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# The unusual suspects? Perception of underlying causes of anthropogenic climate change in coastal communities in Cambodia and Tanzania

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Public perception of the underlying causes of anthropogenic climate change is a complex and subjective issue that is critical to effective risk communication. This issue is important to scientists and policymakers because of the role of individual perceptions in influencing their protective behaviour towards risk (e.g., the adoption of climate risk reduction and mitigation strategies). This cross-sectional study elucidated people's perceptions of the underlying causes of human-induced climate change in coastal communities in Cambodia and Tanzania. The multinomial logistic regression model was based on a geographically and demographically stratified national sample of 3,706 individuals conducted between March and September 2013. The distribution of the fundamental causes of anthropogenic climate change in the pooled sample was deforestation (29%), overpopulation – births and immigration (18%), greenhouse gas emissions (12%), illegal resource extraction (14%), and God's will and transgressing cultural norms (26%). Few people in both countries believed that, the usual suspect, greenhouse gas emission was the fundamental cause of anthropogenic climate change. The number of poor rural residents who indicated that deforestation was the major underlying cause of climate change was approximately three times more than members of the same sub-group who noted that greenhouse gas emissions were the underlying cause of climate change. People who had tertiary education were less likely to consider God's will and transgressing cultural norms as the underlying cause of anthropogenic climate change rather than attributing it to greenhouse gas emissions. Therefore, it is imperative to mainstream climate change into educational curricula in both countries.

**Keywords:** risk; perception; climate change; urban poverty; multinomial; Cambodia; Tanzania

## 1. Introduction

Anthropogenic climate change, which has been severally framed as an environmental, health, justice, security, and political issue, has dominated the global policy agenda over the last two decades. Increasingly, it is now recognized that anthropogenic climate

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change is occurring (IPCC 2014; Pachauri *et al*. 2014). Yet, many of the underlying causes of anthropogenic climate change are not perceived as threats when first encountered. Three interconnected drivers that are major contributors to anthropogenic climate change are global trade (Peters *et al.* 2011), industrial agriculture (Gerber *et al.* 2013), and petroleum production and consumption (Tsai 2014). Public understanding of anthropogenic climate change is a topic of interest to most scientists and policymakers owing to the fact that people's views on climate change tend to influence their attitudes towards national policy (e.g., reducing emissions) and personal actions (e.g., reducing one's own impact on the environment) (see Capstick *et al.* 2015; Demski *et al*. 2017; Lee *et al*. 2015; Pidgeon 2012; Spence, Poortinga and Pidgeon 2012).

Public understanding of climate change is an area of substantial scientific research around the world. According to Pidgeon (2012), although climate change is regarded by many individuals as an issue which is important for society to deal with, it is frequently considered as temporally, geographically, or socially distant from ordinary people's everyday lives. This has culminated in a 'psychological distancing' of people from the climate change problem, and is regarded as one of the root causes of an ensuing lack of public engagement (Spence, Poortinga, and Pidgeon 2012). Studies on the factors that influence public perception of climate change risk are ongoing. For instance, based on surveys in 119 countries, Lee *et al*. (2015) documented the relative influence of sociodemographic characteristics, geography, perceived well-being, and beliefs on public climate change awareness and risk perceptions at national scales. Beyond sociodemographic characteristics, it has been suggested that the respondents' own judgement regarding their knowledge, as well as the effect of trust in external aid, science and technology, and personal experiences with extreme weather events are significant determinants of public perception of the underlying causes of climate change (see Etkin and Ho 2007; Menny *et al*. 2011; Weber 2006; Swim *et al*. 2009).

Furthermore, studies have also revealed that a myriad of factors influence risk perceptions and the decision-making that shapes change in behaviour. These factors comprise interpretation of danger, understanding, and knowledge of the cause (Bostrom *et al*. 1994); proximity, exposure, direct personal threat, and personal experiences with recent serious consequences (Goltz, Russell, and Bourque, 1992); people's priorities (Lorenzoni and Pidgeon 2006); experiential factors (Leiserowitz 2006); and environmental values (O'Connor, Bord, and Fisher 1999).

The bulk of research on public understanding of the underlying causes of anthropogenic climate change has been carried out in developed countries. The literature suggests that developing countries, especially those located in low-lying coastal areas that are potentially vulnerable to the impacts of sea level rise, are at high risk to the adverse impacts of climate change (Chan *et al*. 2014; Dasgupta *et al*. 2011). This is especially so given that most people in developing countries are dependent on natural resources and have climate-sensitive livelihoods (Conway and Schipper 2011; Kniveton, Smith, and Black 2012). However, even within the same country, heterogeneities in impacts of climate change exist. A changing climate affects the poorest in developing countries the most. Research on differences in public understanding of the underlying causes of anthropogenic climate change across sub-groups (e.g., rural poor, rural non-poor, urban poor, urban non-poor) is imperative. Understanding public perceptions of climate change risks across sub-groups is a critical component in motivating public support for future policy action. Therefore, the objective of this study was to analyze the perceptions of coastal communities in Cambodia and Tanzania regarding their

understanding of the causes of anthropogenic climate change. The paper specifically assesses how urbanicity (rural-urban residence) and wealth status jointly, self-rated health status; religion and education influence how people in coastal communities understand the causes of human-induced climate change.

The two-tailed Chi-square tests ($\alpha = 0.05$) were used based on the following hypothesis:

$H_1$: $\chi^2 \neq 0$, there is a relationship between perception of underlying causes of anthropogenic climate change and urbanicity wealth status (monotonic, not necessarily linear trend).
$H_2$: $\chi^2 \neq 0$, there is a relationship between perception of underlying causes of anthropogenic climate change and religious beliefs, gender, educational attainment, and geographical region of residence.

Pursuing these objectives is important for theory in terms of our understanding of how beliefs about climate change are shaped. It is also important for developing strategies to engage members of the public in addressing the causes of climate change, and for responding to climate impacts. Overall, it is anticipated that this study will contribute to the development of more effective climate science communication in a manner that embraces the complex linkages between sub-group heterogeneities and public perception of climate change.

## 2. Materials and method

### *2.1. Study context*

Coastal communities in two Indian Ocean nations, that is, Cambodia and Tanzania provide the context of this study. A comprehensive description of the study area (Figure 1) and the motivation for selecting the two countries is given in Armah *et al*. (2015b). Cambodia and Tanzania are characterized by low-lying coastal areas that are potentially vulnerable to the impacts of sea level rise. Apart from the fact that both countries have witnessed tremendous growth in their urban populations, they are also confronted with extreme temperature fluctuations, land degradation, and desertification, all of which are likely to be exacerbated by anthropogenic climate change.

The two case studies are already experiencing the impact of climate change at various levels. The effects of climate change in Tanzania have been a subject of scientific scrutiny for a while, and effects have been identified in different sectors. These include water, forestry, human security, human health, crop production, livestock, and food security (Mongi, Majule, and Lyimo 2010; Mwandosya, Nyenzi, and Lubanga 1998; Paavola 2008; Piikki *et al*. 2015; Tenge, Gillo, and Mberege 2014). Effects specific to coastal zones in Tanzania include reductions in the productivity of coastal fisheries which affects livelihoods, food security, and health (Suckall, Tompkins, and Stringer 2014); sea level rise which affects the health of mangrove forests and the sustainability of coastal fisheries (Ellison 2015), as well as contributes to coastal erosion, contamination of freshwater resources, and floods (Rugai and Kassenga 2014). In Cambodia, several impacts of climate change have also been identified. While impacts such as floods resulting from increased tendencies of extreme precipitation does affect large portions of the country (most of which is low-lying), coastal regions are particularly vulnerable. The relationship between extreme rainfall events and associated floods (in the Mekong Delta) on the production of the region's staple food (rice) has been seen as one of the main

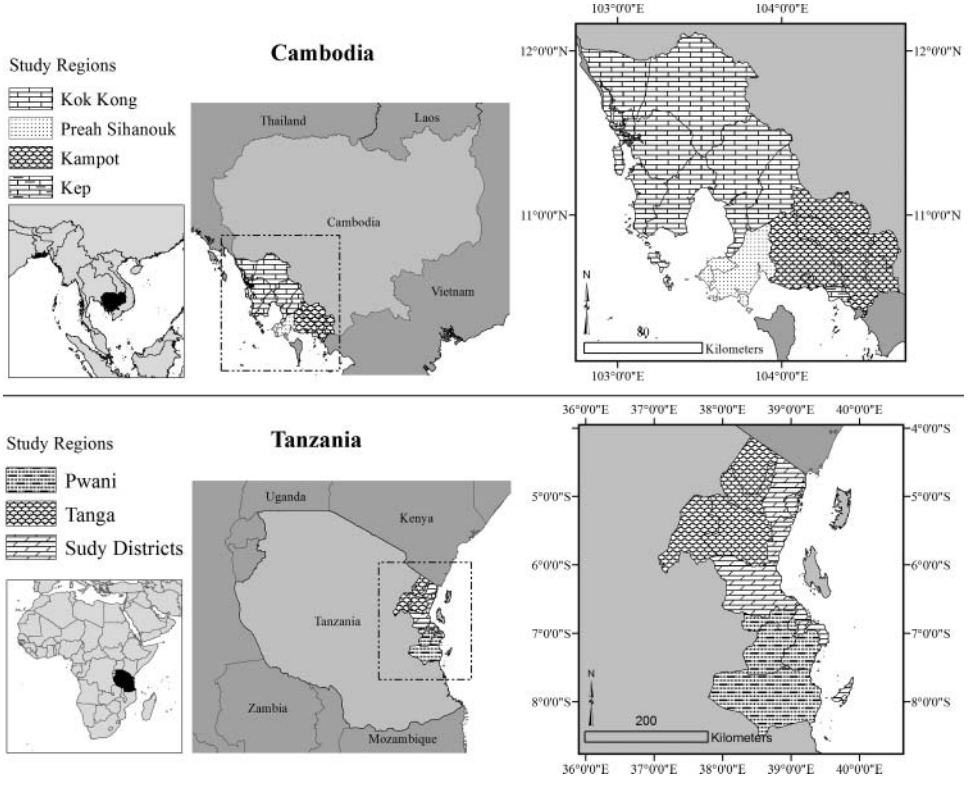


Figure 1. Map showing the study areas in coastal Cambodia and Tanzania.

issues to be addressed in the country's climate change adaptation policy (Nguyen and Alexander 2015). Coastal flooding and sea water intrusion into coastal fresh water reserves has been identified as some of the identifiable effects of climate change (Mendoza *et al*. 2014). These have negative effects on sectors such as agriculture, human security, and the health of coastal communities (Barbier 2015). The aforementioned similarities make the two countries likely candidates for the study of perceptions of underlying causes of anthropogenic climate change. Life expectancy in Cambodia is 71 years (World Bank 2014) whereas it is estimated at 61.8 years in Tanzania (National Bureau of Statistics 2013). The World Bank estimates show that GDP per capita of Tanzania and Cambodia were 842 and 1,006 US Dollars, respectively.

Cambodia is part of mainland Southeast Asia in the Lower Mekong region with an area of 181,035 km$^2$ and lies between parallels of 10° N and 15° N and meridians of 102° E and 108° E (see Armah *et al*. 2015b). Cambodia is linked to the Pacific Ocean/South China Sea more than the Indian Ocean, unlike Tanzania. It is bordered by Laos and Thailand to the north, the Gulf of Thailand to the south, Vietnam to the east, and Thailand to the west (MoP 2008). The physical landscape is dominated by the lowland plains around the Mekong River and the Tonle Sap Lake. Cambodia has a total population of 13.4 million, where over 70% reside in rural settings. The annual growth rate of the population is 1.54, with a density of about 75 people per km$^2$ (MoP 2008). Administratively, Cambodia is divided into 25 provinces and cities (Mom 2014). Tanzania is a coastal country lying between longitudes 29° and 49° East, and latitudes 1° and 12° South of the Equator (Francis and Bryceson 2001). It has a marine area

of 64,000 km$^2$ and an off-shore exclusive economic zone of 223,000 km$^2$ (Mngulwi 2003). Tanzania's coastline stretches for 800 km. It has five coastal regions – Tanga, Pwani, Dar es Salaam, Lindi, and Mtwara. The five coastal regions cover about 15% of the country's total land area and are home to approximately 25% of the country's population. According to the 2012 Population and Housing census, the total population of Tanzania was 44,928,923 compared to 12,313,469 in 1967 (National Bureau of Statistics 2013), reflecting an annual growth rate of 2.9%.

### *2.2. Data collection*

The sample was drawn from the adult population composed of individuals who were 18 years or older and resident in coastal regions and provinces in both countries, at the time of the survey (see Armah *et al*. 2015b; Ung *et al*. 2016). A comprehensive account of the sampling design, data collection, and tests of content validity, internal consistency and reliability of the instruments are given in Armah *et al*. (2015a,b). Both oral and written consent was obtained from each participant prior to the interviews. Ethical approval for the study in both countries was obtained from the Western University, Canada Non-medical Research Ethics Board. The National Ethics Committee (NEC) in Cambodia also gave approval prior to the study. In Tanzania, study approval was granted by the Commission on Science and Technology (COSTECH). In Cambodia, data were collected from April to September 2013 from 17 communes in four coastal provinces: Kampot, Kep, Kok Kong, and Presh Sihanouk). A total of 1,823 participants (1,257 females and 566 males) were interviewed in a cross-sectional survey in Cambodia. The survey in Tanzania was conducted with 1,253 individuals in three regions (Dar es Salaam, Tanga, and Pwani) between March and September 2013. The study participants included 606 males and 647 females.

### *2.3. Measures*

#### *2.3.1. Response variable*

Originally, as part of a pilot study, respondents were asked whether or not they believed that climate change was human-induced (see Armah *et al.* 2015a). Nine out of ten respondents answered in the affirmative and were further asked to indicate the potential underlying causes of climate change. They indicated a plethora of potential factors, which were further reduced to five underlying causes based on principal component and factor analyses. In the main study, the respondents were asked to indicate the single most important cause of climate change. Based on this, a polytomous nominal response variable consisting of five mutually-exclusive categories: deforestation, overpopulation (births and immigration), greenhouse gas emissions, illegal resource extraction, and God's will and transgressing cultural norms as the outcome variable. Greenhouse gas emission was used as the baseline comparison group. Given that the polytomous variable is not ordered randomly shifting 'baseline' makes no difference.

#### *2.3.2. Predictor variables*

Variable selection, or model specification methods, for this study was based on theoretical relevance and sequential logistic regression analysis. Also, the selection and sequence of entry of the predictor variables in the multinomial regression model was informed by

parsimony, model fit, theoretical relevance, and previous experience (Armah *et al*. 2015a, Armah *et al*. 2015b, Armah *et al.* 2015c). It is well documented that perception of underlying causes of anthropogenic climate change varies systematically with compositional factors (biosocial and socio-cultural factors) (Hartter *et al*. 2012). For this reason, compositional factors were accounted for by including them in the multinomial regression models. These include length of time respondents have lived in the study area, self-rated health; geographical setting, social status (rural-urban residence and wealth status), religion, and educational attainment (see Hartter *et al*. 2012; Hartter and Goldman 2011; Leiserowitz 2005; Maddison 2007; McCright 2010; Wolf and Moser 2011; Zahran *et al.* 2006).

The number of years respondents had lived in their respective areas was categorised into four groups: up to five years was coded as 1, greater than 5 years and up to 10 years was coded as 2, greater than 10 years and up to 15 years was coded as 3, and more than 15 years was coded as 4. Self-rated health, a single-item measure of relative health status was operationalised by asking respondents the following: "compared with other persons of your age, would you say that your health is excellent (coded as 4), good (coded as 3), fair (coded as 2) or poor (coded as 1)?" Consistent with previous studies (Oksanen *et al.* 2008; Meng and Chen 2014), poor health was considered as the reference category. Urbanicity wealth status was operationalised using a combination of the World Bank threshold for absolute poverty in developing countries and the administrative units designated as either rural or urban by statutory bodies in both countries. This measure was categorised into four mutually exclusive groups including rural poor (1), rural non-poor (2), urban poor (3), and urban non-poor (4). Regarding educational attainment, no formal education, primary education, secondary education, and tertiary education were coded as 0, 1, 2, and 3, respectively.

### *2.4. Statistical analyses*

#### *2.4.1. Inferential statistics*

Data were processed in IBM SPSS version 20 and analyzed using STATA version 13 (StataCorp, TX, 2013). We used non-parametric tests (Pearson chi-square and Cramer's $V$ statistics) to determine whether the observed differences in perception of underlying causes of anthropogenic climate change and compositional factors were independent (statistical significance was set to $\alpha \leq 0.05$). The outputs were presented as contingency tables in the results (Tables 1 and 2).

#### *2.4.2. Multinomial logistic regression*

In multinomial logistic regression (MLR), the evaluation of the probability of categorical membership is estimated using maximum likelihood. MLR was used to predict categorical placement in, or the probability of, category membership on the dependent variable based on multiple independent variables in the data. Correlations among the independent variables were used to assess multicollinearity. Also, multivariate diagnostics (i.e., standard multiple regression) was used to assess for multivariate outliers and for the exclusion of outliers or influential cases (see Armah *et al.* 2015c). Sample size guidelines for multinomial logistic regression indicate a minimum of 10 cases per independent variable (Schwab 2002). This requirement was met for the data. MLR is frequently regarded as a technique of choice since it does not assume normality, linearity,

Table 1. Distribution of respondents in Cambodia ($n = 1{,}823$) and Tanzania ($n = 1{,}253$).

| | Cambodia | Tanzania | Measures of association |
|---|---|---|---|
| Urbanicity wealth (%) | | | Pearson $\chi^2$ (3) = 395.0598 |
| Rural poor | 66.1 | 33.9 | Pr = 0.000 |
| Rural non-poor | 95.1 | 5.0 | Cramér's $V = 0.3584$ |
| Urban poor | 42.4 | 57.6 | |
| Urban non-poor | 37.9 | 62.1 | |
| Self-rated health (%) | | | Pearson $\chi^2$ (4) = 528.1553 |
| Poor | 88.8 | 11.2 | Pr = 0.000 |
| Fair | 79.2 | 20.8 | Cramér's $V = 0.4144$ |
| Good | 37.8 | 62.2 | |
| Very good | 73.9 | 26.1 | |
| Excellent | 43.4 | 56.6 | |
| Religion (%) | | | Pearson $\chi^2$ (2) = 1.7e+03 |
| Christian | 0.7 | 99.3 | Pr = 0.000 |
| Muslim | 39.8 | 60.2 | Cramér's $V = 0.7494$ |
| Buddhist | 100.0 | 0.0 | |
| Education (%) | | | Pearson $\chi^2$ (3) = 114.2821 |
| No Education | 77.3 | 22.7 | Pr = 0.000 |
| Primary | 61.2 | 38.8 | Cramér's $V = 0.1928$ |
| Secondary | 49.7 | 50.3 | |
| Tertiary | 47.9 | 52.1 | |
| Gender (%) | | | Pearson $\chi^2$ (1) = 94.4137 |
| Male | 48.3 | 51.7 | Pr = 0.000 |
| Female | 66.0 | 34.0 | Cramér's $V = -0.1752$ |
| Age (%) | | | Pearson $\chi^2$ (9) = 39.8030 |
| 18–25 | 63.4 | 36.6 | Pr = 0.000 |
| 26–30 | 57.2 | 42.8 | Cramér's $V = 0.1138$ |
| 31–35 | 53.1 | 47.0 | |
| 36–40 | 48.7 | 51.3 | |
| 41–45 | 58.9 | 41.1 | |
| 46–50 | 65.1 | 34.9 | |
| 51–55 | 61.0 | 39.0 | |
| 56–60 | 57.5 | 42.6 | |
| 61–65 | 66.0 | 34.0 | |
| More than 65 years | 67.6 | 32.4 | |
| Marital status (%) | | | Pearson $\chi^2$ (1) = 81.5710 |
| Unmarried | 45.9 | 54.2 | Pr = 0.000 |
| Married | 64.0 | 36.0 | Cramér's $V = -0.1628$ |
| Duration of residency (%) | | | Pearson $\chi^2$ (3) = 1.9e+03 |
| Up to five years | 5.7 | 94.3 | Pr = 0.000 |
| Ten years | 31.7 | 68.3 | Cramér's $V = 0.7846$ |
| Fifteen years | 88.9 | 11.1 | |
| Twenty years | 0.0 | 100.0 | |

Note: Rows sum up to 100%.

Table 2. Distribution of perceived underlying causes of climate change by participant characteristics ($n = 3{,}076$).

| | Deforestation | Overpopulation (births and immigration) | Greenhouse gas emissions | Illegal resource extraction | God's will and transgressing cultural norms | Measures of association |
|---|---|---|---|---|---|---|
| Urbanicity wealth (%) | | | | | | Pearson $\chi^2$ (12) = 283.5274 |
| Rural poor | 33.8 | 12.3 | 11.7 | 16.2 | 25.9 | Pr = 0.000 |
| Rural non-poor | 18.7 | 3.9 | 15.9 | 27.2 | 34.3 | Cramér's $V = 0.1753$ |
| Urban poor | 28.0 | 27.8 | 10.4 | 7.7 | 26.1 | |
| Urban non-poor | 20.5 | 32.6 | 14.0 | 11.5 | 21.4 | |
| Self-rated health (%) | | | | | | Pearson $\chi^2$ (16) = 450.3480 |
| Poor | 25.1 | 2.7 | 30.0 | 6.4 | 35.8 | Pr = 0.000 |
| Fair | 18.2 | 14.1 | 7.3 | 23.4 | 37.0 | Cramér's $V = 0.1913$ |
| Good | 36.3 | 25.0 | 7.5 | 13.3 | 17.8 | |
| Very good | 26.7 | 12.0 | 22.9 | 8.4 | 30.0 | |
| Excellent | 30.3 | 29.0 | 14.5 | 7.9 | 18.4 | |
| Religion (%) | | | | | | Pearson $\chi^2$ (8) = 679.2261 |
| Christian | 32.5 | 43.5 | 15.7 | 4.9 | 3.4 | Pr = 0.000 |
| Muslim | 32.1 | 23.6 | 6.6 | 7.5 | 30.2 | Cramér's $V = 0.3323$ |
| Buddhist | 24.0 | 3.8 | 16.6 | 25.1 | 30.5 | |
| Education (%) | | | | | | Pearson $\chi^2$ (12) = 248.2729 |
| No Education | 21.9 | 10.8 | 6.6 | 12.3 | 48.4 | Pr = 0.000 |
| Primary | 31.7 | 16.3 | 9.6 | 14.2 | 28.1 | Cramér's $V = 0.1640$ |
| Secondary | 28.3 | 23.6 | 16.9 | 16.0 | 15.3 | |
| Tertiary | 26.8 | 24.7 | 19.3 | 15.3 | 14.1 | |
| Country (%) | | | | | | Pearson $\chi^2$ (4) = 1.1e+03 |
| Cambodia | 21.6 | 3.2 | 14.0 | 19.9 | 41.3 | Pr = 0.000 |
| Tanzania | 39.2 | 40.1 | 9.3 | 6.6 | 4.8 | Cramér's V = 0.6020 |

(*continued*)

Table 2. (*Continued*)

| | Deforestation | Overpopulation (births and immigration) | Greenhouse gas emissions | Illegal resource extraction | God's will and transgressing cultural norms | Measures of association |
|---|---|---|---|---|---|---|
| Gender (%) | | | | | | Pearson $\chi^2$ (4) = 54.6909 |
| Male | 30.8 | 20.7 | 13.1 | 16.4 | 19.0 | Pr = 0.000 |
| Female | 27.5 | 16.7 | 11.5 | 13.3 | 31.0 | Cramér's $V$ = 0.1333 |
| Age (%) | | | | | | Pearson $\chi^2$ (36) = 68.6133 |
| 18–25 | 34.3 | 13.8 | 11.6 | 12.7 | 27.6 | Pr = 0.001 |
| 26–30 | 25.9 | 22.7 | 11.8 | 16.0 | 23.5 | Cramér's $V$ = 0.0747 |
| 31–35 | 26.7 | 22.3 | 11.7 | 16.5 | 22.8 | |
| 36–40 | 29.9 | 24.0 | 10.7 | 12.7 | 22.7 | |
| 41–45 | 25.9 | 18.0 | 10.1 | 19.2 | 26.8 | |
| 46–50 | 32.2 | 14.8 | 12.4 | 17.2 | 23.5 | |
| 51–55 | 26.9 | 15.4 | 15.7 | 11.2 | 30.8 | |
| 56–60 | 30.9 | 17.1 | 11.6 | 13.5 | 26.9 | |
| 61–65 | 30.1 | 15.8 | 12.4 | 12.0 | 29.7 | |
| More than 65 years | 27.3 | 14.5 | 13.7 | 10.2 | 34.4 | |
| Marital status (%) | | | | | | Pearson $\chi^2$ (4) = 56.0103 |
| Unmarried | 30.7 | 25.7 | 11.7 | 11.0 | 20.9 | Pr = 0.000 |
| Married | 28.1 | 15.6 | 12.3 | 15.7 | 28.4 | Cramér's $V$ = 0.1349 |
| Duration of residency (%) | | | | | | Pearson $\chi^2$ (12) = 676.2056 |
| Up to five years | 32.8 | 43.2 | 12.7 | 6.7 | 4.7 | Pr = 0.000 |
| Ten years | 35.6 | 29.4 | 11.4 | 12.2 | 11.4 | Cramér's $V$ = 0.2707 |
| Fifteen years | 22.8 | 8.3 | 13.1 | 17.7 | 38.2 | |
| Twenty years | 45.6 | 30.3 | 7.9 | 9.3 | 6.9 | |

Note: Rows sum up to 100%.

or homoscedasticity. However, it has to meet the assumption of independence among the dependent variable choices. This assumption states that the choice of, or membership in, one category is not related to the choice or membership of another category (i.e., the dependent variable). In this study, the assumption of independence was tested with the Hausman-McFadden test (Hausman and McFadden 1984). Furthermore, multinomial logistic regression also assumes non-perfect separation. If the groups of the outcome variable are perfectly separated by the predictor(s), then unrealistic coefficients will be estimated and effect sizes will be greatly exaggerated (Armah *et al*. 2015c). The mathematical formulation of the relationship between the response categories and the predictors are given in the supplementary information file (online supplemental data).

## 3. Results

The results on the distribution of respondents by country, distribution of perception of underlying causes of anthropogenic climate change by participant characteristics, cross-country differences in significant predictors of perceived underlying causes of climate change, and the outputs of the multivariate multinomial logistic regression model are presented in this section.

Cramér's $V$ was used to determine the magnitude of effect sizes of the relationships between categorical variables. The demographics of the survey respondents in coastal communities in Cambodia differed from the demographics of respondents in Tanzania in the following ways: proportion in median age group (59% vs. 41%); more female (66% vs. 34%); higher monthly income (8%, meaning $500 or more, vs. 5%); less highly educated (48% university vs. 52%); less likely to be urban poor (38% vs. 62%); more likely to be in very good health (74% vs. 26%); and more likely to be coastal resident for 15 years or more (89% vs. 11%). Also, there were differences in the perception of the underlying causes of climate change across the two countries. The proportion of people in Cambodia who attributed climate change exclusively to deforestation, overpopulation, illegal resource extraction, greenhouse gas emissions, and God's will were 45%, 10%, 69%, 81%, and 92%, respectively. A different picture emerged in Tanzania where those who attributed climate change exclusively to deforestation, overpopulation, illegal resource extraction, greenhouse gas emissions, and God's will were 39%, 40%, 6%, 9%, and 3%, respectively. In Table 1, the effect size in decreasing order of magnitude is length of time living in the study area > religion > self-rated health > urbanicity wealth status > educational attainment.

There were significant between-group and within-group differences in perceived underlying causes of anthropogenic climate change, as shown in Table 2. This suggests that, even within the same sub-group, heterogeneities in risk perception exist. For example, the number of poor rural residents who indicated that deforestation was the major underlying cause of climate change was approximately three times more than members of the same group who noted that greenhouse gas emissions were the underlying cause of climate change. Similarly, cross group variations were discernible. For instance, poor rural residents were almost twice more likely to indicate that deforestation was the main underlying cause of climate change compared with their non-poor rural counterparts. Similar disproportionalities were observed for self-rated health, education, gender, age groups, and length of time living in the study area. The effect size in decreasing order of magnitude is country > religion > length of time living in the study area > self-rated health > urbanicity wealth status > educational attainment. Based on the above, we failed to reject the two null hypotheses (see above).

Table 3. Cross-country differences in perceived underlying causes of climate change ($n = 3{,}076$).

| Covariates compared with emission of greenhouse gases (RRR) | Cambodia | Tanzania |
|---|---|---|
| **Deforestation** | | |
| Urbanicity wealth status | Only urban poor was a significant predictor. | All categories were statistically significant. RRR < 1 in all cases. |
| Self-rated health status | All categories are significant predictors although to varying degrees of statistical significance and practical importance. Higher categories had higher RRRs except those who rated their health as very good. | None of the categories were significant. |
| Religion | This was not significant. This is understandable given that nearly all Cambodians sampled were Buddhists. | Only Muslims were significant predictors. RRR >1. |
| Education | Only secondary education was significant. RRR = 0.53. | None of the categories were significant. |
| **Overpopulation (births and immigration)** | | |
| Urbanicity wealth status | Urban residence irrespective of poverty status was significant. Both poor and non-poor groups had RRR greater than 3.0. | All categories were statistically significant. RRR < 1 in all cases. |
| Self-rated health status | All groups were significant except those who rated their health as very good. | None of the categories were significant. |
| Religion | Religion was not a significant predictor of underlying perceptions of climate change. | Only Muslims were significant predictors. RRR >1. |
| Education | Education was not a significant predictor of underlying perceptions of climate change. | None of the categories were significant. |

(*continued*)

Table 3. (*Continued*)

| Covariates compared with emission of greenhouse gases (RRR) | Cambodia | Tanzania |
|---|---|---|
| **Illegal resource extraction** | | |
| Urbanicity wealth status | Only urban non-poor was significant. | All categories were statistically significant although to varying degrees. RRR < 1 in all cases. |
| Self-rated health status | All groups were significant except those who rated their health as very good or excellent. | None of the categories were significant. |
| Religion | Not statistically significant. | Only Muslims were significant predictors. RRR > 1. |
| Education | Not statistically significant. | None of the categories were significant. |
| **God's will and transgressing cultural norms** | | |
| Urbanicity wealth status | Urban poor and urban non-poor were significant. RRR > 2 for both. | Urban poor and urban non-poor were significant unlike rural non-poor. RRR < 1 in all cases. |
| Self-rated health status | All categories were significant. Each with RRR > 1. | None of the categories were significant. |
| Religion | Not statistically significant. | Only Muslims were significant predictors. RRR >1. |
| Education | All categories were significant. Each category with RRR < 1. | None of the categories were significant. |

Several differences in the significant predictors of perception of the fundamental causes of climate change were observed between Cambodia and Tanzania (Table 3). In Cambodia, only urban poverty, secondary education attainment, and all categories of self-rated health were significant predictors of deforestation as the underlying cause of climate change, unlike in Tanzania where only Muslims and all urbanicity wealth groups were statistically significant. Urban poor and urban non-poor groups as well as all categories of self-rated health (except those with very good health) were significant predictors of overpopulation as the fundamental cause of anthropogenic climate change in Cambodia in contrast with Tanzania where all urbanicity wealth groups and Muslims were statistically significant. In Cambodia, those who rated their health as either fair or good and only the urban non-poor residents were significant predictors of illegal resource extraction as the underlying cause of climate change, whereas in Tanzania all urbanicity wealth groups and Muslims were statistically significant. For those who indicated that climate change is due to God's will and transgression of cultural norms, educational attainment, regardless of the level, was a significant predictor in Cambodia, unlike in Tanzania.

Results of the multivariate multinomial logistic regression of perceived underlying causes of anthropogenic climate change are shown in Table 4 (pooled analysis). The model converged in five iterations. The likelihood ratio (chi-square of 1,933.5 with a $p$-value $< 0.0001$) indicates that the model as a whole fits significantly better than the null or intercept only model.

Urbanicity wealth status (only rural non-poor), all categories of self-rated health, religion, and residence in Tanzania were statistically significant for respondents who perceived underlying causes of climate change to be deforestation compared with greenhouse gas emissions. The relative risk ratio of switching from the rural poor category to the rural non-poor category is 0.58 for being in the deforestation vs. greenhouse emissions group (Table 4). The expected risk of reporting deforestation as the underlying cause of climate is lower for respondents who are rural non-poor compared with their counterparts who are rural poor. The relative risk ratio of switching from poor self-rated health to fair self-rated health is 3.48 for being in the deforestation vs. greenhouse emissions group. The expected risk of staying in the greenhouse gas emissions group is higher for respondents who rated their health as fair compared to their counterparts who rated their health as poor. Similar orders of relative risk ratios were observed for good self-rated (5.54), very good self-rated (1.98), and excellent self-rated health (4.17), indicating that in each case, the expected risk of staying in the greenhouse gas emissions group is higher for respondents who rated their health as good, very good, or excellent compared to their counterparts who rated their health as poor. The relative risk ratio of switching from the Christian category to the Muslim category is 2.20 for being in the deforestation vs. greenhouse emissions group. The expected risk of reporting deforestation as the underlying cause of climate change is higher for respondents who are Muslim compared with their counterparts who are Christian. Also, the relative risk ratio of switching from the Christian category to the Buddhist category is 1.91 for being in the deforestation vs. greenhouse gas emissions group. Therefore, the expected risk of reporting deforestation as the underlying cause of climate change is higher for respondents who are Buddhists compared with their counterparts who are Christian.

The relative risk ratio of switching from no education to secondary education is 0.37 for being in the deforestation vs. greenhouse gas emissions group. That is, the expected risk of staying in the deforestation group is lower for respondents with secondary education compared to their uneducated counterparts. Analogous results were observed

Table 4. Multivariate multinomial regression showing perceived underlying causes of climate change in Cambodia and Tanzania.

| Underlying causes of climate change | RRR | Std. Err. | $P > z$ | [95% confidence | Interval] |
|---|---|---|---|---|---|
| **Deforestation** | | | | | |
| Urbanicity wealth (ref: rural poor) | | | | | |
| Rural non-poor | 0.58 | 0.12 | **0.010** | 0.385 | 0.877 |
| Urban poor | 0.82 | 0.14 | 0.233 | 0.586 | 1.139 |
| Urban non-poor | 0.63 | 0.16 | 0.066 | 0.385 | 1.031 |
| Self-rated health (ref: poor) | | | | | |
| Fair | 3.48 | 0.90 | **0.000** | 2.090 | 5.790 |
| Good | 5.54 | 1.38 | **0.000** | 3.399 | 9.029 |
| Very good | 1.98 | 0.48 | **0.005** | 1.226 | 3.196 |
| Excellent | 4.17 | 1.83 | **0.001** | 1.758 | 9.878 |
| Religion (ref: Christianity) | | | | | |
| Muslim | 2.20 | 0.51 | **0.001** | 1.398 | 3.452 |
| Buddhist | 1.91 | 0.61 | **0.041** | 1.027 | 3.562 |
| Education (ref: No formal education) | | | | | |
| Primary | 0.80 | 0.19 | 0.353 | 0.503 | 1.278 |
| Secondary | 0.37 | 0.10 | **0.000** | 0.226 | 0.621 |
| Tertiary | 0.40 | 0.11 | **0.001** | 0.227 | 0.691 |
| Country (ref: Cambodia) | | | | | |
| Tanzania | 2.70 | 0.69 | **0.000** | 1.635 | 4.446 |
| Constant | 0.55 | 0.22 | 0.141 | 0.248 | 1.219 |
| **Overpopulation (births and immigration)** | | | | | |
| Urbanicity wealth (ref: rural poor) | | | | | |
| Rural non-poor | 0.77 | 0.27 | 0.446 | 0.388 | 1.518 |
| Urban poor | 1.76 | 0.34 | **0.003** | 1.208 | 2.555 |
| Urban non-poor | 2.37 | 0.66 | **0.002** | 1.370 | 4.092 |
| Self-rated health (ref: poor) | | | | | |
| Fair | 21.68 | 11.36 | **0.000** | 7.758 | 60.564 |
| Good | 15.16 | 7.79 | **0.000** | 5.537 | 41.507 |
| Very good | 5.36 | 2.81 | **0.001** | 1.915 | 14.986 |
| Excellent | 13.16 | 8.48 | **0.000** | 3.727 | 46.496 |
| Religion (ref: Christianity) | | | | | |
| Muslim | 2.06 | 0.47 | **0.002** | 1.314 | 3.236 |
| Buddhist | 3.46 | 1.63 | **0.008** | 1.377 | 8.688 |
| Education (ref: no formal education) | | | | | |
| Primary | 0.68 | 0.19 | 0.169 | 0.391 | 1.179 |
| Secondary | 0.37 | 0.11 | **0.001** | 0.203 | 0.665 |
| Tertiary | 0.28 | 0.10 | **0.000** | 0.143 | 0.557 |
| Country (ref: Cambodia) | | | | | |
| Tanzania | 28.71 | 11.82 | **0.000** | 12.811 | 64.332 |
| Constant | 0.01 | 0.01 | **0.000** | 0.003 | 0.047 |

(*continued*)

Table 4. (*Continued*)

| Underlying causes of climate change | RRR | Std. Err. | $P > z$ | [95% confidence | Interval] |
|---|---|---|---|---|---|
| **Greenhouse gas emissions** | **(base outcome)** | | | | |
| **Illegal resource extraction** | | | | | |
| Urbanicity wealth (ref: rural poor) | | | | | |
| Rural non-poor | 1.10 | 0.23 | 0.655 | 0.730 | 1.650 |
| Urban poor | 0.73 | 0.15 | 0.127 | 0.491 | 1.093 |
| Urban non-poor | 1.33 | 0.37 | 0.314 | 0.766 | 2.294 |
| Self-rated health (ref: poor) | | | | | |
| Fair | 18.16 | 6.49 | **0.000** | 9.012 | 36.586 |
| Good | 14.95 | 5.37 | **0.000** | 7.396 | 30.212 |
| Very good | 2.45 | 0.90 | **0.015** | 1.192 | 5.032 |
| Excellent | 5.48 | 3.41 | **0.006** | 1.621 | 18.541 |
| Religion (ref: Christianity) | | | | | |
| Muslim | 3.08 | 1.02 | **0.001** | 1.610 | 5.885 |
| Buddhist | 6.23 | 2.59 | **0.000** | 2.754 | 14.074 |
| Education (ref: no formal education) | | | | | |
| Primary | 0.75 | 0.20 | 0.275 | 0.451 | 1.254 |
| Secondary | 0.46 | 0.13 | **0.006** | 0.265 | 0.804 |
| Tertiary | 0.44 | 0.13 | **0.007** | 0.237 | 0.798 |
| Country (ref: Cambodia) | | | | | |
| Tanzania | 1.20 | 0.37 | 0.549 | 0.658 | 2.201 |
| Constant | 0.05 | 0.03 | **0.000** | 0.018 | 0.160 |
| **God's will and transgressing cultural norms** | | | | | |
| Urbanicity wealth (ref: rural poor) | | | | | |
| Rural non-poor | 0.94 | 0.19 | 0.757 | 0.637 | 1.387 |
| Urban poor | 1.35 | 0.24 | 0.086 | 0.958 | 1.910 |
| Urban non-poor | 1.28 | 0.34 | 0.354 | 0.762 | 2.135 |
| Self-rated health (ref: poor) | | | | | |
| Fair | 5.77 | 1.45 | **0.000** | 3.528 | 9.442 |
| Good | 5.02 | 1.26 | **0.000** | 3.064 | 8.210 |
| Very good | 2.02 | 0.49 | **0.004** | 1.255 | 3.235 |
| Excellent | 4.28 | 2.14 | **0.004** | 1.610 | 11.382 |
| Religion (ref: Christianity) | | | | | |
| Muslim | 3.36 | 1.22 | **0.001** | 1.648 | 6.837 |
| Buddhist | 1.04 | 0.43 | 0.926 | 0.464 | 2.325 |
| Education (ref: no formal education) | | | | | |
| Primary | 0.44 | 0.10 | **0.000** | 0.281 | 0.685 |
| Secondary | 0.16 | 0.04 | **0.000** | 0.097 | 0.265 |
| Tertiary | 0.14 | 0.04 | **0.000** | 0.081 | 0.250 |
| Country (ref: Cambodia) | | | | | |
| Tanzania | 0.12 | 0.03 | **0.000** | 0.067 | 0.198 |
| Constant | 1.63 | 0.77 | 0.305 | 0.641 | 4.136 |

Note: Bold font represents relationships that are statistically significant.

for those who had attained tertiary education. In other words, people who had tertiary education were less likely to consider deforestation as the underlying cause of anthropogenic climate change rather than attributing it to greenhouse gas emissions. On the whole, residents in Tanzania were more likely to suggest deforestation as the underlying cause of anthropogenic climate change instead of greenhouse gas emissions compared with their Cambodian counterparts.

Urban residence irrespective of poverty status, all classes of self-rated health, religion, and residence in Tanzania were statistically significant for respondents who perceived underlying causes of climate change to be overpopulation rather than greenhouse gas emissions. The relative risk ratio of switching from the rural poor category to the urban poor category is 1.76 for being in the overpopulation vs. greenhouse gas emissions group (Table 4). The expected risk of reporting overpopulation as the underlying cause of climate change is higher for respondents who are urban poor compared with their counterparts who are rural poor. Similarly, the relative risk ratio of switching from the rural poor category to the urban non-poor category is 2.37 for being in the overpopulation vs. greenhouse gas emissions group. Therefore, the expected risk of reporting overpopulation as the underlying cause of climate change is higher for respondents who are urban non-poor compared with their counterparts who are rural poor. Higher categories of self-rated health were associated with higher relative risk ratios. The expected risk of staying in the greenhouse gas emissions group is therefore higher for respondents who rated their health as good, very good, or excellent compared with their counterparts who rated their health as poor.

The relative risk ratio of switching from the Christian category to the Muslim category is 2.06 for being in the overpopulation vs. greenhouse gas emissions group. The expected risk of reporting overpopulation as the underlying cause of climate change is higher for respondents who are Muslim compared with their counterparts who are Christian. Also, the relative risk ratio of switching from the Christian category to the Buddhist category is 3.46 for being in the overpopulation vs. greenhouse gas emissions group. Hence, the expected risk of reporting overpopulation as the underlying cause of climate change is higher for respondents who are Buddhists compared with their counterparts who are Christian. The relative risk ratio of switching from no education to tertiary education is 0.40 for being in the overpopulation vs. greenhouse gas emissions group. Respondents who had tertiary education were less likely to assign overpopulation as the underlying cause of anthropogenic climate change rather than attributing it to greenhouse gas emissions. On the whole, residents in Tanzania were far more likely to indicate overpopulation as the underlying cause of anthropogenic climate change rather than greenhouse gas emissions compared with their Cambodian counterparts.

Interestingly, for respondents who attributed the main underlying causes of climate change exclusively to illegal resource extraction, urbanicity wealth status was not a significant predictor. Apart from this, results on self-rated health, religion, and country of residence were analogous to the results obtained for those who considered overpopulation as the underlying cause of anthropogenic climate change instead of greenhouse gas emissions.

All categories of self-rated health, religion, and residence in Tanzania were statistically significant for respondents who perceived underlying causes of climate change to be God's will rather than greenhouse gas emissions. For a second time, urbanicity wealth status not a significant predictor of perceived anthropogenic climate change. Also, Muslim was a significant predictor of perceived climate change in the God's will sub-group, unlike Buddhism. The relative risk ratio of switching from poor

self-rated health to fair self-rated health is 5.77 for being in the God's will and transgressing cultural norms vs. greenhouse emissions group. The expected risk of staying in the greenhouse gas emissions group is higher for respondents who rated their health as fair compared with their counterparts who rated their health as poor. Similar orders of relative risk ratios were observed for good self-rated health (5.02), very good self-rated health (2.02), and excellent self-rated health (4.28), indicating that in each case, the expected risk of staying in the greenhouse gas emissions group is higher for respondents who rated their health as good, very good, or excellent compared with their counterparts who rated their health as poor. All categories of educational attainment were significant predictors of perceived climate change for those who indicated that anthropogenic climate change was entirely due to God's will and transgressing cultural norms. The relative risk ratio of switching from no education to primary education is 0.44 for being in the God's will and transgressing cultural norms vs. greenhouse gas emissions group. The relative risk ratio of switching from no education to secondary education is 0.16 for being in the God's will and transgressing cultural norms vs. greenhouse gas emissions group. That is, the expected risk of staying in the God's will group is lower for respondents with secondary education compared to their uneducated counterparts. Analogous results were observed for those who had attained tertiary education. Therefore, people who had tertiary education were less likely to consider God's will and transgressing cultural norms as the underlying cause of anthropogenic climate change rather than attributing it to greenhouse gas emissions. It is only in the God's will and transgressing cultural norms sub-group that the order of magnitude of the relative risk ratio for educational attainment was reversed. Residents in Tanzania were less likely to suggest God's will and transgressing cultural norms as the underlying cause of anthropogenic climate change rather than greenhouse gas emissions compared with their Cambodian counterparts.

## 4. Discussion

Research on climate change especially cross-country differences in risk perceptions is nascent (see Lee *et al.* 2015). In this context, much of the scholarly work on perception of the underlying causes of climate change has been restricted to developed regions such as Australia, Europe, and the United States (Brulle, Carmichael, and Jenkins 2012; Lee *et al*. 2015; Lorenzoni and Pidgeon 2006). There is very little information on the phenomenon in developing countries. One of the most critical determinants of climate change adaptation and behaviour is belief in the underlying or primary cause of anthropogenic climate change (O'Connor, Bord, and Fisher 1999; Wolf and Moser 2011). The usual suspect has always been greenhouse gas emissions particularly carbon dioxide. In this study, we elucidate people's perception about the fundamental causes of anthropogenic climate change. We also examined the contribution of cross-country differences in the distribution of contextual and demographic characteristics in accounting for cross-country differences in the distribution of underlying causes of anthropogenic climate change. The factors we considered include urbanicity (rural-urban residence), wealth status, self-rated health, religion, educational attainment, age, gender, marital status, and duration of residency. In addition to investigating the overall effect of all these factors we also investigate the contribution of each of these factors separately. This analysis allowed us to isolate the importance of different factors in explaining cross-country differences in individuals risk perception and their implications in explaining differences in urbanicity wealth inequality.

In the pooled sample, God's will and transgressing cultural norms was only second to deforestation in terms of the distribution of the fundamental causes of anthropogenic climate change. This distribution was more than twice the number of people alluded to greenhouse gas emissions as the main cause of climate change, indicating that only few respondents believed that greenhouse gas emissions were the fundamental cause of anthropogenic climate change contrary to scientific evidence. This finding is significant, given that according to Lee *et al*. (2015), understanding the anthropogenic cause of climate change is the strongest predictor of climate change risk perceptions. Besides, disbelief in the fundamental cause of climate change mediates human responses to climate change impacts, which eventually limit the capacities of individuals and communities to initiate adaptation measures or actions (see Hobson and Niemeyer 2013; Norgaard 2011).

We found significant differences in attribution of the causes of climate change across the two countries. For instance, in Cambodia, the order of magnitude of attribution was God's will and transgressing cultural norms > deforestation > illegal resource extraction > greenhouse gas emissions > overpopulation-births and immigration. The trend is markedly different in Tanzania where the order was overpopulation-births and immigration > deforestation > greenhouse gas emissions > illegal resource extraction > God's will and transgressing cultural norms. These findings are consistent with new comparable data that suggest that the distribution of perception of underlying causes of anthropogenic climate change vary substantially across countries (see Lee *et al.* 2015).

Previous research has focused on the independent effects of urbanicity and wealth on climate change risk perception. In this study, we moved beyond to assess the joint influence of the two factors. Several interesting findings emerged, especially in the sub-group analyses. In Tanzania, all categories of urbanicity wealth (rural non-poor, urban poor, urban non-poor) were important determinants of the underlying cause of anthropogenic climate change, irrespective of whether the individual attributed climate change exclusively to deforestation, overpopulation, or illegal resource extraction. This is in sharp contrast to Cambodia where only urban residence, regardless of wealth status, was a robust determinant of the underlying cause of anthropogenic climate change. On the whole, this finding suggests within-country, cross-country, intra-urban, and rural-urban heterogeneities in climate change risk perception. It also reflects wealth-specific disparities in climate risk perception. This warrants the need to better understand the nexus between climate change, risk perception, and the urban poor. Emerging literature has recognized the disproportional impacts of climate change on urban areas in low-income countries (see Armah *et al*. 2015b; Lankao and Qin 2011; Leichenko 2011; Winsemius *et al*. 2015). Within an urban centre, the urban poor contribute very little to climate change compared to high-income groups. Unfortunately, the urban poor also bear most of the impacts of climate change and lack the capacity to cope with them.

The sub-group analyses also provide a nuanced account of the most important predictors of the underlying causes of anthropogenic climate change. For instance, the effect size of religion was second only to country in the measure of association between perceived underlying causes of climate change and participant characteristics. Yet, at the multivariate level, religion was not a significant predictor of perceived underlying causes of climate change in Cambodia, unlike in Tanzania. This is due, in part, to the homogeneity of religion (almost all respondents were Buddhists) in the Cambodian sample. Previous research on the moral and ethical values underpinning climate change identified religion as a core determinant of perceived anthropogenic climate change (Bergmann and Gerten 2010; O'Brien and Wolf 2010; Wardekker, Petersen, and Van Der Sluijs 2009).

Interestingly, self-rated health was not a determinant of the underlying cause of anthropogenic climate change in Tanzania, although in Cambodia, to varying degrees, all levels of perceived health (fair, good, very good, excellent) matter. Analogous trends were observed for levels of education. Educational attainment was not a significant predictor of the underlying cause of anthropogenic climate change in Tanzania whereas in Cambodia, to some extent, all levels of education (primary, secondary, tertiary) were significant. On the whole, highly educated individuals were significantly more likely to attribute anthropogenic climate change to greenhouse gas emissions rather than deforestation, overpopulation, or God's will and transgressing cultural norms. Copious attention is being devoted to the role of education in shaping climate risk perception (see Crona *et al*. 2013; Muttarak and Lutz 2014; Stevenson *et al*. 2014). In this context, it has been suggested that the level of educational attainment is the single strongest determinant of a person's awareness of climate change although sharp cross-country differences exist (Lee *et al.* 2015).

Given that highly educated participants were more likely to attribute climate change to greenhouse gas emissions than other causes, there is a need for mainstreaming climate change into educational curricula in both countries. Such education programs should aim to modify public perceptions (especially for less educated respondents) to be more consistent with current scientific findings. Previous studies indicate that knowledge may not necessarily contribute to higher risk perception of climate change in certain geographical settings (see Guy *et al.* 2014; Kahan *et al.* 2012) whereas other studies indicate otherwise (see Van der Linden 2016). The inconsistent findings on the link between educational attainment and climate risk perception suggest that the relationship is complex and varies across geographical contexts. A recent study involving 119 countries (see Lee *et al.* 2015) identified education as the strongest determinant of people's awareness of climate change. The core message from that extensive study was that education and beliefs about the cause of climate change were the strongest predictors of both awareness and risk perception across the world. This finding is significant given that previous studies found that local weather changes have a significant effect on risk perceptions.

In Tanzania, four out of ten people believed that anthropogenic climate change was due to over population, whereas only three out of 100 Cambodians believed the same. On the other hand, four out of 10 Cambodians believed that climate change was God's will, while less than 5% of Tanzanians agreed to this. This finding, which suggests that climate change risk perception is unevenly distributed is consistent with the findings of Lee *et al.* (2015). Several reasons may account for these differences in attribution of the underlying cause of climate change particularly values, social norms and culture (Lee *et al*. 2015; Van der Linden 2016).

The observed heterogeneities in the significant determinants of climate change risk perceptions across the two countries in the present study indicate that each country has its own comparatively distinctive set of correlates. This implies that a one-size-fits-all institutional arrangement for influencing risk perception and by extension, shifting the behaviour of individuals and communities towards climate change adaptation will be ineffective. For such arrangements to work, it must be region and context-specific, be supported by appropriate policies, and apply approaches that bring together all the different actors in a coordinated manner (a multi-scale and multi-actor approach).

## 5. Conclusion

Climate change has now become much more than an environmental issue. The nature of people's perceptions about climate change appears to have evolved. Instead of a typically

global, almost abstract, issue of concern, it has become tangible, impacting not just the public discourse but also people's private lives. It is therefore of paramount importance to develop our knowledge of public perceptions of this emerging risk, by learning about its physical nature, its environmental and health consequences, and its implications in terms of policy and governance. This study elucidated personal perceptions and understanding of coastal populations in two developing countries in the Indian Ocean (Cambodia and Tanzania) regarding the fundamental cause of anthropogenic climate change. Except for religion and educational attainment, the influence of compositional factors such as age, gender and marital status of respondents diminished at the multivariate level. However, the influences of contextual factors such as urbanicity (rural-urban residence) and country of origin on public perceptions of the underlying cause of anthropogenic climate change were robust. It can be concluded that perceptions of anthropogenic climate change are therefore less dependent on socioeconomic criteria, such as age or occupation, than on place of residence and that region's exposure to climate risks. Only a few people in both countries believed that, the usual suspect, greenhouse gas emission was the fundamental cause of anthropogenic climate change, contrary to scientific evidence. Furthermore, there were significant between–group and within–group differences in the perceived underlying causes of anthropogenic climate change, indicating that even within the same sub-group, heterogeneities in risk perception exist. This is significant because scholarly work on climate risk perception has tended to emphasize between–group differences rather than within–group differences in the perceived fundamental causes of anthropogenic climate change.

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## Supplemental data

Supplemental data for this article can be accessed here.

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