to compare themselves to “others your age” (p= 0.006). Participants in low risk areas were more likely to show optimism than those in high risk areas. Table 2 shows that the majority of people in both regions found themselves to be at lower risk than others; however, a substantial proportion in each group perceived their risk to be “the same” as others, and there were some who held a pessimistic bias. Using the Morrison wording, the second
question asked what proportion of the village would get malaria this year. The means for both the high (40.51) and low (30.80) risk areas were significantly different p = 0.001.

[PLACE TABLE 4.2 HERE]

Discussion

The results from our study show that that people in the low risk area were clearly pessimistic, while those in the high risk area were realistic. When using Morrison et al. wording (for the 2 questions), the results were the same, but I also found an optimism bias (and a lot of “realism”) when using Weinstein’s wording. This is intriguing on a number of levels. First, this pessimistic view might be a result of an inability to realistically gauge one’s absolute risk. Although only 8.8% of the low risk area reported having had the disease, a relatively high percentage (29.3%) of the low risk group believed that more than half of their community was at risk for acquiring malaria for the year. This belief was in direct contradiction to the actual statistics available from the Ministry of Health which showed no cases in the district (Belize district) for the past few years. This inability of individuals to accurately predict their personal risks, especially for those in very low risk areas, is an area that needs more research.

Morrison et al. (1999) found that people faced with the threat of malaria presented a pessimistic view. It appears, however, that this pessimism was simply an artifact of their wording and method of sampling. When the wording was changed to the standard set by Weinstein et al. (2007), the risk perception was now optimistic. Instead of using having the participant compare their likelihood of malaria to someone else. To assess
comparative risk, Morrison asked participants what proportion of the village would get malaria. This is not a true comparative risk assessment.

Both high and low risk groups displayed an optimistic view of their comparative risks for contracting malaria. This finding does not support results from the Morrison et al. (1999) study and is more in line with the body of literature on risk perceptions. When we look at the results from the Morrison et al. question, we found similar findings, however they were not truly a measure of comparative risk perceptions. The populations of both high and low risk areas view themselves to be at less risk, than either those in their town, nation, or people of the same age.

**Limitations**

There are a number of limitations inherent to this study. First the data were collected utilizing self report. Errors or inconsistencies could have entered the study through a misunderstanding in language and wording. Even though English is the official language of Belize, to many of the Mayan it is a secondary language. This limitation was minor as during the oral interviews all participants seemed to understand the questions and would often explain their answers in greater detail than the scale permitted. A second limitation is the ability of the findings to be generalized beyond the study. The observed effects of perceived risk are only relative to malaria and not other diseases. Finally because this was not a longitudinal study the effects cannot be used to show causality.

It would be prudent for researchers in this area to look at the role barriers to preventive behaviors play in the perceptions of control and risk. By understanding the comparative risk perceptions of people affected with malaria and how those perceptions are related to behavior, health educators and other healthcare professionals will be able to
develop more effective prevention programs to reduce the spread of malaria. Having
knowledge of how risk perceptions relate to preventive behaviors is fundamental to
successfully developing health programs. People who do not view themselves to be at
risk are less likely to seek out treatment or engage in preventative behaviors (Neil D.
Weinstein, et al., 2007). In the past, program planners have encouraged behaviors that
would reduce the risk of health problems in the target population, but one of the faults of
this approach is that if the target population does not see the specific health topic as an
issue or risk, they will not see a need to maintain learned behaviors. As health educators
understand the risk perceptions of populations, we can help create appropriate and
realistic programs that address those perceptions in order to correct them. With accurate
risk perceptions people will be able to correctly evaluate their risk and will desire to
make and maintain health behavior changes.
### Table 4.1 Characteristics of Study Sample by High and Low Risk Endemic Areas

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample N= 299</th>
<th>High Risk Sample N= 150</th>
<th>Low Risk Sample N= 148</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency or Mean</td>
<td>SD</td>
<td>Frequency or Mean</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>53.7%</td>
<td>55.7%</td>
<td>51.7%</td>
</tr>
<tr>
<td>Male</td>
<td>46.3%</td>
<td>44.3%</td>
<td>48.3%</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>34.72</td>
<td>13.9</td>
<td>31.19</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creole</td>
<td>43%</td>
<td>8.7%</td>
<td>77.2%</td>
</tr>
<tr>
<td>Maya Kechi</td>
<td>21.5%</td>
<td>43.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Maya Mopan</td>
<td>15.4%</td>
<td>30.2%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Mestizos</td>
<td>10.7%</td>
<td>11.4%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Other</td>
<td>4.4%</td>
<td>2.7%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Garinagu</td>
<td>2.7%</td>
<td>1.3%</td>
<td>4.0%</td>
</tr>
<tr>
<td>East Indian</td>
<td>2.3%</td>
<td>2.7%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Malaria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25.8%</td>
<td>42.7%</td>
<td>8.8%</td>
</tr>
<tr>
<td>No</td>
<td>73.5%</td>
<td>56%</td>
<td>91.2%</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>0.7%</td>
<td>1.3%</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Standard 3</td>
<td>7.5%</td>
<td>9.7%</td>
<td>5.4%</td>
</tr>
<tr>
<td>&gt; Standard 3</td>
<td>37.1%</td>
<td>51.7%</td>
<td>22.8%</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Form 2</td>
<td>5.8%</td>
<td>3.4%</td>
<td>8.1%</td>
</tr>
<tr>
<td>&gt; Form 2</td>
<td>27.6%</td>
<td>24.8%</td>
<td>30.2%</td>
</tr>
<tr>
<td>Tertiary</td>
<td>22.1%</td>
<td>10.3%</td>
<td>33.6%</td>
</tr>
</tbody>
</table>
Table 4.2 Absolute and Comparative Risk Perceptions across High and Low Malarial Risk Area Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>High Risk</th>
<th>Low Risk</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Absolute Risk(^1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood this season(^2)</td>
<td>4.13</td>
<td>1.64</td>
<td>3.60</td>
</tr>
<tr>
<td>Likelihood during your lifetime(^2)</td>
<td>4.82</td>
<td>1.62</td>
<td>4.26</td>
</tr>
<tr>
<td>Likelihood this month(^2)</td>
<td>3.23</td>
<td>1.94</td>
<td>2.81</td>
</tr>
<tr>
<td>Likelihood of getting malaria ever(^3)</td>
<td>50.87</td>
<td>28.97</td>
<td>45.93</td>
</tr>
<tr>
<td>Proportion in your village who will get malaria this year(^3)</td>
<td>40.51</td>
<td>25.13</td>
<td>30.80</td>
</tr>
</tbody>
</table>

Comparative Risk

<table>
<thead>
<tr>
<th>Compared to others in your town, your chances of getting malaria are:</th>
<th>Percentage</th>
<th>Percentage</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Average</td>
<td>44.6%</td>
<td>49.7%</td>
<td>0.224</td>
</tr>
<tr>
<td>Average</td>
<td>37.2%</td>
<td>27.9%</td>
<td></td>
</tr>
<tr>
<td>Above Average</td>
<td>18.2%</td>
<td>22.4%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compared to others in Belize, your chances of getting malaria are:</th>
<th>Percentage</th>
<th>Percentage</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Average</td>
<td>35.8%</td>
<td>49.0%</td>
<td>0.069</td>
</tr>
<tr>
<td>Average</td>
<td>35.5%</td>
<td>27.2%</td>
<td></td>
</tr>
<tr>
<td>Above Average</td>
<td>28.4%</td>
<td>23.8%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compared to others your age, your chances of getting malaria are:</th>
<th>Percentage</th>
<th>Percentage</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below Average</td>
<td>39.6%</td>
<td>42.9%</td>
<td>0.006*</td>
</tr>
<tr>
<td>Average</td>
<td>49.0%</td>
<td>34.0%</td>
<td></td>
</tr>
<tr>
<td>Above Average</td>
<td>11.4%</td>
<td>23.1%</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Absolute Risk Variables were assessed using a 7-point Likert scale where 1 = No chance, and 7 = certain to happen.

\(^2\) These questions asked what the likelihood of acquiring malaria would be without the use of a bednet during the various time frames.

\(^3\) These questions were assessed on a scale of 0 to 100 percent.

*Significant difference between High and Low Risk Groups at p<.05.
References


CHAPTER 5

SECOND PUBLISHABLE PAPER

Title:
Reappraisal of the Accuracy Hypothesis using Malaria and Preventive Behaviors in High versus Low Endemic Malaria Settings in Belize, Central America

Authors:
Daniel G. Handysides, DrPH(C), MPH, CPH, CHG, School of Public Health, Department of Health Promotion and Education, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 254-3720
Fax: (909) 558-0471
E-mail: dhandysides@llu.edu

Helen Hopp Marshak, PhD, MS, CHES, School of Public Health, Department of Health Promotion and Education Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: hhoppmarshak@llu.edu

Naomi Modeste, DrPH, MPH, CHES, School of Public Health, Department of Health Promotion and Education, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: nmodeste@llu.edu

Patti Herring, PhD, MA, RN, School of Public Health, Department of Health Promotion and Education, Loma Linda University, Loma Linda, CA, 92350
Telephone: (909) 558-4741
Fax: (909) 558-0471
E-mail: pherring@llu.edu

*For submission to Annals of Behavioral Medicine
Reappraisal of the Accuracy Hypothesis using Malaria and Preventive Behaviors in High versus Low Endemic Malaria Settings in Belize, Central America

Daniel Handysides, Helen Hopp Marshak, Naomi Modeste, Patti Herring
Loma Linda University School of Public Health

Jose Marenco
Ministry of Health, Belmopan, Belize, Central America

Address for correspondence: Helen Hopp Marshak, School of Public Health, Loma Linda University, Loma Linda, CA, 92354, USA. Tel: 909-558-4741 E-mail: hhoppmarshak@llu.edu

Abstract

Background: Perceived risk is seen as playing an important role in understanding preventive behavior. Understanding this role will help combat diseases such as malaria.

Purpose: To assess the accuracy hypothesis (Brewer, et al., 2004) between perceived risk of malaria and engaging in the preventive behavior of using a bednet, removing standing water, and indoor spraying of DDT. Methods: We used a cross-sectional, non-equivalent group comparison observational design to collect self-reported data about malarial risk perceptions and behaviors among residents in high (n=150) and low (n=150) endemic areas in Belize. Perceived control over malaria was also assessed. Results: There was little evidence for the accuracy hypothesis: perceived risks regarding malaria were not associated with preventive behavior. However, perceived control was significantly correlated to preventive behavior (r=0.236, p<0.001).

Keywords: accuracy hypothesis, unrealistic optimism; risk perceptions; preventive behaviors malaria; perceived control; Belize
Introduction

In daily existence people are faced with a vast array of threats to their safety and health. These threats are often hidden or beyond our direct control, examples of a threat beyond our direct control would be drunk drivers”, an example of a hidden threat would be high sodium in our favorite food. There are other threats that we recognize and have some control over, like malaria or teen pregnancy. Our perceptions of these risks are central to understanding and predicting health behavior in many theories (Brewer, et al., 2004). The concept of perceived risk has been examined under a number of terms including likelihood, susceptibility, vulnerability, and probability (Laver, et al., 2001; Neil D. Weinstein & Nicoli, 1993).

Perceived risk has historically been assessed through one or more self-reported items, such as “What is your chance of getting malaria in the next year?” In most interventions based upon these theories it is assumed that there is a need for an increase in risk perceptions in order for people to take action. There is inconsistency in the results of studies looking at the role risk perceptions have on health behavior. Brewer et al. (2004) argued that many of the inconsistent findings were due largely to an “inadequate specification of the links between risk perception and behavior” (p. 125).

An example of these inconsistencies can be seen in the Morrison et al. (1999) study. In this study perceptions of risk were assessed using questions which involved concepts of proportions; these concepts are difficult to translate to a population with lower education levels. An example of this type of question is “What proportion of people living here do you think will get malaria next year?” (Morrison, et al., 1999). Proportions are not easily conceptualized, which may be particularly so in a study
population such rural Africa, where their study was conducted. Morrison et al. (1999) defined and operationalized comparative risk in a manner that was inconsistent with the majority of perceived risk literature. Morrison, et al. had participants state the proportion of their village that was at risk for malaria. This is not the standard method of comparing oneself to others. Therefore instead of using having the participant directly compare their likelihood of malaria to someone else, Morrison asked participants what proportion of the village would get malaria, and the likelihood of their personal risk. This is not a true comparative risk assessment.

The discrepancy between Morrison et al. (1999) and the majority of the literature on the perceptions of risk associated with malaria raises questions about the relationship between beliefs about susceptibility compared to others (unrealistic optimism or pessimism) and how such perceptions are related to preventive behaviors to reduce risk of malaria. Morrison et al. found that people were pessimistic when it came to their perceptions of risk. Their finding was an artifact of the method of measurement, rather than a true comparative perception.

In their article; “Risk Perceptions and Their Relation to Risk Behavior,” Brewer et al. (2004) discussed three distinct hypotheses that would explain the relationship between risk perceptions and behavior. For this article we looked at what they termed the “accuracy hypothesis.” According to Brewer and associates, the accuracy hypothesis refers to the idea that once other risk factors are held constant, people who engage in risky behaviors have higher actual risk and therefore should have higher perceived risk. The accuracy hypothesis is primarily examined through a cross-sectional design.
Brewer and associates discussed how to appropriately assess perceived risk, as this is a key source of potential error. If perceived risk is assessed using a standard method, then the results will be uniformed across studies. Research by Weinstein and others have provided a clear guideline for the structuring of questions about perceptions (Brewer, et al., 2004; Neil D. Weinstein et al., 2004). Weinstein et al. found that perceived risks phrased in terms of feelings rather than as a purely cognitive probability judgment predicted more accurately the relationship between behavior and perceptions. With Weinstein’s results in mind, in our study we developed items which used this method of wording and assessment. A sample question from the malaria study was worded “If you do not use a bednet what do you feel is the chance that you will get malaria during your lifetime?”

In studying the perceptions of risk surrounding malaria, it was important to identify a location that had both high and low risk of malaria. The local conditions in Central American countries such as Belize are ideal for mosquito growth (Hakre, et al., 2004). The nation of Belize is a geologically and environmentally varied region. The annual rainfall varies drastically across the country from high level of 4000 millimeters in the south to the lowly 1200 millimeters received in the north (Hakre, et al., 2004). The elevation of Belize varies from 0 meters at the shores and swamp forests of the coastal areas to 1124 meters of the high Maya Mountains. The seasons are quite pronounced with the months of January through April considered the dry season, and June through November the wet season (Hakre, et al., 2004). As mosquito populations use standing water as the medium for their larva to mature, levels of rain fall are directly related to increase in mosquito populations, which in turn produce a larger number of vectors to
carry malaria (Winch, et al., 1994). Due to the elevation and warm, wet weather areas as experienced in the south of Belize, the threat of malaria is almost constant. The geography and weather of Belize has created an environment where in the south of the country malaria cases are high and in the north the burden of disease is lower. Because of its natural setting Belize was an ideal location to assess the relationships of perceptions, control and behavior surrounding malaria.

Methods

The study used a cross-sectional, non-equivalent group comparison observational design and was conducted in Belize. The study was completed through the use of both self-reported surveys and personal interviews. The data were primarily collected through oral interviews to assure consistency in how the questions were posed. The data were collected from villages across the country where there is high and low endemic malaria. These villages were selected based on direct discussion with the Ministry of Health and the local health workers and on the most recent rates of malaria available. A total of 20 villages were sampled, with a minimum of 15 people per village, for a total goal sample size of 300 people; however, in reality, only 298 people completed the survey, and of these, 160 participants or 53.5% were female. Participants were recruited on an opportunistic basis in the course of a transect through the villages. To gain access to the remote rural villages, a 4-wheel drive truck was utilized. Upon entering a village the truck was parked at a central location, normally a school or church. The surveys would often begin with adults at this central location. If insufficient participants were present, then a search of the village would take place using a door-to-door method, and inviting
villagers to participate in the study. To ensure a wider sample of the village no more than two people per house were selected.

A pilot test of the instrument, recruitment and data collection procedures occurred with a sample of 20 people from the Ladyville/Lords bank area (Low Risk for malaria). These people were selected by convenience from local markets and meeting places. The survey assessed risk perceptions, perceived control over malaria and risk behaviors related to malaria, as well as standard demographics, history of malaria, and perceived health and use of health care services. The study was approved by the Loma Linda University Institutional Review Board.

**Procedure**

Participants in each of the two study areas were selected from 10 preselected villages across the nation of Belize. The villages were selected based on in-country discussions with the Ministry of Health. These discussions occurred at the national level with the ministry and then at regional level with the local district directors. 10 villages within the highest rates of malaria were selected: Trio/Bladden, Bella Vista, Red Bank, Maya Mopan, Independence, Tam Bran, Golden Stream, Indian Creek, Hicatee Creek, and Corazon Creek. Another ten villages, within the area with the lowest malaria rates were selected: Maskall, Belize City, Hattiville, Burrell Boom, Gardenia, Sand Hill, Crooked Tree, Ladyville, Lords Bank, and Biscayne.

The requirements for participation in the study were that individuals be 18 years of age or older, currently living in Belize and self-identify as a Belize national. Participants were also required to provide verbal consent and complete the survey or
interview in English. The participants were recruited from a wide range of urban to rural settings. This selection was done to ensure heterogeneity within the sample population.

Upon entering a village, the truck was parked at a central location, normally a school or church. The surveys would often begin at this central location. If insufficient participants were present, then a search of the village would take place using a door-to-door method, and inviting villagers to participate in the study. To ensure a wider sample of the village no more than two people per house were selected.

Upon meeting a potential participant, the primary author briefly introduced himself, explained the purpose of the study, and obtained verbal consent from the subjects after providing them with a detailed description of the participant’s role, including the fact that the data would contain no names and their responses would be completely confidential. The participants were interviewed in English, the official language of Belize. The interview format was standardized and consisted of the primary author reading the survey items and providing the available response options to the participant, while the participant followed along with a hard copy of the survey. Upon completion of the survey, a small token of appreciation (flashlight) was given to the participant.

Measure of Absolute Perceived Risk  Five items were used to measure absolute perceived risk. These measures were worded according to the recommendations by Weinstein (Neil D. Weinstein, 1982; Neil D. Weinstein, et al., 2007). The first three items differed only in the time frame of the risk (i.e., “If you do not use a bednet, what do you feel is the chance that you will get malaria ... this season, this month, your lifetime”). The scale for each of these items was a 7-point Likert scale anchored with 1 being “no
chance” and 7 being “certain to happen”. The fourth and fifth items were worded based on the items used in the Morrison et al. study. These questions had a response scale of 0 to 100% in 10%-point increments with anchors of 0 = will never contract the disease, 100 = certain to contract the disease (i.e., “What is the likelihood of you getting malaria ever?” and “What proportion of people living in your village will get malaria this year?”). The first four questions looked at the absolute perceived likelihood of contracting malaria. The fifth question looked at the perceived proportion of the village that the participant thought would acquire malaria that year and is not a standard of assessing personal absolute risk. This question was taken from the Morrison et al. (1999) study. Even though it is not the standard method of sampling it was included to allow for comparison with Morrison et al.’s findings.

Measure of Comparative Perceived Risk Three questions assessed comparative perceived risk. These items asked participants to compare themselves to their community, their country, and to a person of the same age. The wording for these questions was taken from Weinstein’s (2007) recommendation. The first two items were based on a 7-point Likert scale where 1 = “Much below average”, 4 = “Average for a person like me”, and 7 = “Much above average”. An example of these questions is “Compared to other people in your town, your chances of getting malaria are…” In the second item, people compared their chance to “the entire country of Belize” and in the third question people compared their chance “to a person your age.”

Measure of Perceived Control Three items were used to assess perceived control for avoiding malaria. The items for perceived control were structured around Weinstein’s (2007) suggestions but tailored to fit malaria specifically. All three utilized
the same 7-point Likert scale with the anchors of 1 = “No control” and 7 = “Complete control”. These questions were worded as follows: “How much control do you feel you have when it comes to avoiding malaria?” “How much control do you have at preventing a mosquito from biting you?” and “How much control do you have over reducing mosquito breeding grounds?” Control over breeding grounds and preventing a mosquito from biting you are important due to the fact that they assess not only environmental controls but personal protection measures as well. These controls lead into the major preventive behaviors of sleeping under a bednet and removing standing water from your surroundings.

Measures of Preventive Behavior Preventive behaviors for avoiding malaria were measured with three items, using a 4-point measurement scale of “Never”, “Sometimes”, “Most of the time”, and “Always”. The first question focused on the use of bednets: “Do you sleep under a bednet or mosquito net at night?” The second question looked at an environmental factor a person had control over: “If you find standing water around your yard or community, how often do you pour it out right away?” The third and final question regarding behaviors was “Would you allow the Health Department to conduct indoor spraying against mosquitoes in your house?” This final question looked at the individual’s behavior towards allowing the Ministry of Health to conduct preventive measures in the area. Spraying is done in areas that show high levels of infection. Because the desired level of preventive behavior for each of these items was “always,” the items were grouped into two categories: those who “always” did the behavior, and those who did the behavior “less than always.” In addition, degree of
adherence to these three behaviors was determined by creating another variable by summing the values for each of the three preventive behavior items.

**Analyses**

Frequencies were run in order to describe the demographics in this study. Chi-square was used to compare the high and low areas relationships on preventive behaviors. The analyses used to describe the relationship between perceptions and behaviors were nonparametric correlations. For this study SPSS-17 software was used to perform all statistical tests and analyses. The tests were run after sorting the data by location.

**Results**

**Demographics of the study**

The study was stratified by gender and therefore, there was no significant difference found between the high and low endemic groups with regards to gender (Table 1). There were demographic differences for age, ethnicity and education between the high and low risk groups. The high risk sample was significantly younger with a mean age of 31.19 compared to 38.27. High and low risk groups also differed on ethnicity with the majority of the low risk sample being Creole (77.2%), the high risk group majority was made up of Maya (Kechi 43.0 and Mopan 30.2%). The high risk sample represents the more diverse population, due to the cultural makeup of this geographical area. The low risk population had higher education; only 10.3% of the high risk population had tertiary education compared to 33.6% in the low risk area. In addition, personal history of malaria was significantly different, with 42.7% of the high risk group and less than 10% in the low risk group reporting ever having had malaria. Due to this difference, personal history
of malaria was included in subsequent analyses to determine if the differences between the high and low endemic areas were still present after controlling for history of malaria.

[PLACE TABLE 5.1 HERE]

**Behaviors**

A total of three preventive behaviors were assessed, ranging from sleeping under a bednet to allowing for indoor spraying of insecticides by the Ministry of Health. Significant differences were found between high and low risk areas for the use of a bednet, with 40.7% of the high risk area using the bednets “all of the time” compared to only 2.0% of the low risk area. The low risk population was more likely (50.3%) to remove standing water “all of the time” than the high risk population (39.3%). For the final behavior of allowing the Health department to spray for mosquitoes, 74.7% of the high risk population was willing to allow this “all of the time” compared to 58.4% in the low risk population. Another way that this information was looked at between the groups was by creating a score which represented the sum of the behaviors. The scores were calculated as “always” vs. “less than always” and the possible range over the three items was a scale of 0 -3. Statistically significant differences were found between the risk populations with the high risk area scoring 1.6 and the low risk area scoring 1.1.

**Absolute Perceptions**

Absolute perceptions of risks related to behavior and performance of preventive behavior were first examined to assess the descriptive nature of each measure of absolute perception. We found that 27.5% of the low risk sample stating that their
likelihood of acquiring malaria during their lifetime was 50%. This means that a substantial portion of the sample saw their risk as 50-50 for acquiring the disease.

**Perceptions of Control**

When perceptions of control were examined in relation to behavior, significant positive correlation was found between control and behavior. There was a positive correlation between perceived control over “preventing a mosquito from biting you” and the summed score across the three preventive behavior items \((r=0.236, p<0.001)\), indicating that perceived control was related to behavior. The specific question on perceived control “over reducing mosquito breeding grounds” was also positively correlated with the summed behavior score \((r=0.170, p = .003)\). Finally, the correlation between the third perceived control on “How much control do you feel you have when it comes to avoiding malaria?” approached significance \((r=.113, p=.051)\). All control items were significantly but not highly intercorrelated indicating that they tapped different aspects of perceived control regarding malaria.

There were no significant associations between absolute risk perceptions and perceptions of control. This finding remained consistent across both high and low risk malaria settings.

Absolute risk perceptions were positively associated with preventive behavior scores for seasonal and lifetime risk only and only related to Morrison’s measure of comparative risk (“proportion of people living in the village who will get malaria this year”).
Comparative Perceptions

There were associations between comparative risk perceptions and perceived control, depending on risk setting. In the low risk group, there was a statistically significant negative correlation between perceived control at avoiding malaria and perception of risk compared to other people their age ($r=-0.178, p = 0.031$). In the high risk group, the comparative risk perceptions (i.e., specifically, "Compared to other people in the entire country of Belize, your chances of getting malaria are...") was significantly positively correlated with perceived control at avoiding malaria ($r=0.213, p = 0.010$) and perceived control about preventing a mosquito from biting you ($r=0.198, p = 0.016$). Comparative risk perceptions were not related to behavior.

[PLACE TABLE 5.2 HERE]

Discussion

The differences in preventive behavior between the high and low risk groups were significantly different, with 40.7% of those in the high risk using bednets compared to only 2.0% in the low risk area. For the other two measured behaviors, the differences between the groups were still statistically significant but not as strong. For the removal of standing water, the low risk population actually preformed this behavior more, with 50.3% compared to 39.3% in the high risk area. The majority in both the low and high risk areas, would be willing to allow for spraying in their homes, 74.7% in the high risk area, and 58.4% in the low risk area.

The main point of this article was to examine the accuracy hypothesis as proposed by Brewer et al. The accuracy hypothesis refers to the idea that once other risk factors are
held constant, people who engage in risky behaviors have higher actual risk and therefore should have higher perceived risk. Of those who are pessimistic (felt more at risk) 28.6% always engaged in the use of bednets compared to only 14.4% of those who were optimistic; however those who were optimistic were statistically more likely to remove standing water (52.8%) compared to those who were pessimistic (42.9%). When it came to allowing spraying in the home, there was no significant difference between those who were optimistic (65.5%) and those who were pessimistic (63.3%). This leads to the conclusion that there is no direct correlation between risk perceptions and behavior.

One major difference between the Brewer et al. (2004) study and ours is that they did not allow for the presence of an average group. They simply divided the participants into high or low categories. As shown earlier, a large portion of our study self-identified their malaria risk as 50/50. In addition, those individuals who engaged in preventive behaviors did report feeling less at risk. This difference could go a long way in explaining why Brewer and associates found support for the accuracy hypothesis, while our study did not. Previous exposure to malaria played a significant role in behavior. Of the individuals who had had malaria, 50% always used the bednet, compared with only 33% of those who had not had malaria. Experience with a disease is therefore important in the relationship between risk perceptions and behavior.

**Limitations and Future Research**

There are several aspects of this study that will have an effect on generalizing our findings. First the sample was selected from several villages in Belize, Central America, with both high and low rates of malaria. This study may yield different results in locations other than Belize and certainly with other diseases. The sample
population was representative of the country in question but may not be similar to any other nation. Language was another possible limitation of this study. Although the majority of Belizeans speak English, the level of reading, in the rural villages, was low. This was overcome through reading the survey directly to the participants and completing it with them. However, the comprehension of the questions may not have been perfect. Participants appeared to understand the questions, and answered them consistently, but this could pose opportunities for errors. Thirdly, as all the answers were self-reported, it is possible that the participants would try to answer in a method they thought was in favor of the research. Although instructions stated that there were no correct answers, this is a possible limitation.

Due to the complex nature of the relationships between perceived risk and behavior, additional studies are recommended. These studies should be longitudinal in nature, having a pre-test to assess perceptions of risk and behavior, and then following education and the supply of preventive tools (bednets), a post-test to see if the perceptions and behaviors had changed. In addition, a control group should be assessed without the supply of preventive tools. These studies must focus on testing the hypothesis with the use of the correct and standardized formulation of questions and study design. Having knowledge of how risk perceptions relate to preventive behaviors is fundamental to successfully developing health education programs to reduce risk. People who do not view themselves to be at risk are less likely to seek out treatment or engage in preventative behaviors (Neil D. Weinstein, et al., 2007). In the past, program planners have encouraged behaviors that would reduce the risk of health problems in the target population, but one of the faults of this approach is that if the target population does not
see the specific health topic as an issue or risk, they will not see a need to maintain learned behaviors. As health educators understand the risk perceptions of our populations, it will help us to create programs that address those perceptions in order to correct them and ensure that they are realistic in nature. With accurate risk perceptions people will be able to correctly evaluate their risk and will desire to make and maintain health behavior changes.
Table 5.1 Characteristics of Study Sample by High and Low Risk Endemic Areas

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample N= 299</th>
<th>High Risk Sample N= 150</th>
<th>Low Risk Sample N= 148</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency or Mean</td>
<td>SD</td>
<td>Frequency or Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>53.7%</td>
<td>55.7%</td>
<td>51.7%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>46.3%</td>
<td>44.3%</td>
<td>48.3%</td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>34.72</td>
<td>13.9</td>
<td>31.19</td>
<td>13.0</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creole</td>
<td>43%</td>
<td>8.7%</td>
<td>77.2%</td>
<td></td>
</tr>
<tr>
<td>Maya Kechi</td>
<td>21.5%</td>
<td>43.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Maya Mopan</td>
<td>15.4%</td>
<td>30.2%</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>Mestizos</td>
<td>10.7%</td>
<td>11.4%</td>
<td>10.1%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4.4%</td>
<td>2.7%</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>Garinagu</td>
<td>2.7%</td>
<td>1.3%</td>
<td>4.0%</td>
<td></td>
</tr>
<tr>
<td>East Indian</td>
<td>2.3%</td>
<td>2.7%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25.8%</td>
<td>42.7%</td>
<td>8.8%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>73.5%</td>
<td>56%</td>
<td>91.2%</td>
<td></td>
</tr>
<tr>
<td>Don’t Know</td>
<td>0.7%</td>
<td>1.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Standard 3</td>
<td>7.5%</td>
<td>9.7%</td>
<td>5.4%</td>
<td></td>
</tr>
<tr>
<td>&gt; Standard 3</td>
<td>37.1%</td>
<td>51.7%</td>
<td>22.8%</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; Form 2</td>
<td>5.8%</td>
<td>3.4%</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>&gt; Form 2</td>
<td>27.6%</td>
<td>24.8%</td>
<td>30.2%</td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>22.1%</td>
<td>10.3%</td>
<td>33.6%</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.2 Preventive Behaviors of Study Sample by High and Low Risk Endemic Areas

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample (N=299)</th>
<th>High Risk Sample (N=150)</th>
<th>Low Risk Sample (N=149)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you sleep under a bednet or mosquito net at night?</td>
<td></td>
<td></td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>Never</td>
<td>61.5%</td>
<td>35.3%</td>
<td>87.9%</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>12.7%</td>
<td>17.3%</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>Most of the time</td>
<td>4.3%</td>
<td>6.7%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>21.4%</td>
<td>40.7%</td>
<td>2.0%</td>
<td></td>
</tr>
<tr>
<td>If you find standing water around your yard or community, how often do you pour it out right away?</td>
<td></td>
<td></td>
<td></td>
<td>0.014</td>
</tr>
<tr>
<td>Never</td>
<td>9.0%</td>
<td>6.7%</td>
<td>11.4%</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>18.1%</td>
<td>18.0%</td>
<td>18.1%</td>
<td></td>
</tr>
<tr>
<td>Most of the time</td>
<td>28.1%</td>
<td>36.0%</td>
<td>20.1%</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>44.8%</td>
<td>39.3%</td>
<td>50.3%</td>
<td></td>
</tr>
<tr>
<td>Would you allow the Health Department to conduct indoor spraying against mosquitoes in your house?</td>
<td></td>
<td></td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>Never</td>
<td>7.7</td>
<td>2.7</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>14.4</td>
<td>8.7</td>
<td>20.1</td>
<td></td>
</tr>
<tr>
<td>Most of the time</td>
<td>11.4</td>
<td>14.0</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>66.6</td>
<td>74.7</td>
<td>58.4</td>
<td></td>
</tr>
</tbody>
</table>
References


A. Implications

These results show that people in Belize exhibit both pessimistic and optimistic biases (as well as accurate perceptions) regarding their risk of malaria. The biases depend on the type of risk assessed (absolute vs. comparative), the actual risk of malaria (high vs. low risk areas), the past history of malaria, and the method of assessment (especially true when assessing comparative risk).

The risk perceptions regarding malaria were not reliably associated with preventive behaviors, unlike that found by Brewer et al. Little evidence was found for the accuracy hypothesis: greater perceived risks regarding malaria were not strongly associated with regular bednet usage.

A major finding of this study was that risk perceptions were not directly related to participants engaging in preventive behaviors. With regards to absolute perceived risk, the average perceived risk of ever getting malaria was 48.4% with no significant difference between the high (51%) and low (46%) areas. Past experience with malaria played a major role in participants risk perceptions, in that personal experience with malaria appears to increase personal perceptions of risk. Those in the high risk areas who had experienced malaria reported a significantly higher risk of ever getting malaria in the future than those in low risk areas (mean = 59% vs. 45% chance, p = 0.003). This high risk perception shows a fairly accurate perception of risk among those in the high risk
area. However the 45% chance reported by those in the low risk area is a clear sign of pessimism.

When we examined the comparative risk items, those in both the high and low risk areas were most likely to show an optimistic bias. When compared to others in their town, 47.1% thought they were below average, 32.5% average, and 20.3% above average risk (with no differences between high and low areas).

Perceived control had a positive relationship with participants engaging in preventive behaviors ($r=0.236, p<0.001$). An individual who feels s/he has control over a problem is more likely to engage in behavior to prevent that problem is. The implication of this finding for health education is that it is important to find successful ways to raise a person’s perceived control surrounding preventive behaviors. Health education practitioners can utilize these findings to enhance their understanding of the effect of perceptions on a participant’s use of preventive tools.

B. Recommendations

1. Future Research

Researchers should continue to focus on the area of perceptions surrounding behaviors. According to the health belief model, if perceived susceptibility for a disease such as malaria is high, people are more likely to engage in preventive behaviors (Lai & Hamid, 2000). In this study we found was no direct relationship between risk perceptions and preventive behavior. This missing link may be mediated by factors not examined in this study. These mediating factors could include barriers to preventive tools like bednets. Due to the complex nature of the relationships between perceived risk and behavior, additional studies are needed to understand the nuances of
this topic. It would be prudent for further researchers in this area to look at the role perceived barriers plays in discouraging preventive behaviors via the perceptions of control and risk. In the past, people who did not view themselves to be at risk were less likely to seek out treatment or engage in preventative behaviors (Neil D. Weinstein, et al., 2007). Possibly due to the cross-sectional nature of my study, this relationship was not observed. However if a longitudinal study was conducted these relationships could be examined.

Future studies should be longitudinal in nature, having a pre-test to assess perceptions of risk and behavior, and then, following education and the supply of preventive tools (bednets), a post-test to see if the perceptions and behaviors had changed. This style of study would allow for a clearer understanding of the role perceptions play in the adoption of preventive behaviors. In addition, a control group could be included to assess behaviors in the absence of education.

Future researchers also need to examine why those in low risk areas had such a high perception of malaria risk, even though they did engage in preventive behaviors. These studies must focus on testing the hypothesis with the use of the correct and standardized formulation of questions and study design.

2. Practice

Having knowledge of how risk perceptions relate or fail to relate to preventive behaviors is fundamental to developing successful health education programs. People who do not view themselves to be at risk are less likely to seek out treatment or engage in preventive behaviors (Neil D. Weinstein, et al., 2007). In the case of Belize, those in low risk areas had high levels of perceived risk; however, this did not relate to
behavior. It will be important for health educators to educate the population about the actual levels of risk, and then ensure people clearly understand the steps they can take to further reduce their risk. In the high risk area, perceptions of risk were fairly accurate for those who had exposure to malaria. Health educators need to continue education on the tools of prevention and ensure that barriers are addressed. In the past, program planners have encouraged behaviors that would reduce the risk of health problems in the target population, but one of the limitations of this approach is that if the target population does not see the specific health topic as an issue or risk, they will not see a need to maintain learned behaviors. As health educators understand the risk perceptions of our populations, it will help them to create programs that address those perceptions in order to correct them and ensure that they are realistic in nature.

C. Conclusion

The purpose of this research was to examine risk perceptions, specifically unrealistic optimism or pessimism, regarding malaria in an area where the disease is endemic, and the role such perceptions play in encouraging or discouraging preventive behavior. By focusing on absolute and comparative unrealistic optimism with regards to malaria it was hoped that the discrepancy in the literature can be explained. In addition, the link between levels of optimism and preventive behaviors was examined. It was expected that higher levels of optimism would be associated with lower levels of preventive behaviors.

The results of the study show that people who had no previous experience with malaria, regardless of high and low risk areas held a pessimistic view of their absolute risk for contracting malaria. However, when we looked at people who had exposure to
malaria, those in high risk area had a fairly accurate perception of risk, while those in the low risk area maintained their pessimistic view. This is intriguing on a number of levels. First, this pessimistic view might be a result of an inability to realistically gauge one’s absolute risk. Although only 8.8% of the low risk area reported having had the disease, a high percentage (29.3%) of the low risk group believed that more than half of their community was at risk for acquiring malaria for the year. This belief directly contradicted the malarial rates available from the Ministry of Health which showed no cases in the district (Belize district) for the past few years. This inability of individuals to accurately predict their personal risk, especially in a low risk area, needs more research. Another important finding was that absolute optimism had no consistent relationship to preventive behaviors. This means that the bias, whether optimistic or pessimistic, does not appear to be related to behavior.

Morrison et al. (1999) found that people faced with the threat of malaria presented a pessimistic view. It appears, however, that this pessimism was simply an artifact of their wording and method of sampling. The questions asked during the Morrison study were worded in a rather complex nature. Some of the questions involved concepts like proportions, concepts which are difficult to translate to a population with lower education levels. An example of this type of question is “What proportion of people living here do you think will get malaria next year?” (Morrison, et al., 1999, pg. 364). Proportions are not easily conceptualized, particularly in a rural population. When the wording was changed to the standard set by Weinstein et al. (2007) the comparative risk perception was now optimistic. Both high and low risk groups displayed an optimistic view of their comparative risks for contracting malaria. This finding does not support results from the
Morrison et al. (1999) study and is more in line with the body of literature on risk perceptions.
REFERENCES


Laver, S. M., Wetzels, J., & Behrens, R. H. (2001). Knowledge of malaria, risk perception, and compliance with prophylaxis and personal and environmental preventive measures in travelers exiting zimbabwe from harare and victoria falls international airport. *Journal of Travel Medicine, 8*(6), 298.


Malaria. (2009). Retrieved April 21, 2009, from


APPENDIX A: IRB APPROVAL

INSTITUTIONAL REVIEW BOARD

Exempt Notice

OFFICE OF SPONSORED RESEARCH • 11181 Artesian Street • Loma Linda, CA 92350
(909) 558-4511 voice • (909) 558-4131 FAX

To: Marshak, Helen H
Department: Health Promotion & Education
Protocol: The role of unrealistic optimism in explaining preventive behaviors in high versus low endemic malaria settings in Belize

Your application for the research protocol indicated above was reviewed administratively on behalf of the IRB. This protocol is determined to be exempt from IRB approval as outlined in federal regulations for protection of human subjects, 45 CFR Part 46.101(b)(2).

Stipulations:

Please note the PI's name and the IRB number assigned to this IRB protocol (as indicated above) on any future communications with the IRB. Direct all communications to the IRB c/o the Office of Sponsored Research.

Although this protocol is exempt from further IRB review as submitted, it is understood that all research conducted under the auspices of Loma Linda University will be guided by the highest standards of ethical conduct.

Signature of IRB Chair/Designee Date: 8/25/09

Loma Linda University Advinced Health Sciences Center Holtz Federalwa Assurance (FWA) No. 6447 with the U.S. Office for Human Research Protections, and the IRB registration no. 154722. This Assurance applies to the following Institutions: Loma Linda University, Loma Linda University Medical Center, including Loma Linda University Children’s Hospital; LLU Community Medical Center; Loma Linda University Behavioral Medicine; and affiliated medical practice groups.

IRB Chair: Rhodes L. Rigby, M.D.
Department of Medicine
(909) 558-2941 rigby@llu.edu

IRB Administrator: Linda G. Hallwash, M.A.
Office of Sponsored Research
Ext 41570. Fax 80131. hallwash@llu.edu

IRB Specialist: Mark Fiederman
Office of Sponsored Research
Ext 43042. Fax 80131. m.fiederman@llu.edu

107
APPENDIX B: INFORMED CONSENT

#59182 (Marshak)

Verbal recruitment and consent script

Pilot Study

Recruitment:

Individual

Good morning

My name is Daniel Handysides; I am a doctoral student from Loma Linda University in California. I have come to Belize to conduct a research study on the way people view malaria. This study will use a survey to assess people's perceptions. It is my goal to have the survey, be culturally appropriate to Belize. I am conducting a pilot test of the survey to ensure that the population of Belize will be able to understand and answer each question. I would like to give you that pilot survey, which asks your feelings and perceptions about malaria. Are you interested in hearing more about the study?

If Yes: Proceed to Consent

If No: Thank you for your time

Consent

There are no correct answers. It should take about 30 minutes for you to fill out this survey. The purpose of the survey is to better understand the way people feel about malaria. The purpose of the pilot test is to see if there are questions that may be confusing or not worded in a culturally acceptable way. As you take the survey, if you find a question confusing, please point it out to me.

If you need help reading the survey, I can read it to you, and I will record your answers on the survey. At any time you can stop and I will not be upset. If while I am reading the survey to you, a question is confusing, please state that to me.

Please do not put your name on the survey. All your answers will be anonymous. There are minimal risks to participation. While there are no direct benefits to you from participating, your answers will help us prepare an appropriate survey to better understand how people in Belize view malaria.

As a small thank you, when you have completed the pilot test, I will be giving you a small gift. Participating in this study is totally your choice.

I would be happy to answer any questions you have about the study. Do you have any questions now?

Loma Linda University

Advisory Health Sciences Center

Institutional Review Board

Approved: 8/5/09

Chair: R. Rigley
Would you like to participate?

If Yes: 
1) If they can read and write, they can self-complete the survey
2) If they can NOT read or write, I (Daniel Handysides) will assist them in completing the survey.

If No: Thank them for their time.

Upon completion of the survey present them with a token (small flashlight) of appreciation.
Recruitment:

Individual

Good morning

My name is Daniel Handysides; I am a doctoral student from Loma Linda University in California. I have come to Belize to conduct a research study on the way people view malaria. I would like to give you a survey, which asks your feelings and perceptions about malaria. Are you interested in hearing more about the study?

If Yes: Proceed to Consent

If No: Thank you for your time

Group

Good morning

My name is Daniel Handysides; I am a doctoral student from Loma Linda University in California. I have come to Belize to conduct a research study on the way people view malaria. I would like to give you a survey, which asks your feelings and perceptions about malaria. Are you interested in hearing more about the study?

If Yes: Proceed to Consent

If No: Thank you for your time

Consent

There are no correct answers. It should take about 30 minutes for you to fill out this survey. The purpose of the survey is to better understand the way people feel about malaria.

If you need help reading the survey I can read it to you, and I will record your answers on the survey. At any time you can stop and I will not be upset.

To lessen any risk to your privacy, please do not put your name on the survey. All your answers will be anonymous. While there are no direct benefits to you from participating, your answers will help us better understand how people in Belize view malaria and create more effective education programs in the future.

As a small thank you, when you have completed the survey, I will be giving you a small gift. Participating in this study is totally your choice.

Loma Linda University
Adventist Health Sciences Center
Institutional Review Board
Approved 6/13/09

Chair
I would be happy to answer any questions you have about the study. Do you have any questions now?

Would you like to participate?

If Yes:  
1) If they can read and write, they can self-complete the survey

2) If they can NOT read or write, I (Daniel Handysides) will assist them in completing the survey.

If No: Thank them for their time

Upon completion of the survey present them with a token (small flashlight) of appreciation.
APPENDIX C: QUESTIONNAIRE

MALARIA HEALTH SURVEY

Instructions: Please do NOT write your name on the survey. Try to answer every question. Remember there is no correct answer, only your opinion. Thank you!

Health Information

1. How would you rate your health?
   □ 1 Very poor
   □ 2 Poor
   □ 3 Good
   □ 4 Very Good
   □ 5 Excellent

2. When was the last time you saw a doctor?
   □ 1 Less than a month ago
   □ 2 1-3 months ago
   □ 3 4-6 months ago
   □ 4 More than 6 months ago
   □ 5 Have never seen a doctor

3. Have you ever had malaria? (If you are currently sick with malaria, select “yes”)
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know

4. Has anyone in your family had malaria?
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know

5. Have you ever known someone other than your family, who had malaria?
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know

Beliefs about Malaria

For each of the items below, circle the number you feel is the best answer.

6. In your opinion, how serious a threat is malaria?
   1 2 3 4 5 6 7
   No threat Extreme threat

7. Compared to a cold or flu, how serious is malaria?
   1 2 3 4 5 6 7
   Not as bad About the same Much worse
8. How much control do you feel you have when it comes to avoiding malaria?
1 2 3 4 5 6 7
No control complete control

9. How much control do you have at preventing a mosquito from biting you?
1 2 3 4 5 6 7
No control complete control

10. How much control do you have over reducing mosquito breeding grounds?
1 2 3 4 5 6 7
No control complete control

11. If you do not use a bednet, what do you feel is the chance that you will get malaria during this season?
   □ 1 No chance  □ 2 Very unlikely  □ 3 Unlikely  □ 4 Moderate  □ 5 Likely  □ 6 Very likely  □ 7 Certain to happen

12. If you do not use a bednet, what do you feel is the likelihood that you will get malaria during your lifetime?
   □ 1 No chance  □ 2 Very unlikely  □ 3 Unlikely  □ 4 Moderate  □ 5 Likely  □ 6 Very likely  □ 7 Certain to happen

13. If you do not use a bednet, what do you feel is the likelihood that you will get malaria during this month?
   □ 1 No chance  □ 2 Very unlikely  □ 3 Unlikely  □ 4 Moderate  □ 5 Likely  □ 6 Very likely  □ 7 Certain to happen

14. On a scale of 0 to 100, what is the likelihood of you getting malaria ever? (When 0 equals “never contracting malaria”, and 100 equals “certainly contracting malaria”)
   0% 5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95% 100%
No chance Certain
15. Compared to other people in your town, your chances of getting malaria are:
   □ 1 Much below average
   □ 2 Below average
   □ 3 A little below average
   □ 4 Average for a person like me
   □ 5 A little above average
   □ 6 Above average
   □ 7 Much above average

16. Compared to other people in the entire country of Belize, your chances of getting malaria are:
   □ 1 Much below average
   □ 2 Below average
   □ 3 A little below average
   □ 4 Average for a person like me
   □ 5 A little above average
   □ 6 Above average
   □ 7 Much above average

17. On a scale of 0 to 100, what proportion of people living in your village will get malaria this year?
   (When 0 equals “no one”, and 100 equals “everyone”)
   0%  5%  10%  20%  30%  40%  50%  60%  70%  80%  90%  95%  100%
   No one  Everyone

18. Compared to a person your age, your chances of getting malaria are:
   □ 1 Much below my friends chances
   □ 2 Below my friends chances
   □ 3 A little below my friends chances
   □ 4 About the same as my friends chances
   □ 5 A little above my friends chances
   □ 6 Above my friends chances
   □ 7 Much above my friends chances

Malaria Prevention Behaviors

19. Do you sleep under a bednet or mosquito net at night?
   □ 1 Never
   □ 2 Sometimes
   □ 3 Most of the time
   □ 4 Always

20. If you find standing water around your yard or community, how often do you pour it out right away?
   □ 1 Never
   □ 2 Sometimes
   □ 3 Most of the time
   □ 4 Always

21. Would you allow the Health Department to conduct indoor spraying against mosquitoes in your house?
   □ 1 Never
   □ 2 Sometimes
   □ 3 Most of the time
   □ 4 Always
22. What are the symptoms of malaria?

**A few questions about you**

23. What is your age? ______ years

24. What is your gender? □ 1 Male □ 2 Female

25. Which of the following group's best represents your ethnic background? (Choose one.)
   □ 1 Mestizos
   □ 2 Creole
   □ 3 Maya
   □ 4 Garinagu
   □ 5 East Indian
   □ 6 Other (please describe) __________________________

26. What is the highest form of schooling that you have completed? (Choose one.)
   □ 1 Primary; less than Standard 3
   □ 2 Primary; greater than Standard 3
   □ 3 Secondary; less than Form 2
   □ 4 Secondary; greater than Form 2
   □ 5 Tertiary or greater

**Health Information**

27. How would you rate your health?
   □ 1 Very poor
   □ 2 Poor
   □ 3 Good
   □ 4 Very Good
   □ 5 Excellent

28. When was the last time you saw a doctor?
   □ 1 Less than a month ago
   □ 2 1-3 months ago
   □ 3 4-6 months ago
   □ 4 More than 6 months ago
   □ 5 Have never seen a doctor

29. Have you ever had malaria? (If you are currently sick with malaria, select “yes”)
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know

30. Has anyone in your family had malaria?
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know

31. Have you ever known someone other than your family, who had malaria?
   □ 1 Yes
   □ 2 No
   □ 3 Don’t know
Beliefs about Malaria

For each of the items below, circle the number you feel is the best answer.

32. In your opinion, how serious a threat is malaria?
   1  2  3  4  5  6  7
   No threat          Extreme threat

33. Compared to a cold or flu, how serious is malaria?
   1  2  3  4  5  6  7
   Not as bad          About the same          Much worse

34. How much control do you feel you have when it comes to avoiding malaria?
   1  2  3  4  5  6  7
   No control          complete control

35. How much control do you have at preventing a mosquito from biting you?
   1  2  3  4  5  6  7
   No control          complete control

36. How much control do you have over reducing mosquito breeding grounds?
   1  2  3  4  5  6  7
   No control          complete control

37. If you do not use a bednet, what do you feel is the chance that you will get malaria during this season?
   □1 No chance
   □2 Very unlikely
   □3 Unlikely
   □4 Moderate
   □5 Likely
   □6 Very likely
   □7 Certain to happen

38. If you do not use a bednet, what do you feel is the likelihood that you will get malaria during your lifetime?
   □1 No chance
   □2 Very unlikely
   □3 Unlikely
   □4 Moderate
   □5 Likely
   □6 Very likely
   □7 Certain to happen

39. If you do not use a bednet, what do you feel is the likelihood that you will get malaria during this month?
   □1 No chance
   □2 Very unlikely
   □3 Unlikely
   □4 Moderate
   □5 Likely
   □6 Very likely
   □7 Certain to happen
40. On a scale of 0 to 100, what is the likelihood of you getting malaria ever? (When 0 equals “never contracting malaria”, and 100 equals “certainly contracting malaria”)

0% 5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95% 100%
No chance Certain

41. Compared to other people in your town, your chances of getting malaria are:
   □1 Much below average
   □2 Below average
   □3 A little below average
   □4 Average for a person like me
   □5 A little above average
   □6 Above average
   □7 Much above average

42. Compared to other people in the entire country of Belize, your chances of getting malaria are:
   □1 Much below average
   □2 Below average
   □3 A little below average
   □4 Average for a person like me
   □5 A little above average
   □6 Above average
   □7 Much above average

43. On a scale of 0 to 100, what proportion of people living in your village will get malaria this year? (When 0 equals “no one”, and 100 equals “everyone”)

0% 5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 95% 100%
No one Everyone

44. Compared to a person your age, your chances of getting malaria are:
   □1 Much below my friends chances
   □2 Below my friends chances
   □3 A little below my friends chances
   □4 About the same as my friends chances
   □5 A little above my friends chances
   □6 Above my friends chances
   □7 Much above my friends chances

Malaria Prevention Behaviors

45. Do you sleep under a bednet or mosquito net at night?
   □1 Never
   □2 Sometimes
   □3 Most of the time
   □4 Always

46. If you find standing water around your yard or community, how often do you pour it out right away?
   □1 Never
   □2 Sometimes
   □3 Most of the time
   □4 Always
47. Would you allow the Health Department to conduct indoor spraying against mosquitoes in your house?  
☐ 1. Never  
☐ 2. Sometimes  
☐ 3. Most of the time  
☐ 4. Always  

48. What are the symptoms of malaria?  

A few questions about you  

49. What is your age? ___ years  

50. What is your gender?  
☐ 1. Male  
☐ 2. Female  

51. Which of the following group’s best represents your ethnic background? (Choose one.)  
☐ 1. Mestizos  
☐ 2. Creole  
☐ 3. Maya  
☐ 4. Garinagu  
☐ 5. East Indian  
☐ 6. Other (please describe) ______________________  

52. What is the highest form of schooling that you have completed? (Choose one.)  
☐ 1. Primary; less than Standard 3  
☐ 2. Primary; greater than Standard 3  
☐ 3. Secondary; less than Form 2  
☐ 4. Secondary; greater than Form 2  
☐ 5. Tertiary or greater  

Thank you for taking time to complete this survey!