FACULTY SEED GRANTS APPLICATION

Funding Year 2010-2011

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Proposals with text exceeding the prescribed limits will not be considered

Applicant Information	
First Name	Kacey
Last Name	Ernst
Email Address	kernst@email.arizona.edu
Position Title	Assistant Professor
Phone Number	520-626-7374
Department Name	Epidemiology and biostatistics
Department Number	
UA Mailing Address	1295 N Martin Ave. P.O. Box 254211 Tucson, AZ 85724
Proposal Title:	On the Edge: Dengue Emergence on the Arizona/Sonora Border
Requested Amount:	10,000

Compliance/Research Risk Acceptance of Responsibility:

I acknowledge that if my project includes research risk item(s), I and my department are responsible for maintaining compliance in conjunction with institutional policies. Automatic notices for research risk items are not generated for gifts. Faculty Seed Grants submission implies acceptance and agreement with the University's Conflict of Interest Policy. To acknowledge please check the box (double click): ☒

Eligibility:

I certify that I am an eligible applicant and I have prepared my budget in conjunction with my department business office. To acknowledge please check the box (double click): ☒

Authorized Signers (Names and Titles)

Kacey C. Ernst

Abstract/Project Summary (100 word maximum):

Despite dramatic improvements malaria remains a significant health problem in many regions of the world. As malaria programs move from control to elimination there is an urgent need to understand barriers and promoters to the use of control measures, specifically insecticide treated nets (ITN). Small pockets of residual transmission can fuel a resurgence of malaria if donor interest wanes and resources are no longer available. The objectives of this pilot study are to gather preliminary data on barriers to ITN ownership and use in a high transmission and low transmission site in western Kenya.

Statement of Need

Despite worldwide initiatives to scale up malaria control programs, malaria remains one of the primary threats to children's health in sub-Saharan Africa. Control efforts have relied heavily on the free distribution of insecticide treated bednets (ITNs). While factors related to ITN ownership have been fairly well explored, little follow up has been made to determine actual use of ITN after they have been provided. Anecdotal evidence suggests that community members may be using distributed ITN for a variety of unintended purposes including 1) redistribution and income 2) fishing nets 3) fencing 4) protection of plants 5) curtains and decoration 6) protecting lower risk household members or they may not be used at all. Determining the prevalence levels of these behaviors and identifying acceptable low cost interventions is critical in the fight against malaria. If even small pockets of transmission remain in areas that are slated for elimination, resurgence could occur as it did in the 1960's, negating all efforts that are being made to reduce the worldwide malaria burden.

In Kenya, malaria remains a leading cause of morbidity and mortality accounting for 30-50% of all outpatient attendance and 20% of all admissions to health facilities. Yet risk of malaria is not evenly distributed. Malaria transmission in highland areas is low and seasonal, mirroring transmission dynamics in areas where elimination is currently feasible. In the lowlands transmission rates are high and perennial, where the malaria strategy is one of control, not elimination. These differences in transmission likely lead to differences in ITN use and may present an effective model for how the changing dynamics of malaria transmission may impact the use of control measures.

To reduce malaria risk, individuals must not only own but use their ITN properly. The first step in prevention, ownership, has been strongly associated with household wealth (Astakie *et al.* 2009, Noor et al. 2006, Noor et al. 2007, Oresanya *et al.* 2008, Agha *et al.* 2007). It is not surprising then that free distribution of ITN has been highly successful in reducing disparities in Kenya while social marketing and subsidized low cost bednets were less effective at reducing these disparities (Al Noor *et al.* 2007). Other factors traditionally associated with ITN ownership include education level of household head (Astatkie *et al.* 2009, Noor 2006, Oresanya et al. 2008), region of residence (Babu *et al.* 2007, Baume *et al.* 2009), and presence of an individual from a high risk group in the household (Astatkie *et al.* 2009).

While high bednet coverage has been shown to have indirect community effects (Hii et al. 2001, Hawley et al. 2003), the greatest reduction in risk is to those sleeping under them (Gosoniu et al. 2008). Ensuring that ITN are used by high risk groups requires solutions more complex than the distribution of free ITN. The disconnect between ITN ownership and subsequent use raises an important question that has begun to receive more attention in recent years. Much is still unclear and reasons are likely culturally and contextually variable, but lack of use, or misuse, of ITN is widely reported (Adoga et al. 2005, Belay et al. 2008, Oresanya 2008, Baume 2009, Atkinson 2009, Ng'ang'a *et al.* 2009). Individuals have consistently reported using ITN for nuisance reduction of mosquitoes but not to prevent malaria (Adoga et al. 2005, Atkinson 2009, Atkinson 2010, Baume 2009), likely due to lack of knowledge about malaria transmission and lower perceived risk of the disease (Atkinson 2010, Baume 2009, Chuma et al. 2010). It has also been reported that ITN have been used for purposes other than as a bednet including as fishing nets (Baume 2009, Minikawa 2008). Many of the reasons for not using an ITN are linked to cultural beliefs. In Kenya, white ITN resemble shrouds and sleeping under them was reported as bad luck (Chuma et al. 2010).

The following objectives for this pilot study are as follows:

Objective 1: Gain community support for research project in Kapkangani and Miwani, Kenya.

Objective 2: Use the ecological and health beliefs models to construct a survey tool for use in cross-sectional surveys in Miwani, Kenya and in Kapkangani, Kenya.

Preliminary Data

The principal investigator conducted a population-based case-control study that examined malaria risk (Ernst et. al. 2009) in Kipsamoite and Kapsisiywa sublocations in the Nandi District of western Kenya in 2004. A secondary analysis of the data indicated that only 15% (n = 172) of people reported owning a net in their household and only 52% (n=90) of those were treated nets. Data was not collected on whether the bednet was used at all in the household, but only 37% (n=63) of respondents who had a bednet in the home had used it. With 55% (n=30) of children under the age of 5 sleeping under a bednet the night prior, this high risk group was more likely than older age groups to sleep under a net. A multivariate model of use revealed that in households owning bednets respondents were more likely to report using the bednet if they were under age 5 years (OR = 3.4 (1.7, 6.8)), reported a high level of nuisance insects (OR = 2.7 (1.2, 5.9)), slept in a bed (OR=2.7 (1.2, 6.1) and mosquitoes coils were also used (OR=7.3 (1.4, 38.5)). Conversations with individuals in the community revealed that many people wanted bednets but didn't know where to obtain them or couldn't afford them. Those who did own bednets said that they did not always use them as they didn't like putting them

up and down. We are proposing to work in a neighboring community, Kapkangani. The other study site proposed is Miwani, Kenya. The principal investigator worked in this area in 2001 and maintains contact with community members and former field research team members.

Methods

Objective 1: Gain community support for research project in Kapkangani and Miwani, Kenya. We will work with colleagues at the Kenyan Medical Research Institute and the Kenyan Ministry of Health to approach community leaders including sublocation chiefs and village elders. We will hold community meetings organized by the sublocation chiefs to talk to the community about working in the area.

Study Sites: Kapkangani, Kenya is located in Nandi District in the western Kenyan highlands. Altitude ranges from approximately 1600m – 2100 m. Malaria transmission in this area is low and unstable with acute seasonal peaks generally after the peak rains in April-May. The population is primarily indigenous Kalenjin people and Luhya settlers from neighboring highland areas. The primary occupation is rural subsistence agriculture, while some work as casual laborers on local tea estates. By contrast, Miwani, Kenya is located on the Kano Plain in western Kenya, 30 km east of Kisumu. Altitude is approximately 1200m above sea level. Malaria transmission in this area is holoendemic and occurs year-round. People are primarily of the Luo tribe and are subsistence farmers with some casual labor in the nearby sugarcane plantations. All households have been mapped and given an identifying number. Age and sex of all occupants were recorded.

Objective 3: Use the health beliefs model to construct a survey tool for use in cross-sectional surveys in Miwani, Kenya and in Kapkangani, Kenya.

Focus groups will be held with community members in Miwani, Kenya and Kapkangani, Kenya to explore concepts surrounding ITN ownership and use. Questions will be structured around results from specific aim 1 as they fall under the different aspects of the health beliefs model. Using results from the focus groups, a questionnaire will be designed and a cross-sectional study will be undertaken.

Focus groups and semi-structured interviews: Field assistants will be trained using established methods (Maynard-Tucker 2000). Four focus groups discussions (FGD) will be held for community members in Kapkangani, Kenya and Miwani, Kenya. Approximately 6-8 participants will be chosen on the basis of age, gender and parental status. In Miwani, Kenya, we will include men and women who have young children, those at most risk of malaria as well as older people who have great influence in family decision making in the discussions. In Kapkangani, Kenya, malaria is seasonal and people of all ages can experience severe illness when infected. We will choose participants to reflect the general community and include participants from both young adult through older age groups. All FGDs will be tape recorded and notes will be taken to ensure accuracy in translation and content. Topics to be discussed will follow the health beliefs model and include 1) perceptions of malaria severity 2) perceptions of risk of malaria 3) perceived benefits of ITN use 4) perceived barriers to ITN use 5) cues to action such as health promotion programs and public media campaigns and 6) confidence in the subject's ability to obtain an ITN and use it properly. FGDs data will be translated and transcribed into Nvivo 9.0. The data will be coded. Themes and subthemes will be identified by investigators.

Feasibility

While the project is ambitious for the small funds available, we have already begun work in the study sites and have experienced field assistants available for the project. The study sites have already been mapped and censused and community members have expressed interest in working on health related research.

Future Research Plans

After establishing the study sites and gathering preliminary evidence of factors impacting insecticide treated net ownership and use we will implement several sequential studies with the overall objective of improving compliance and exploring alternative control measures for malaria. **Phase 1:** To determine the generalizability of themes identified in focus groups, we will conduct a cross-sectional survey. A combination of open and closed-ended questions will be used to quantify and explore hypotheses related to ITN ownership and use. We will follow the health beliefs model to identify factors related to ITN ownership and use. **Phase 2:** We will use the positive deviance model to explore why some households reported using all their ITN despite experiencing typical barriers. Individuals who use an ITN despite reporting at least 75% of factors determined to be associated with lack of use of ITN will be administered semi-structured interviews to determine more complex motivations and behaviors that facilitate use of the ITN. **Phase 3:** We will use the data based on the results generated in the initial studies to design and implement culturally appropriate interventions created to improve ITN ownership and use in the community.

FACULTY SEED GRANTS
Budget and Budget Justification

A. Project Budget

EXPENSE ITEM	FSG Requested Amount
Wages & ERE	--
Travel	4500
Capital Equipment (>$5k)	--
Operations	
<$5k equipment	400
materials and supplies	200
printing/duplication/marketing	400
Postage	--
Consultant Fees	4000
Participant Payments	500
Other	---
TOTAL EXPENSES	10,000

B. Total Project Budget Justification (be concise)

Expense Items
Wages & ERE:
Travel: Three week trip to Kenya to set up the project and train field assistants. Includes RT airfare, hotel accommodation and per diem.
Operations (include justification for each subcategory): <$5k equipment: We will need 3 handheld GPS units to map the study sites. Materials and supplies: Pens, backpacks, batteries for the GPS, notepads etc. will all need to be purchased. Printing: We will need to photocopy forms for inputting data in the field.
Postage:
Consultant Fees: Four field assistants will be paid $200 per month for 3 months ($2400). Our colleague in the ministry of health will act as an onsite coordinator and contact ($600). We will pay someone for database construction and translation ($1000).
Participant Payments: Each participant in the focus groups will receive a small compensatory gift of ($5). There are an estimated 100 participants in the 10 focus groups.
Other:

Applicant Brief CV (two pages maximum)

KACEY CLARICE ERNST, Ph.D., M.P.H.

CHRONOLOGY OF EDUCATION

B.A. in Chemistry and Biology – Lawrence University (1997)

M.P.H. in Epidemiology – University of Michigan – Ann Arbor (2001)
Thesis: "Seasonal influences on predominant malaria vectors in western Kenya: *Anopheles funestus* important in transmission during the dry season"
Advisor: Mark L. Wilson, Sc.D.

Ph.D. in Epidemiology – University of Michigan – Ann Arbor (2006)
Dissertation**: "**Malaria in the highlands of western Kenya: Epidemiology of environmental influences, spatial patterns and disease risk."
Advisor: Mark L. Wilson, Sc. D.

CHRONOLOGY OF EMPLOYMENT

2008-present	Assistant Professor, Division of Epidemiology and Biostatistics College of Public Health, University of Arizona, Tucson, Arizona
2008–present	Assistant Professor, Arid Lands, University of Arizona, Tucson, Arizona
2007–2008	Influenza Epidemiologist, Office of Infectious Disease Services, Arizona Department of Health Services, Phoenix, Arizona
2003–2006	Graduate Research Assistant, Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor, Michigan (based in Kenya)
2005	Graduate Student Instructor, Introductory Epidemiology, University of Michigan, Ann Arbor, Michigan
2003	Bioterrorism Preparedness Coordinator, Milwaukee County/ Waukesha County Consortium, Wauwatosa, Wisconsin
2000	Summer Research Fellow, U.S. Army Medical Research Unit, Kisian, Kenya

HONORS AND AWARDS

2001	Global Transformations Seminar Scholar, University of Michigan
1999-2001	Klare Memorial Scholar, University of Michigan
1999-2001	Dean's Award, University of Michigan
1993-1997	Trustee Fellowship, Lawrence University
1993-1997	Dow Chemical Fellowship, Lawrence University

SERVICE

2008 -	Judge, M.P.H. Internship Conference (6 terms), MEZCOPH
2008 -	Member, Epidemiology MS/PhD Admissions Committee
	2008 Adhoc Committee lead – Creating a PhD graduation checklist
2008 -	Member, Epidemiology MPH Admissions Committee
2008-	Member, International Affairs Committee, University
2008-	Member, Community Engaged Practice Committee (CEPAS), College
	2009 - Subcommittee member – Community Engaged Practice and Service Award Committee
	2008 - Subcommittee member – MEZCOPH college-wide retreat – Creating a Collective Vision
	2009 – Subcommittee member – MEZCOPH college-wide retreat – Collaborations across the college
	2009 – Subcommittee member – Staff Training Public Health 101 seminar
	2009 – Subcommittee member – Staff Training Epidemiology 101 seminar
2009	Member, Annual Performance Review Committee (Epidemiology- Biostatistics)

2009 Member, Africa Forum, University
Subcommittee Member, East African Ties – Developing collaboration between an NGO, the U of A, a University in East Africa and a community in East Africa.
2008-2009 Member, Pandemic Influenza Intercollegiate Exercise between COM, CON, MEZCOPH, COP and COL
2009 Member, EWIDS grant work team to develop online training modules for ADHS epidemiology staff
2009 SWAT team member, Pima County Health Department and Community Partners working to implement vector control in Pima County

PROFESSIONAL ORGANIZATIONS

2008 Member, International Society of Infectious Disease
2010 American Society of Tropical Medicine and Hygiene

RELATED PUBLICATIONS AND SCHOLARLY WORKS

Peer Reviewed Journal Articles

1. ***Ernst KC**, Adoka SO, Kowuor DO, Wilson ML, John CC. Malaria hotspot areas in a highland Kenya site are consistent in epidemic and non-epidemic years and are associated with ecological factors. Malar J. 2006 Sep 13;5:78.
2. *Cohen JM, **Ernst KC**, Lindblade KA, Vulule JM, John CC, Wilson ML Topography, land-cover, and elevation predict areas at risk for malaria within communities in a highland region of western Kenya. Mal Journal Jan 2008 17:40.
3. Menge DM, **Ernst KC**, Vulule JM, Zimmerman PA, Guo H, John CC. (2008) Microscopy underestimates the frequency of *Plasmodium falciparum* infection in symptomatic individuals in a low transmission highland area. American Journal of Tropical Medicine and Hygiene 79 (2):173-7.
4. **Ernst KE**, Lindblade, KA, Koech D, Sumba PO, Kuwuor D, John CC, Wilson ML. Environmental, socio-demographic and behavioral determinants of malaria risk in the western Kenyan highlands: a case-control study. Tropical Medicine and International Health. 14 (10), pp. 1258-1265
5. Cohen JM, **Ernst KC,** Lindblade KA, Vulule JM, John CC, Wilson ML Local topographic wetness indices predict household malaria risk better than land-use and land-cover in the western Kenya highlands. Malar J. 2010 Nov 16;9:328.

Published Abstracts

1. *Dunton, R.F., **Ernst, K**. Malaria transmission in western Kenya: the importance of *Anopheles funestus Giles*. American Journal of Tropical Medicine and Hygiene 2001; 65(3 Suppl):308-09.

PRESENTATIONS (*indicates invited)

1. ***Ernst KC**, McHugh M, Kowuor DO, Wilson ML, John CC. MSP-1 and MSP-2 allelic family diversity of *Plasmodium falciparum* infection in a malaria epidemic-prone area of the western Kenyan highlands. Presented at ASTMH conference December 2005.
2. *Menge DM, **Ernst KC**, Vulule JM, John CC Characterization of *Plasmodium falciparum* Populations from Epidemic Prone Sites with varying Transmission Patterns in a Western Kenya Highland. Presented at ASTMH conference November 2006.
3. *Ernst KC, Arora M Who's Under the bednet: barriers to bednet use in children under 5 in Kenya. Presented at ASTMH conference Atlanta, November 2010.

RELATED RESEARCH SUPPORT

Concluded

2003 - 2006 $100,000 Project director NIH RO3 "Environmental determinants of malaria in the western highland of Kenya" (50% effort) Grant # 5R03AI056184-02.

This a true and accurate statement of my activities and accomplishments. I understand that misrepresentation in securing continuing status and promotion may lead to dismissal or suspension under ABOR Policy 6-301 I.2.b.

Kacey C. Ernst