The Effect of Adaptive Capacity to Climate-Sensitive Health conditions on Subjective Well-being: A Case of Malaria in Ghana

Introduction

The changing global climate affects morbidity distribution in varying ways (Caminade et al 2014, Harlan & Ruddell 2011, McMichael 2009, McMichael 2013, McMichael et al 2006, Patz et al 2005, White-Newsome et al 2012, WHO 2008). Current climatic trends have significantly heightened the incidence of tropical diseases like malaria, presenting significant challenges to efforts in maintaining and improving the health and well-being of people, particularly in sub-Saharan Africa.

Although the potential nexus between adaptive capacity to climate-sensitive health conditions and human well-being has been alluded to by some researchers, the nature and extent of this relationship has inadequately been developed in the literature (Hogan et al 2013). A further understanding of the adaptive capacity of people exposed to diseases such as malaria and their well-being may be critical in designing social welfare policies.

Taking cues from seminal works by Van Praag (Van Praag & Kapteyn 1973, Van Praag 1968, Van Praag & Ferrer-i-Carbonell 2008), we have employed a novel approach to investigate the influence of adaptive capacity to a climate sensitive health condition –malaria- on individuals subjective measure of wellbeing. The motivation question for this paper is, how does households adaptive capacity to malaria- (a climate sensitive health condition) – influences individual's subjective evaluation of wellbeing. Following the logic of van Praag model we are also able to determine the amount of support (monetary or social) that should be given to individuals having low adaptive capacity order to reach a given level of subjective well-being as their counterparts having a high adaptive capacity to the disease.

Materials and methods

The study was conducted in three different localities in Accra (5.55° N, 0.20° W). Accra is the administrative and commercial capital of Ghana, occupying an approximate area of 114 km2 with a total population of approximately 2 million. This is a cross-sectional study involving households systematically sampled from 29 defined enumeration areas situated in the three resource poor coastal communities. Survey data were collected through one- on- one interview with household heads of sampled households and individuals belonging to the reproductive age brackets.

Measurements of selected variables

a) Adaptive capacity: Three main categories of adaptive capacity was derived:
    1. Households with High / Primary adaptive capacity to malaria: These were households who indicated that they have the ability to adequately prevent the incidence of malaria.
    2. Households with Medium / Secondary adaptive capacity to the disease: These are households who indicated they have inadequate ability to either prevent or treat the disease.
    3. Household with Low / Poor adaptive capacity to the disease: These are households who indicate inadequate ability to prevent and also to treat malaria.

b) *Want parameter:* With the fundamental premise that, based on an individual's own circumstances, he/she is able to estimate income ranges considered as 'excellent,' 'good,' 'sufficient,' 'inadequate'. Following the logic of Van Praag, an individual with a high or higher *want parameter* needs a high or higher amount of income to attain the welfare evaluation of 0.5 as compared to his / her counterpart with a low or lower want parameter. In order words for any two individuals (A and B), B with a lower want parameter will be more satisfied with her monetary income than her counterpart A with a relatively higher want parameter.

c) Social capital: From responses given by study participants, four categories of social capital were derived (1) respondents who neither receive nor give any social support (2) respondent who only gives social support to others (3) respondent who receives social support and (4) those who give and also receives support.

Exposure of household to some climatic stress was captured as the frequency of a household experiencing flooding within a year. Other variables of interest were formal education and annual income of respondents. These were captured as continuous variables.

Data analysis and results

A. Descriptive statistics of variables in equation

The descriptive statistics of selected variables used are shown in Table 1. A total of 515 respondents were obtained for analysis after data screening and cleaning. The mean number of years of formal education by respondents was approximately 8 years - with a standard deviation of 4.42.

Table 1: Selected descriptive Statistics of Variables Used in the Empirical Model

		Mean	SD
Adaptive capacity to malaria			
Low Adaptive capacity	(=1, 0 otherwise)	0.04	0.18
Moderate Adaptive capacity	(=1, 0 otherwise)	0.88	0.32
High Adaptive capacity	(=1, 0 otherwise)	0.08	0.27
Social capital			
Receives no support	(=1, 0 otherwise)	0.42	0.49
Receives support	(=1, 0 otherwise)	0.14	0.35
Gives support	(=1, 0 otherwise)	0.28	0.45
Receives and gives	(=1, 0 otherwise)	0.15	0.36
Formal education(yrs.)		7.84	4.42
Income (Ghana Cedi)		4794.24	31723.06

Source: Data extracted from RIPS EDULINK Survey 2013

B. Predictor of welfare parameter- want parameter

Results show that in our study sample (**Table 2**), the 'want parameter' is predicted by respondent's Adaptive capacity to Malaria, Household social capital, Household size, respondent formal education and Income.

Selected positive predictors of *want parameter* –Predictors with positive coefficient were respondent's income, household size and formal education. Based on the logic of Van Praag, this implies

a. Income: A respondent that is relatively well-off (with higher income compared to one with lower income), all else being equal, requires a higher level of income to reach the same level of a subjective welfare evaluation compared to his/her counterpart with lower monetary income.
b. Formal education: The greater the number of years of formal education the higher the level of income needed to reach the same level of subjective welfare evaluation compared to respondent with lesser years of formal education.

Negative predictors: With *Low Adaptive Capacity* serving as the reference category, the coefficient of the dummy variables for *Medium* Adaptive Capacity and *High Adaptive Capacity* were both statistically significant at 5%. The negative coefficient indicates that, all other things being equal, a households with *Low Adaptive Capacity* has the highest aspiration (i.e., want parameter), on the average, than theirs counterpart with *Medium* Adaptive Capacity and *High Adaptive Capacity* to malaria. This finding has implications for public policy

Table 2: The effect of household adaptive capacity to malaria and selected socioeconomic characteristics on the welfare function-natural unit

	Natural unit, μ			
	Coefficient		Robust Std. Error	Elasticity
Adaptive Capacity				
Moderate adaptive capacity (=1, 0 otherwise)	-0.730	**	(0.265)	-0.080
High adaptive capacity (=1, 0 otherwise)	-0.893	**	(0.320)	-0.009
Social capital				
Receives social support (=1, 0 otherwise)	-0.460	**	(0.147)	-0.008
Household size	0.025		(0.015)	
Formal education (yrs.)	0.026	**	(0.010)	0.026
Ln (Income)	0.193	***	(0.056)	0.024
Constant	7.010	***	(0.498)	
N	515			
R^2=0.089 ; F =7.38***				

Significance ***1 percent level, ** 5percent level, *10 percent level

Discussion and implication of study

To our knowledge this is the first study that has examined the relationship between the adaptive capacity to a climate-sensitivity condition, specifically malaria, and individual's subjective well-being. This study buttresses the assertion by Cork et al that adaptive capacity and wellbeing vary considerably within communities as they are between communities (Hogan et al 2013). Current adaptation strategies do focus on '*one-fit all'* intervention programs for places or localities, however per the availability of resources; program managers must target sub-groups and individuals with low adaptive capacity for more impact. This finding gives more credence to the fact that resource availability (in this case monetary funds or income) is key to enhancing adaptive capacity in human systems (Smit & Pilifosova 2003).

The resource gap identified between individuals with low and high adaptive capacities calls for the prospect of social safety nets (SSN) programs to aid the vulnerable cope with the health risks associated with climate change (Asfaw et al 2011). One such SSN program is the conditional cash transfer (CCT) programs. CCT programs could increase the adaptive capacity to climate-sensitive by use of extra resource to purchase insecticide treated net which intend reduce exposure or risk of malaria (Handa et al 2012).

Reference

Asfaw S, Davis B, Dewbre J. 2011. Cash transfer programs in sub-Saharan Africa: measuring the impact on climate change adaptation.

Caminade C, Kovats S, Rocklov J, Tompkins AM, Morse AP, et al. 2014. Impact of climate change on global malaria distribution. *Proceedings of the National Academy of Sciences* 111: 3286-91

Handa S, Huang C, Hypher N, Teixeira C, Soares FV, Davis B. 2012. Targeting effectiveness of social cash transfer programmes in three African countries. *Journal of development effectiveness* 4: 78-108

Harlan SL, Ruddell DM. 2011. Climate change and health in cities: impacts of heat and air pollution and potential co-benefits from mitigation and adaptation. *Current Opinion in Environmental Sustainability* 3: 126-34

Hogan A, Tanton R, Lockie S, May S. 2013. Focusing resource allocation-wellbeing as a tool for prioritizing interventions for communities at risk. *International journal of environmental research and public health* 10: 3435-52

McMichael AJ. 2009. Climate change in Australia: risks to human wellbeing and health. *Austral Special Report*

McMichael AJ. 2013. Globalization, Climate Change, and Human Health. *New England Journal of Medicine* 368: 1335-43

McMichael AJ, Woodruff RE, Hales S. 2006. Climate change and human health: present and future risks. *The Lancet* 367: 859-69

Patz JA, Campbell-Lendrum D, Holloway T, Foley JA. 2005. Impact of regional climate change on human health. *Nature* 438: 310-17

Smit B, Pilifosova O. 2003. Adaptation to climate change in the context of sustainable development and equity. *Sustainable Development* 8: 9

Van Praag B, Kapteyn A. 1973. Further evidence on the individual welfare function of income: An empirical investigatiion in The Netherlands. *European Economic Review* 4: 33-62

Van Praag BM. 1968. *Individual welfare functions and consumer behavior: A theory of rational irrationality*. North-Holland Pub. Co.

Van Praag BM, Ferrer-i-Carbonell A. 2008. *Happiness quantified: A satisfaction calculus approach*. Oxford University Press.

White-Newsome JL, Sánchez BN, Jolliet O, Zhang Z, Parker EA, et al. 2012. Climate change and health: indoor heat exposure in vulnerable populations. *Environmental research* 112: 20-27

WHO. 2008. Climate change and health.