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Health Communications and Malaria:
The Applicability of EPPM in Predicting Bed Net Use

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Abstract

Malaria is a devastating illness and its endemic presence throughout Mozambique and sub-Saharan Africa carries profound consequences. Vector control through the use of protective bed nets is one strategy that has shown considerable success in reducing this disease burden. This study applied the Extended Parallel Process Model (EPPM) to survey data collected from several Mozambican villages to investigate the cognitions underlying bed net use and to determine the applicability of this model in a high threat disease context. It also investigated the role of economic barriers in predicting danger/fear control responses. Overall, EPPM was not supported. A modified model using EPPM constructs as independent effects was able to predict fear control outcomes, but not danger control outcomes. Fear control was also positively associated with high levels of threat, further emphasizing the importance of considering unintended consequences in campaign design. The influence of economic stress on outcome was not supported, but also should not be summarily discounted. While the precise interactions of EPPM are called into question, its constructs are in general supported and potential expansions of the model may offer guidance in reducing malaria disease burdens.

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Chapter 1: Malaria Etiology and Impacts

Malaria is one of the critical disease challenges facing Sub-Saharan Africa. Despite great gains in recent years, malaria remains a salient threat to global health. An estimated 225 million malaria cases occurred in 2009, with an accompanying 781,000 deaths. An overwhelming majority of these cases (78%) occurred on the African continent. While the coverage of vector control technologies has increased greatly, such coverage needs to be expanded and continually maintained. This, coupled with the risk of resistance arising in the insecticides used to combat mosquitoes and in antimalaria medications, means that malaria will continue to be a focus of international health initiatives for many years to come. (World Health Organization [WHO], 2010a)

Involving a complex interplay of epidemiological, ecological, and sociological factors, a likewise multifaceted approach is needed to generate and continue gains in combating the disease. One prevention mechanism that has so far been central to malaria reduction campaigns is the bed net (WHO, 2010d). This study seeks to investigate the cognitions underlying bed net use as a protective measure against malaria, focusing specifically on rural populations in Mozambique. The following chapter explores this disease context and covers malaria's biological basis, its associated disease burden, and the use of bed nets as a means of vector control.

Disease biology

Malaria is a disease that results from infection by the *Plasmodium* parasite. Four *Plasmodium* species are responsible for human malaria: *P. falciparum*, the most deadly and most common, *P. vivax,* also considered more common, *P. malariae*, and *P. ovale.* (WHO, 2010d) In Mozambique, malaria is predominantly caused by *P. falciparum*

(WHO, 2009a). Parasite prevalence is highest in the northern regions and coastal areas (Mabunda, Casimiro, Quinto, & Alonso, 2008). Transmission is seasonal, primarily occurring between November and July (WHO, 2009a) and peaking during and after the rainy season (Mabunda et al., 2008).

The malaria parasites are transmitted to their human hosts via a 30-40 species subset of *Anopheles* mosquito, which serves as a vector and secondary host (Centers for Disease Control and Prevention [CDC], 2010). Of note, only adult, infected, female mosquitoes are capable of transmission, a process that is essential in the continuation of the *Plasmodium* life cycle (CDC, 2010).

This cycle begins when an infectious mosquito bites a human, which the female mosquito is required to do as a part of the egg production phase of its own life cycle (CDC, 2010). The malaria sporozoite (infective form of the parasite) is then able to enter the bloodstream of the human host (Parmet, Lynn, & Glass, 2010). These sporozoites migrate to the liver, where they enter the hepatocytes and multiply, forming merozoites that are released when the cells rupture (Parmet et al., 2010). In *P. vivax* and *P. ovale* species, they may also form hypnozoites, a dormant stage that can persist in the liver and result in a relapse weeks or even years following the initial infection (CDC, 2010). Released merozoites enter the red blood cells and multiply, where they have the option of producing either more merozoites or developing into gametocytes, the parasite's reproductive stage (Parmet et al., 2010). Gametocytes (both male and female forms) are taken up with a second mosquito's blood meal (CDC, 2010), later developing into sporozoites, and migrating to the mosquito's salivary glands to reinitiate the cycle (Parmet et al., 2010).

All resulting symptoms arise due to the blood-stage infection of merozoites, which are the parasite's asexual, erythrocytic phase. The incubation period following the initial infectious bite typically lasts between seven and thirty days, in part depending on the species of *Plasmodium* involved. The disease can take one of two forms, uncomplicated or complicated/severe. Complicated malaria is the more serious development, involving organ failure and/or irregularities of the blood or metabolism (see Table 1 for a complete listing of malaria symptoms and manifestations). According to the CDC, severe malaria "Is a medical emergency and should be treated urgently and aggressively." (CDC, 2010)

Table 1: Symptoms/Manifestations of Malaria

Uncomplicated	**Complicated/Severe**
fever	*cerebral malaria
chills	severe anemia
sweats	hemoglobinuria
headaches	acute respiratory distress syndrome
nausea and vomiting	abnormalities in blood coagulation
body aches	low blood pressure
general malaise	acute kidney failure
	metabolic acidosis
	hypoglycemia

*Manifestation of malaria in the brain, resulting in abnormal behavior, impairment of consciousness, seizures, coma, and other neurological abnormalities

Source-CDC website (2010)

Although it is both preventable and curable, malaria remains a serious, life-threatening illness (WHO, 2010d). The disease's inherent biological complexity, incorporating both multistage parasitic infection and nonhuman vectors (CDC, 2010), imposes significant challenges to malaria control. Such challenges, however, are not insurmountable and if biology provides the difficulties, it also provides the means and targets for successful intervention. The mosquito is one such target. Exacerbating disease spread, it also provides an opportunity to disrupt the *Plasmodium* life cycle. Insecticide-treated bed nets, which act as a barrier against mosquitoes, are able to significantly reduce malaria morbidity and mortality (CDC, 2010). The successful implementation of such technologies, however, depends on the human disease context.

Malaria in Mozambique

Mozambique is one of the many African nations where malaria is endemic, i.e. is considered to be habitually present in the country (Kanchanaraksa, 2008). According to the World Health Organization, 100% of Mozambique's 22,894,291 UN census population (2009 data) is considered to be at high risk for malaria (WHO, 2010b). The country experienced 4,310,086 malaria cases during that year, with at least 93,874 requiring inpatient care (WHO, 2010b). The following section describes how this malaria burden adversely affects the health and economic well-being of Mozambique.

Although the entire population is vulnerable, young children are at particular risk. In areas of stable transmission, younger children may not have had the chance to develop protective immunity. (WHO, 2010d) A study by Mabunda, Casimiro, Quinto, and Alonso concluded that malaria and malaria-related anemia during childhood constitute "a major public health problem," projecting that roughly 2.6 million Mozambican children under ten may carry the *P. falciparum* parasite (2008). This conclusion was supported by the 2009 National Child Mortality Study, which found that malaria was the leading cause of death (33.2%) of children under five in Mozambique (Ministry of Health, 2009).

Pregnant women are the adult group considered to be most at risk; again, the dangers are mostly the result of *P. falciparum* infection. In areas of lower/unstable transmission, pregnant women are two to three times more vulnerable to severe malaria, which can result in the death of the mother or the fetus. (Roll Back Malaria Partnership) A study of Mozambican women found that severe malaria accounted for 10.1% of all deaths in pregnant women (Menendez et al., 2008). Approximately 10,000 women in malaria-endemic countries die annually as a consequence of malaria infection during pregnancy (WHO, 2007). In areas of stable transmission (and correspondingly higher levels of immunity), mothers may present as asymptomatic, but can develop anemia and parasitic infection of the placenta, both of which impair fetal nutrition, resulting in low infant birth weights. Low birth weight in turn can have a significant negative impact on infant survival and development. (Roll Back Malaria Partnership) Approximately 200,000 infants die every year as a consequence of maternal malaria infection during pregnancy (WHO, 2007).

In addition to its profound impact on human health, malaria also has significant economic consequences. In high transmission areas, it can reduce GDP by up to 1.3% (WHO, 2010d). In their review, Sachs and Malaney found that malaria-endemic countries were on the whole less wealthy and experienced lower rates of economic growth as compared to non-malarious countries, going on to suggest multiple factors by which malaria could negatively impact development, including effects on fertility, population growth, savings and investment, worker productivity, absenteeism, premature mortality, and medical costs (2002). The association between malaria and economic factors appears to involve dual causation. This conclusion was supported by a study at the household level examining the relationship between malaria infection and socioeconomic status; the authors suggested the existence of “reinforcing cycles” where those of low socioeconomic status experience higher levels of malaria, maintaining their low status

(Somi et al., 2007, p. 1025). Other studies (Mboera et al. 2010; Teklehaimanot & Majia, 2008), including one addressing Mozambique (Castillo-Riquelme, McIntyre, & Barnes, 2008), also support the interaction of malaria and economics as a threat to households.

Although Mozambique has been undergoing an impressive period of economic growth since the end of its civil war in 1992, it is still one of the world's 20 poorest countries; 54% of its population remains below the poverty line. 70% of its population is rural, a majority surviving on subsistence agriculture. (United Nations Children's Fund) The country's health system is comprised of public, private, and non-profit private sectors, with a majority of care being provided by the public sector. However, this public health network is only able to reach about 60% of the population. (WHO, 2009b) Given the linked nature of malaria and economics, any efforts to alleviate the nation's malaria burden, publicly or privately, should include socioeconomic considerations.

Malaria also poses a significant hindrance to education. A study examining malaria in school-age children in Kenya found that, of preventable medical causes for school absenteeism, malaria accounts for 13-50% of days missed (Brooker et al., 2000). Perhaps even more worrying than school absenteeism, however, is the direct cognitive consequences of the disease. A review of literature found across studies that children who had experienced malaria (both severe and uncomplicated) demonstrated impaired cognitive abilities and school performance; additionally, in three studies concerning cognitive/academic performance and malaria prophylaxis, the groups protected from malaria achieved higher in comparison with their placebo counterparts (Fernando, Rodrigo, & Rajapakse, 2010).

Widespread and with far-reaching consequences, malaria poses a significant handicap to development in Mozambique. After HIV/AIDS, it is the country's leading cause of all-age deaths (WHO, 2006), with young children and pregnant women at particular risk (WHO, 2010d). This large disease burden affects economics at the household and national levels, with the direct and indirect costs of malaria restricting the possibility of financial growth (Roll Back Malaria Partnership). Malaria also acts as a barrier to education. Given the depth of these connections, the economics of malaria should be taken into account when studying disease impacts and designing interventions. Vector control is one such strategy that has been shown to be extremely cost-effective in sub-Saharan Africa (Yukich et al., 2008).

Use of Bed Nets

Recognizing the significance of the malaria burden, great efforts have been made in recent years to combat the disease. One of the key strategies in these campaign efforts has been vector control via the distribution of protective bed nets (WHO, 2010d). This section describes the types of bed nets available, their efficacy, and their distribution and extent of use.

Types. Nets typically come in three tiers, the most basic of which is the *untreated net*. Untreated nets and bed nets in general act by forming a barrier around sleeping individuals, preventing the mosquito blood meals that transmit malaria. However, mosquitoes can feed through the net if the user is in direct contact with it and even small holes will render the net ineffective, hence the desirability of the next net tier, the *insecticide-treated bed net* (ITN). The insecticides applied to ITNs are capable of killing mosquitoes and other insects and also function to repel mosquitoes, reducing the number of them present in the home. (CDC, 2010) However, only one class of insecticides, the pyrethroids, is approved for ITNs, making them increasingly vulnerable to the development of resistance, potentially threatening future control efforts (WHO, 2010a). The third and final tier is the *long-lasting insecticide-treated net* (LLIN). Unlike ITNs, long-lasting insecticide-treated nets retain their effectiveness for at least three years (CDC, 2010).

Efficacy. The effectiveness of ITNs in reducing malaria morbidity and mortality has been clearly established (Lengeler, 2004). Provided that there is high enough community coverage, the resulting reductions in mosquito numbers can produce community-wide protection even among community members lacking a net (CDC, 2010). ITNs must be retreated with insecticides every 6-12 months in order to retain their efficacy (CDC, 2010). Similarly, the use of LLINs is associated with sharp decreases in malaria in areas where high coverage is achieved (CDC, 2010). Untreated bed nets also offer protective benefits, although their effectiveness is about half that of insecticide-treated nets (Guyatt & Snow, 2002). In one study examining malaria transmission in Tanzanian villages with high preexisting levels of untreated bed net coverage, the augmentation of nets with long-lasting insecticide treatment resulted in a 4.6 fold reduction in transmission in addition to the 4.2 fold reduction that had been achieved with untreated nets alone (Russel et al., 2010).

Distribution and Use. In Mozambique, policies of free ITNs/LLINs distribution and distribution through mass campaigns to all age groups have been adopted (WHO, 2010c). As of 2010, an estimated 42% of households owned at least one ITN (WHO, 2010a). In a study by Chase et al., 38.3% of respondents in rural, southern Mozambique reported sleeping under a net during the rainy season; of these, 94.1% reported doing so every night, indicating that, while bed net use is still comparatively low, those who use them tend to do so consistently (2009). Targeted campaigns have been able to increase bed net ownership in Mozambique, as demonstrated by a 2005 LLIN distribution campaign targeting children <5, which resulted in 50.2% of households owning at least one ITN post-distribution (Oliveira et al., 2010).

Numerous factors influencing willingness to pay for/ownership of bed nets have been identified, including level of education (Chase et al., 2009; Wiseman, Scott, McElroy, Conteh, & Stevens, 2007), net affordability (Chase et al., 2009; Wiseman et al., 2007), malaria knowledge (Mboera et al., 2010), and the utilization of alternative vector control measures (Chase et al., 2009; Wiseman et al., 2007). Of particular note is the apparent presence of a substitution effect between bed nets and other forms of malaria prevention (Chase et al., 2009; Wiseman et al., 2007), a point that should be considered during campaign design. Wiseman et al.'s study additionally identified age, ethnicity, occupation of household head, household size, and the impassibility of the roads to the community as statistically significant factors (2007). Clearly, the dynamics of bed net ownership are multifaceted and the influence of sociological concerns only adds to an already complex epidemiological problem.

Summary

Facing such widespread endemicity, equally extensive malaria interventions are required. The World Health Organization advocates universal coverage of LLINs in all malaria endemic areas, suggesting one LLIN for every two individuals. As of 2010, an estimated 42% of African households owned at least one ITN, while 35% of children slept under an ITN; neither Mozambique nor the continent as a whole has reached target levels (≥80%) of ITN coverage. Even if high levels of coverage are ultimately achieved, they will need to be continuously maintained, necessitating the consistent replacement of nets that have, at best, a three-year lifespan. Care must also be taken to ensure the nets are used consistently and appropriately and WHO recommends the use of behavior change interventions to augment distribution campaigns. (WHO, 2010a)

The spread and persistence of malaria is a testament to its biological success. The consequences of this endemicity place a great burden on the people of Mozambique and sub-Saharan Africa. Malaria control efforts, particularly those involving bed net distribution and usage, must remain the focus of national governments and international aid organizations.

These needs suggest the application of health communications theory. To achieve and sustain adequate levels of coverage, a deeper understanding of the cognitions underlying bed net use as a preventative action against malaria is required. This study seeks to use the Extended Parallel Process Model (EPPM) as a possible framework in examining bed net cognitions and use. The advantage of such an analysis is that it goes beyond rates of behavior to investigate the motivations eliciting said behavior. A better understanding of these motivations will allow for the inclusion of concrete message objectives in malaria interventions. The first and foremost objective of any health campaign is the voluntarily adoption or continuation of the relevant behavior. Given the importance of achieving sufficient bed net coverage in the fight against malaria, a theory-based model for vector control behavior is essential.

Chapter II-The Extended Parallel Process Model

General Model and Theory Assumptions

EPPM seeks to explain how fear appeals lead to either message acceptance or message rejection, which Witte theorizes are the result of threat/efficacy interactions (Witte, 1992). According to this model, an individual is exposed to and begins processing a fear appeal, defined as a persuasive message that elicits fear (an emotion) by depicting a "personally relevant and significant threat" (Witte, 1994, p. 114). The appeal is typically followed by a realistic recommendation that is able to avert the threat presented (Witte, 1992).

Assumptions. EPPM carries with it several basic assumptions. The first is that fear must be reduced, a need that drives defensive motivation. A sustained state of fear is apparently untenable. Secondly, EPPM assumes that heath decisions are made at the level of the individual (Dutta-Bergman, 2005). Such an assumption simplifies (self) efficacy assessments. Third, it assumes that message acceptance requires cognitive appraisal and thus cannot occur spontaneously.

Process

Processing fear appeals involves up to two sequential cognitive appraisals, the first of which is an analysis of the threat being presented (Witte, 1994; Witte, 1992). If threat reaches sufficient levels, the resulting fear motivates a second cognitive assessment that examines levels of efficacy (Witte, 1992). If threat is deemed to be low or nonexistent, the individual has no reason to continue evaluating the message and hence stops doing so, resulting in no evaluation of efficacy and no overall response (Witte, 1992). In the case of malaria in Mozambique, an individual experiencing a lack of response would neither be inclined nor disinclined to utilize a bed net as a preventative measure against malaria. Having no motivation to use a bed net, he does not.

If an individual reaches the analysis of efficacy, that evaluation will be what determines the nature of his or her response, which can take the form of either danger control or fear control processes (Witte, 1994). If threat and efficacy are judged to be high, the individual should engage in danger control processing, eliciting protective motivation that results in message acceptance (Witte, 1994). If threat is perceived as high and efficacy is perceived as low, the individual will instead engage fear control processing (Witte, 1992), in which the individual seeks to control the emotion of fear "by denying or defensively avoiding the threat," eliciting defensive motivation that results in message rejection (Witte, 1994, p. 113), see Figure 1 for graphical interpretation. Fear control results when perceptions of threat overcome perceptions of efficacy (Witte, 1992). This "critical point" is the threshold that divides danger control and fear control processes (Witte, 1992). A person experiencing high threat due to malaria may feel that he or she is capable of successfully responding to the danger and thus takes measures to obtain and use bed nets (danger control); alternatively, he or she may feel that effective response is impossible and instead avoids thinking about malaria and bed nets to avoid arousing stress (fear control). This balancing of threat and efficacy influences requires an examination of their component constructs.

Figure 1-Schematic of Threat/Efficacy Interactions and Responses

		Threat	
		High	Low
Efficacy	High	Danger Control	No Action
	Low	Fear Control	

Threat. Threat is the objective existence of a potential harm. Perception of (holding cognitions and thoughts about) threat is what dictates an individual's response; actual threat and perceived threat may in fact be very different. Perceived threat is comprised of two components, perceived severity and perceived susceptibility. Perceived severity is an individual's beliefs about the seriousness of the threat. (Witte, 1994) In a malaria disease context, the statement "I believe malaria is a potentially fatal illness" is an example of perceived severity. Perceived susceptibility relates to an individual's beliefs about his or her chances of experiencing the threat (Witte, 1994)- e.g. "I believe my exposure to mosquitoes places me at risk for malaria."

Efficacy. Efficacy is the objective "effectiveness, feasibility, and ease with which a recommended response impedes or averts a threat" (Witte, 1994, p. 114). Like threat, efficacy is comprised of two components, response efficacy (the ability of a recommended response to avert a specific threat) and self-efficacy (the ability of an individual to carry out said response). Again, EPPM deals with the perceptions of these constructs. Perceived response efficacy is an individual's beliefs concerning the effectiveness of the recommended response in combating the threat- e.g. "I believe that using a bed net helps reduce the risk of malaria." Perceived self-efficacy refers to an individual's beliefs about his or her personal capability to enact the recommended response- e.g. "I believe I can hang a bed net correctly so that I will be protected from malaria." (Witte, 1994)

Outcomes. The cognitive appraisal of threat determines the strength of the message response; the nature of that response depends on the cognitive appraisal of efficacy, resulting in either danger or fear control processing (Witte, 1994).

Danger control processes are cognitive processes in which individuals acknowledge the threat and their own efficacy, become motivated to protect themselves, and confront the danger by changing their attitudes, intentions, or behaviors. The outcome of danger control processing is message acceptance. (Witte, 1994) An example of message acceptance in a malaria context would be the use of bed nets as a means of preventing malaria.

Alternatively, individuals may engage in fear control processing, in which the fear aroused due to the perceived inability to prevent the threat results in defensive motivation and the need to cope with fear (Witte, 1994). Fear control processing and defensive motivation result in message rejection as individuals act to control their fear (Witte, 1994) by denying the threat or engaging in reactance (the disparagement of a message because of a perceived reduction in autonomy) (Witte, 1992). An example of fear control would be the belief that bed net manufacturers are being purposely manipulative. Fear control processing may or may not operate on a conscious level (Witte, 1992). Logically, fear control responses should interfere with danger control responses and message acceptance (Witte, 1992) Alternatively, if perceived threat is low, there will be no response to the message, and neither acceptance nor rejection should be observed (Witte, 1992).

<u>Empirical Support for EPPM</u>

Witte's initial testing of the model examined the use of fear appeals in the context of AIDS prevention and condom use. Acknowledging that a few specific hypotheses were not supported, the study found overall support for the model, concluding that cognitive danger control processes result in message acceptance while emotion-based fear control processes result in message rejection. (Witte, 1994) EPPM "has been used in a variety of contexts and populations, it is presumed to be general, and consistent support for its predictions is claimed in the literature" (Muthusamy, Levine, & Weber, 2009, p. 336). A meta-analysis (Witte & Allen, 2000) of over one hundred fear appeal studies offered a certain degree of support for EPPM. Overall, fear appeals resulted in danger control and fear control responses, with these responses being inversely related as predicted by EPPM. The paper also concluded that the higher the level of threat, the greater the apparent motivation to process the message. Additionally, it was found that the weaker the efficacy, the greater the fear control and degree of message rejection. High threat/high efficacy produced the most message acceptance, while low threat groups had the lowest message acceptance. These findings are all consistent with EPPM. However, the existence of threat/efficacy interactions as described in EPPM remains unclear. Interestingly, while the high treat/low efficacy situation showed approximately the same level of message acceptance as the low threat/high efficacy group, it had significantly higher acceptance than the low threat/low efficacy group. From EPPM, these three groups should exhibit similar (i.e. lower) message acceptance. (Witte & Allen, 2000)

Although some deviations in the details of EPPM have been documented, the overall model serves as an effective guiding framework.

EPPM in a Malaria Context

This study seeks to apply EPPM to the situation of malaria in Mozambique. Such an analysis is appropriate for several reasons. First, a preexisting fear appeal situation is implied to exist in this context due to the endemic nature of malaria in this nation (provoking threat) and the presence of bed net campaigns (providing a recommended response). Secondly, bed net use in Mozambique has been demonstrated, but is not universal, indicating the presence of both message acceptance and message rejection. The need to understand the reasoning underlying bed net use in Mozambique suggests testing for the presence and effects of EPPM constructs and interactions in the search for possible explanations.

The overarching objective of this study is to determine the applicability of EPPM to the malaria disease context. This was to be determined using the following hypotheses:

H1: Perceived severity and experienced susceptibility of malaria is high.

H2: For those experiencing high levels of threat, response efficacy and self-efficacy are positively related to danger control.

H3: For those experiencing high levels of threat, response efficacy and self-efficacy are negatively related to fear control.

H4: For those experiencing low levels of threat, response efficacy and self-efficacy are not related to danger control or fear control.

The malaria disease context also poses unique challenges to EPPM. In endemic disease situations, it is likely that preexisting threat levels are quite high. As the outcomes of EPPM depend on threat level, this could have important implications. This study also introduces the concept of implied fear appeals. Traditionally, fear appeals have been studied experimentally using deliberately designed materials intended to manipulate fear appeal constructs. This study applies these constructs to a preexisting, informal context and tests for the theorized interactions. Such investigation could indicate the generality of EPPM. Finally, the malaria disease context provides an opportunity to expand the model.

Augmenting original EPPM design, this study suggests the possibility that barriers, especially economic barriers, might dictate whether or not people engage in danger control behavior even when sufficiently motivated. Given the evident importance of economics and poverty in the malaria disease context, economic stress was judged to be a potentially significant barrier. EPPM and other models have been criticized for not adequately incorporating barriers and basic needs into their theories (Dutta-Bergman, 2005). While the concept of barriers could potentially be folded into concepts of self-efficacy, this study proposes its effects are significant enough to constitute its own variable. By incorporating economics and the possible effects of barriers, this study could add a great deal to existing fear appeal literature. The following research question was posed:

RQ1: What is the role of economic stress in predicting danger or fear control?

Chapter III-Methodology

<u>Participants and Procedures</u>

Participants (*N*=182) resided in one of nine rural villages in Northern Mozambique (Lione, Lucucho, Nhamani, Nhamatombo, Ntapo, Matsatsa, Messambuzi, Mugoriondo, and Somba). These villages were selected so that at least two sites were present in each district; one member of these pairings contained an IIAM site, the other did not. Additional selection criteria sought to ensure that the villages were rural, that they were located near international borders (Malawi and Zimbabwe), and that they represented multiple cultures, including differences in religious beliefs and household gender hierarchies. Sampling of each village involved creating a numbered household map of all residences and randomly selecting from the resulting household pool.

Interviewers approached each household and requested to speak with both the male and female household heads. Following the interview process, either the male or the female data was randomly selected to be included in the final data set so as to prevent duplication of household results. The selected individuals, interviewed separately, were gender matched with the interviewer and taken to a private location, where they were then read the informed consent information and assured that participation was voluntary and that all answers would remain confidential. Interviewers verbally asked all survey items so as to ensure low reading ability would not act as a barrier. Interviewers were trained on the survey and were responsible for ensuring survey translation from Portuguese into the given native language. The survey had originally been translated from English to Portuguese, using local informants to provide back translations.

Instrumentation

Perceived Severity: Participants were asked three questions regarding the seriousness of malaria as a concern. The statements began with "How serious a problem is malaria" and the three items included "in Mozambique," "in your community," and "for your household." The items were ranked on a five-point scale (1-*not at all serious*, 5-*very serious*). These items were averaged into a single score (M=4.01, SD=0.87, α = .73).

Experienced Susceptibility. Participants were asked one question regarding their previous encounters with malaria. If the participant indicated that he or she had malaria in the past year, that individual was asked "How long were you sick in bed and unable to work?" (M=6.00*,* SD=11.59). Participants that did not identify themselves as having experienced malaria in the past year were automatically marked as having lost zero days. As we had no direct measures of susceptibility, it was assumed that the number of days missed due to malaria positively correlated with perceptions of malaria susceptibility.

Perceived Response Efficacy. Participants were asked ten items involving perceptions of bed net efficacy as a defense against malaria. Participants were given statements in one of two formats and were asked to indicate whether or not the statements applied. Format 1-"How can a person avoid getting malaria?" including the options of "sleep under a mosquito net (untreated or unspecified) and "sleep under an insecticide-treated mosquito net." Respondents were asked to indicate if these statements applied (1-indicated, 0-not indicated) and, if so, whether or not these methods were effective ("yes"-1, "no"-0). Format 2-Particpants were given a series of statements and asked to indicate if the statements made them think of any mosquito control products. These statements were as follows: "It reduces the risk of malaria," "It reduces mosquito bites," and "It is a long-term solution to malaria." If plain bed nets were mentioned, the statement was marked as applying for plain bed nets (1); not mentioned (0). The same system was used in the case of ITNs. The total number of positive identifications was summed for each classification of bed net (from 0 to 5): untreated (M=1.37, SD=1.55, α=.74), ITN (M=3.14, SD=1.56, α=.66), each serving as an indicator of perceived response efficacy for the respective type of bed net. Total response efficacy equaled the sum of all affirmations of efficacy regardless of net type, for a maximum score of ten (M=4.52, SD=1.92).

Perceived Self-Efficacy. Participants were asked three questions concerning perceptions of self-efficacy, asking them to agree or disagree with the following statements: "I can take action to avoid getting malaria," "I feel capable of using a bed net correctly to avoid malaria," and "I can talk about ways to prevent getting malaria." Responses were selected from a five-point Likert scale (1-*strongly disagree*, 5-*strongly agree*). These items were averaged into a single score (M=3.81, SD=0.78, α =.68), with higher scores indicating stronger self-efficacy.

*Danger Control***:** Danger control behavior was defined as using bed nets (both ITNs and untreated nets) as a preventative action against malaria**.** Danger control was assessed using multiple scales examining both previous bed net use and bed net related intentions. For the former, the participant was first asked two questions to determine if they had within the past week a) slept under a mosquito net (untreated or unspecified) or b) slept under an insecticide-treated mosquito net. If the participant responded in the affirmative to either or both of these questions, that individual was marked as having engaged in bed net use (1) or as having not engaged in use (0). In a follow-up question, participants were asked to indicate "How often [he/she] used [his/her] current bed nets" from the following responses: *did not use* (0), *once a year* (1), *every six months* (2), *every three months* (3), *once a month* (4), *every two weeks* (5), *once a week* (6), *only during the rainy season* (7), or *every day* (8).

The third danger control scale examined intentions towards bed net use and assumes that said intentions are then acted upon. Participants were asked two questions, one to determine if the participant intended to sleep under a bed net (untreated or unspecified) in the next year (1-yes, 0-no), the other to determine if the participant intended to sleep under an ITN in the next year (1-yes, 0-no). Using these, the participant was then marked as intending to use a bed net of any type (1) or as not intending to use a bed net (0).

Fear Control. Participants were asked two questions to determine levels of reactance. Respondents were asked if they believed that the people selling bed nets were trustworthy and if they trusted the people making the insecticides for bed nets. Items were on a five-point Likert scale (1-*strongly disagree*, 5-*strongly agree*). The two responses were averaged into a single score (M=3.62, SD=0.86, α=.72). Low levels of perceived trustworthiness were assumed to be indicative of reactance.

Economic Stress. Participants were asked to identify the "months [their] households were most stressed in terms of food and income." Replies were free response; the number of months identified was summed into a single score reflective of household economic stress ranging from 0 to 12 (all year). Those not indicating any stressed months were marked as experiencing zero stressed months

Chapter IV-Results

<u>Descriptive Statistics</u>

Perceived threat. Perceived threat was assessed according to its component factors, perceived severity and experienced susceptibility (as a substitute for perceived susceptibility). Malaria was generally judged to be a "serious" problem (M=4.01, SD=0.87). Participants lost an average of 6 days to the illness (M=6.00, SD=11.59). Perceived threat and experienced susceptibility were positively correlated, r (180)=.22, p<.01. H1, that perceived severity and experienced susceptibility of malaria is high, is supported for this population.

Perceived efficacy. Perceived efficacy was also assessed according to its component factors, perceived response efficacy and perceived self-efficacy. Perceived response efficacy for ITN use was greater than that for untreated nets, participants agreeing with an average of 3 out of 5 statements affirming ITN efficacy while agreeing with only 1 out of 5 of those same statements as applied to untreated nets (see Table 2). For ITNs, participants most frequently indicated (71.4%) that sleeping under a bed net was a way to avoid getting malaria and that doing so was an effective antimalaria measure (70.3%). For untreated bed nets, participants most often indicated (38.5%) that sleeping under an untreated net was a way to avoid malaria. Response efficacy for ITNs and response efficacy for untreated nets were negatively correlated, r (180)= -.24, p< .01. For total response efficacy summing affirmations of both ITN and untreated bed net efficacy, participants indicated an average of 4.5 statements of bed net efficacy out of a possible ten (M=4.52, SD=1.92). For perceived self-efficacy, concerning both treated and untreated nets, participants on average agreed with statements indicating self-efficacy

(*M*=3.81, *SD*=0.78). Self-efficacy did not significantly correlate with ITN, untreated, or total response efficacy (see Table 2).

Danger and fear control. When asked how often the participant used his or her current bed net, 44.5% reported no use; concerning upper levels of use, 1.6% reported using their bed net once a week, 14.8% reported using their net during the rainy season (when transmission is highest), and 21.4% reported daily use of a bed net (*M*=3.33, *SD*=3.48). Nearly half of the participants reported sleeping under any kind of bed net in the past week (*M*=0.46, *SD*=0.50). 85.2% reported that they intended to sleep under a bed net within the next year (*M*=0.85, *SD*=0.36). All danger control variables positively correlated with each other (see Table 2). Overall, a relative majority of participants engaged in fear control (*M*=3.63, *SD*=0.87).

Economic stress. On average, participants experienced approximately two months of economic stress (*M*=1.75, *SD*=2.14). Economic stress was positively correlated with perceived severity, r (180)=.26, p<.01 and experienced susceptibility, r (180) = .16, p< .05. It was negatively correlated with ITN response efficacy, r (180)= -.19, p<.05 and intended bed net use, r (180)= -.22, p<.01.

Interrelationships. ITN response efficacy and total response efficacy were positively correlated with the intention to use bed nets, r (180)=.34, p<.01 and r (180)= .29, p<.01, respectively. Perceived self-efficacy was positively correlated with all three measures of danger control (see Table 2). No other significant correlations for danger control were observed. The positive relationship between efficacy and danger control is consistent with EPPM.

As expected, fear control was positively correlated with both measures of threat, perceived severity, *r* (180)=.20, *p*<.01, and experienced susceptibility, *r* (180)=.19, *p*<.01. Fear control was negatively correlated with untreated net response efficacy, *r* (180)= -.19, p<.05). Interestingly, it was also positively correlated with bed net use in the past week, *r* (180)= .15, *p* <.05. In general, all correlations, while statistically significant, were relatively small.

Table 2: Means, Standard Deviations, and Pearson Correlations Among the Variables (N=182)

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11
(1) Average Severity	4.01	0.87	1	-	-	-	-	-	-	-	-	-	-
(2) Experienced Susceptibility	6.00	11.59	.22**	1	-	-	-	-	-	-	-	-	-
(3) Response Efficacy, Untreated Nets	1.37	1.55	-.09	-.09	1	-	-	-	-	-	-	-	-
(4) Response Efficacy, ITNs	3.14	1.56	.10	.03	-.24**	1	-	-	-	-	-	-	-
(5) Total Response Efficacy	4.52	1.92	.01	-.05	.61**	.62**	1	-	-	-	-	-	-
(6) Average Self-Efficacy	3.81	0.78	.07	.03	.00	.06	.05	1	-	-	-	-	-
(7) Level of Bed Net Use	3.33	3.48	.06	-.04	-.03	.03	-.01	.16*	1	-	-	-	-
(8) Bed Net Use in the Past Week	0.46	0.50	.03	-.02	-.08	.13	.04	.24**	.59**	1	-	-	-
(9) Intended Bed Net Use	0.85	0.36	-.11	.01	.02	.34**	.29**	.16*	.23**	.29**	1	-	-
(10) Average Fear Control	3.63	0.87	.20**	.19**	-.19*	.01	-.14	.12	.12	.15*	.08	1	-
(11) Total Months Stressed	1.75	2.14	.26**	.16*	.05	-.19*	-.11	.08	.06	.01	-.22**	.06	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

<u>Hypothesis Testing</u>

H2 and H3 stated that for those experiencing high threat, efficacy is positively related to danger control and negatively related to fear control. To test these hypotheses, threat variables were combined and split, so that respondents reporting both high perceived severity ("serious" or "very serious") and experienced susceptibility (days sick

≥ 1) were classified as having high threat (*N*=80), with the remainder (*N*=102) classified as low threat. An independent t-test comparing high and low threat groups found no significant difference in danger control behavior, *t* (180)= -0.37, *p* =.71, a finding that runs contrary to EPPM. However, a significant difference was found for fear control behavior, *t* (180)= -2.59, *p* = .01, with those experiencing high threat engaging in more fear control as predicted by EPPM.

A regression was conducted using danger control as the dependent variable and total response efficacy and self-efficacy as the independent variables. The same was done using fear control as the dependent variable. For those experiencing high threat from malaria, efficacy levels predicted neither danger control, F (77,2)=0.61, R^2=.02 nor fear control, F (77,2)=.90, R^2=.02. H2 and H3 were not supported.

These regressions were repeated for those experiencing low levels of threat. In situations of low threat, efficacy was not a statistically significant predictor of either danger control, F (99,2)=1.83, R^2=.04 or fear control, F (99,2)=1.56, R^2=0.03. H4 stated that, for those experiencing low levels of threat, response efficacy and self-efficacy are not related to danger control or fear control. H4 was supported.

RQ1 asked what role economics had in predicting danger and fear control behaviors. To investigate this question, the above regressions were repeated with economic stress included as an additional independent variable. This modification did not improve the model's predictive power (see Table 3).

Overall, danger and fear control behaviors were not predicted by threat and efficacy interactions, as would be expected according to EPPM. Inclusion of economic stress as an independent variable in the regression did not improve the predictive model.

While greater fear control was associated with higher threat, greater danger control was not. Across all analyses, none of the independent variables were found to be statistically significant predictors of either danger or fear control (see Table 3).

Table 3: Summary of Regression Analysis, Hypothesis Testing

High Threat, Original EPPM								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.125	0.016	0.609	0.546	Total Response Efficacy	0.002	0.020	0.984
					Self-Efficacy	0.125	1.102	0.274
Fear Control	0.151	0.023	0.897	0.412	Total Response Efficacy	-0.115	-1.022	0.310
					Self-Efficacy	0.102	0.907	0.367
Low Threat, Original EPPM								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.189	0.036	1.828	0.166	Total Response Efficacy	-0.026	-0.266	0.791
					Self-Efficacy	0.189	1.910	0.059
Fear Control	0.175	0.030	1.556	0.216	Total Response Efficacy	-0.132	-1.329	0.187
					Self-Efficacy	0.128	1.283	0.202
High Threat, EPPM with Economic Stress								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.125	0.016	0.402	0.752	Total Response Efficacy	0.003	0.024	0.981
					Self-Efficacy	0.124	1.091	0.279
					Economic Stress	0.005	0.046	0.963
Fear Control	0.151	0.023	0.595	0.620	Total Response Efficacy	-0.116	-1.021	0.311
					Self-Efficacy	0.103	0.905	0.368
					Economic Stress	-0.013	-0.111	0.912
Low Threat, EPPM with Economic Stress								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.211	0.044	1.517	0.215	Total Response Efficacy	-0.019	-0.191	0.849
					Self-Efficacy	0.181	1.818	0.072
					Economic Stress	0.094	0.949	0.345
Fear Control	0.175	0.031	1.031	0.382	Total Response Efficacy	-0.131	-1.309	0.194
					Self-Efficacy	0.127	1.262	0.210
					Economic Stress	0.011	0.112	0.911

Post-hoc Analysis

In light of the apparent lack of impact of threat and efficacy interactions on behaviors, each individual EPPM variable (severity, susceptibility, response efficacy, and self-efficacy) was considered as its own independent factor in a new model. This model was not a statistically significant predictor of the level of bed net use, F (4,177) = 1.43, R^2=.03. Examining each individual EPPM variable, only self-efficacy was identified as a significant factor, with greater self-efficacy resulting in higher levels of bed net use (β=0.16, t=2.11, *Sig*.=.04). The model was, however, a statistically significant predictor of fear control, F (4, 177) =4.50, R^2=.09. Of the EPPM variables, perceived severity

(β=0.16, *p*<.05), experienced susceptibility (β=0.15*, p*<.05), and total response efficacy (β=-0.14*, p*<.05) were found to be significant factors. Greater perceived severity and experienced susceptibility resulted in increased fear control, while greater total response efficacy resulted in less fear control.

To readdress the issue of economic barriers in determining individual responses, the modified model was repeated with economic stress as an additional independent variable. When added to the modified model, economic stress was not found to be a statistically significant factor (danger control, β=.05*, ns*; fear control, β=-.04, *ns*).

Table 4: Summary of Regression Analysis, Post-Hoc Inquiries

EPPM Variables as Independent Factors								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.177	0.031	1.429	0.226	Severity	0.063	0.834	0.405
					Experienced Susceptibility	-0.061	-0.809	0.420
					Total Response Efficacy	-0.016	-0.217	0.828
					Self-Efficacy	0.156	2.106	0.037
Fear Control	0.304	0.092	4.497	0.002	Severity	0.157	2.128	0.035
					Experienced Susceptibility	0.146	1.986	0.049
					Total Response Efficacy	-0.140	-1.945	0.053
					Self-Efficacy	0.115	1.598	0.112
EPPM Variables and Economic Stress as Independent Factors								
Dependent Variable	**R**	**R^2**	**F**	**Model Significance**	**Independent Variable**	**Standardized β**	**t**	**Independent Variable Sig.**
Level of Bed Net Use	0.183	0.033	1.218	0.302	Severity	0.052	0.663	0.508
					Experienced Susceptibility	-0.066	-0.867	0.387
					Total Response Efficacy	-0.011	-0.144	0.886
					Self-Efficacy	0.153	2.051	0.042
					Economic Stress	0.049	0.629	0.530
Fear Control	0.306	0.093	3.63	0.004	Severity	0.165	2.178	0.031
					Experienced Susceptibility	0.150	2.020	0.045
					Total Response Efficacy	-0.144	-1.984	0.049
					Self-Efficacy	0.117	1.625	0.106
					Economic Stress	-0.037	-0.486	0.627

Chapter 5-Discussion

Major Findings

This study sought to apply EPPM to a malaria disease context, focusing on bed net use. As predicted, malaria is an active threat for residents in Mozambique. On average, malaria is considered a “serious” problem, with half of respondents having experienced malaria in the past year. 44% of respondents tested high for both components of threat. Given the endemic nature of malaria in Mozambique, these findings are not surprising.

Overall, the results do not support EPPM. Specifically, for respondents experiencing high threat, efficacy levels did not predict their reported danger control (use of bed nets) or fear control (reactance). As predicted by EPPM, for those experiencing low threat, efficacy was not related to either danger or fear control. Although the results indicate that EPPM does not predict either danger or fear control, we were unable to determine if no action was taken, rendering these conclusions tentative. According to EPPM, those experiencing high threat should engage in more danger control/fear control as compared to those experiencing low threat. This difference was found for fear control but not for danger control.

In the post-hoc analysis, in which perceived severity, experienced susceptibility, perceived response efficacy, and perceived self-efficacy were considered as independent effects, the revised model was able to predict fear control outcomes, but not danger control outcomes. The only variable found to have an effect on danger control outcomes was self-efficacy. For fear control, higher perceived severity, higher experienced susceptibility, and less perceived response efficacy predicted greater mistrust. The predictive factors of fear control follow from the logic of EPPM; high threat (from high severity and susceptibility) would make it more difficult for feelings of efficacy to overcome perceptions of threat, resulting in fear control. The effects of response efficacy also follow logically, as lower perceived efficacy would also encourage fear control.

When economic stress was incorporated into the original EPPM and post-hoc models, it was found to have no significant effect. These findings suggest that this particular barrier does not explain bed net use or mistrust. While this may indicate that economic barriers are not a significant factor in determining fear appeal outcomes, the possibility remains that such barriers could be a significant complicating factor. The measure of economic stress used in this study was quite limited and may not reflect true economic circumstances. A more in-depth appraisal of socioeconomic status and perceived barriers to malaria protective behaviors is needed to confirm what, if any, role economic concerns play in health decision-making. The role of barriers has been demonstrated in other health communication models, such as the health belief model, which predicts that higher perceived barriers result in less protective behavior, a relationship has been demonstrated in the literature (Carpenter, 2010). A post-hoc cross-country analysis of reproductive health and health communications theory found that danger control outcomes were strongly related to barriers (Murray-Johnson et al, 2006). Also, rather than interacting as an independent variable, the economic concerns may indirectly interact with EPPM constructs by influencing perceptions of severity and self-efficacy. Given the established reciprocal interactions between malaria and economics, the role of economic barriers remains an issue that merits further investigation.

There are several possible explanations for the study results for danger control responses. The most pessimistic of these is the potential failure of the adapted survey instrument to accurately reflect EPPM variables. An alternative explanation is that the respondents enacted danger control in ways other than bed net use. Indoor residual spraying is a major avenue of mosquito vector control and is the primary method used in Mozambique (WHO, 2009a). Given that there is some evidence of a substitution effect for malaria prevention methods (Chase et al., 2009), this could be very significant. The Chase et al. study also found that 86.3% of its Mozambican study population reported using a preventative measure that was not a bed net and that, while respondents placed some value on bed nets, they preferred to spend their money on other methods (2009). The failure of EPPM to predict danger control behavior is somewhat more understandable in this regard.

The lack of EPPM's predictive power for danger control outcomes may also have to do with the high threat levels of an endemic disease context. It is possible that the threat levels present are simply too high to be overcome, even if efficacy would otherwise be considered high. A study of EPPM in the context of HIV/AIDS in Namibia, a situation that was shown to have high preexisting fear, found that a message's threat level had little impact on attitudes and behavioral intentions, although the results concerning behavior were inconclusive (Muthusamy et al., 2009). The efficacy content of messages also had little impact on attitudes or intentions in this study, although a small impact on behavior was observed; self-reported efficacy, however, did have a significant and positive impact on protective attitudes, intentions, and behaviors (Muthusamy et al., 2009). Overall, however, the study concluded that "using fear appears in context of high preexisting fear is likely ineffective" (Muthusamy et al., 2009, p. 339), calling into question the applicability of EPPM in ameliorating the malaria disease burden.

For fear control, the revised model utilizing EPPM constructs as independent main effects rather than interactions appears to be cautiously acceptable. The possibility exists that the EPPM constructs act independently or in previously unexplored ways. For example, very strong perceptions of response efficacy may be overcome by low self-efficacy. That fear control responses were predicted while danger control responses were not is also very intriguing. It is important to note that fear control behaviors are mental in nature, while danger control may require external action, subject to external requirements. Issues of access, funding, and education may be more restrictive to danger control than fear control processes.

Theoretical Implications

Although EPPM was not generally supported, some interesting points are raised concerning the model. The lack of support is not entirely surprising given the limitations of the instrument. However, the idea that EPPM constructions need to shift from interactions to main effects may have merit and should be further explored. Other studies (Muthusamy et al., 2009; Witte & Allen, 2000) have also failed to find support for the influence of threat by efficacy interactions on danger control outcomes; these studies however did find main effects for threat (Witte & Allen, 2000) and efficacy (Muthusamy et al., 2009; Witte & Allen, 2000).

Additionally, traditional EPPM does not incorporate the concept of barriers outside of their possible role in self-efficacy. Although our measure of economic stress was not found to have an effect, the possibility of outside influences acting as barriers in fear appeal outcomes remains a potential weakness of the theory. This study also illustrates the need to adapt EPPM to endemic disease situations by examining the role of the critical point in the face of overwhelming threat and by addressing the concept of implied fear appeals. While health campaign materials are likely to be formally constructed, implied fear appeals may play a significant role in everyday health decisions.

Practical Implications

This study found that self-efficacy was the only significant factor in danger control outcomes; fear control outcomes were negatively related to response efficacy and positively related to severity and susceptibility. This has profound implications for future health campaign designs. The object of any health campaign is to maximize message acceptance while minimizing unintended (and potentially harmful) consequences. The results of this study suggest that this can be accomplished by maximizing the efficacy component of the message. The issue of unintended consequence is something that must be continually assessed in the implementation of any campaign. As this study shows, even when danger control outcomes are not elicited, fear control responses may still be enacted.

Limitations

As the results of this study are considered, it must be remembered that its design is both retrospective and utilized survey materials adapted outside of their original context. The study assumed that these adapted variables reflected EPPM constructs without any pilot testing to ensure validity. Items may not have been weighted equally and were dependent on self-report. The instrument was also not comprehensive in its assessment of danger/fear control outcomes, and potentially missed relevant indicators. In particular, only one measure of fear control, reactance, was used. Other means of fear control, such as defensive avoidance, were not included. Fear control measures in general present a problem because they are mental behaviors rather than overt, external actions. This is in contrast to the very clear danger control outcome of bed net use. Additionally, distinguishing fear control from a lack of response is somewhat difficult. Finally, only populations of rural northern Mozambique were examined and caution must be taken in applying the results to a wider context.

Future Research

This study suggests many avenues for future investigation. First and foremost, confirmation of EPPM as a useable model in regards to bed net use in Mozambique is required. Such a study should utilize instrumentation specifically designed using EPPM and should be pre-tested before its use in the main study. Additionally, EPPM or a revised version of the model could potentially be applied to other aspects of malaria prevention and treatment at the household level, including indoor residual spraying, intermittent preventative treatment of malaria for pregnant women, retreatment of ITNs with insecticides, distribution of any malaria vaccines that may be developed, and education efforts regarding malaria symptoms. It may also be necessary to also look towards other health communication theories, such as the health belief model, to gain a comprehensive understanding of malaria protection responses. Both social stigma and collective efficacy have been shown to influence outcome and serve to demonstrate how the EPPM constructs of threat and efficacy (Smith, Ferrara, & Witte, 2007) may be expanded. Such elaborations on EPPM could greatly enhance our understanding of health behaviors and should be further explored.

Conclusions:

Although the study's design limitations restrict any definite assessments of EPPM's applicability to the context of malaria in Mozambique, its findings do suggest several intriguing possibilities. Firstly, the significance of fear control outcomes over danger control highlights the importance of accounting for the unintended consequences of fear appeals, particularly in high threat situations. The observed influence of efficacy could be instrumental in counteracting these effects. Secondly, the possibility of EPPM constructs acting as main effects rather than via threat by efficacy interactions may have merit and could have profound implications for the overall model. Thirdly, the influence of barriers, while not supported, could potentially impact message outcomes in ways unexamined in this study and thus should not be discounted. Although the nature of the theoretical interaction of EPPM constructs is called into question, the construct roles as described are in general supported and expansions of the model may offer guidance in reducing malaria disease burdens.

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Academic Vita

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EDUCATION

The Pennsylvania State University — University Park, PA
Bachelor of Science, Biology — May, 2011
Honors in Communication Arts and Sciences
Thesis Title: Health Communications and Malaria:
The Applicability of EPPM in Predicting Bed Net Use
Thesis Supervisor: Rachel Smith

RELEVANT EXPERIENCE

The Pennsylvania State University-Research Aide — Fall 2009
Communications Arts and Sciences — University Park, PA

- Organized survey data regarding malaria prevention and agricultural practices in Mozambique
- Gathered data regarding HPV issues and stress levels
- Ran focus groups
- Reviewed scholarly articles in support of research efforts

AWARDS AND HONORS

Dean's List: Fall 2007-Fall 2010
Phi Beta Kappa
PA Commonwealth Education Abroad Scholarship
Eberly College of Science Travel Grant

EXTRACURRICULAR ACTIVITIES

Springfield THON

- Worked to raise over $207,000 last year alone for the Four Diamonds Fund in the battle against pediatric cancer
- Provided emotional support for the families affected by childhood cancer

Penn State Quiz Bowl
University College Dublin Aikido Club
University College Dublin English Literary Society