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ORIGINAL ARTICLE

Effect of knowledge and perceptions of risks on Ebola-preventive behaviours in Ghana

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Background: Limited studies exist on the effects of knowledge and risk perceptions in Ebola-preventive behaviours in Ghana.

Methods: Using data collected from 800 respondents in 40 randomly selected communities in the Greater Accra Region of Ghana, this study employed hierarchical linear modelling to examine the effects of individual- and community-level factors on Ebola-preventive behaviours.

Results: The study found individual- and community-level factors are significantly associated with Ebola-preventive behaviours. Respondents with greater knowledge about Ebola were more likely to engage in Ebola-preventive behaviours. In addition, there were significant changes in risk perception from the time the disease had peaked in neighbouring countries to the time data were collected. Most importantly, respondents who perceived themselves to have a high risk of contracting Ebola at the time of the survey were significantly less likely to engage in Ebola-preventive behaviours. Compared with Christians, Muslims were significantly less likely to engage in Ebola-preventive behaviours. Findings from the multilevel analysis indicated significant differences across communities. Communities expressing worry about a potential Ebola outbreak were more likely to engage in Ebola-preventive behaviours.

Conclusion: The findings suggest the importance of adopting behaviour change interventions that address Ebola at both the individual and community level, especially in the event of a future outbreak in Ghana.

Keywords: Communities, ebola, Ghana, knowledge, psychosocial models, risk perceptions

Introduction

Epidemiological data released by the World Health Organization (WHO) indicate that more than 11 000 people died of Ebola virus disease (EVD) in the recent outbreak, with 28 646 confirmed or probable cases in some West African countries, including Guinea, Sierra Leone and Liberia.[1] Although all affected countries have been declared Ebola free, they have yet to recover from the social and economic effects of the disease. For one thing, economic activities shrank considerably in affected countries.[2] In addition, both severely affected countries and unaffected but high-risk countries have had to deal with costs related to increased mortality and morbidity resulting from a reluctance to seek treatment for other diseases, mainly due to a general lack of trust in the health system and the fear of exposure to EVD.[3]

Like some other countries in the subregion, Ghana has yet to record any confirmed cases, but because it is surrounded by countries hit hard by the pandemic, it can be considered a high-risk country. Ghana has been identified as one of the 23 at-risk countries that remain environmentally suitable for animal-to-human transmission of the virus.[4] As a result, Ghana has been on high alert since March 2014 when the first case of Ebola was reported in West Africa. As EVD raged through the subregion, questions were asked—and continue to be asked—about Ghana's preparedness and its ability to contain transmission of the virus in the event of an outbreak. Such questions are important, especially when movements across borders in West Africa are extremely fluid. The border laxity is compounded by a regional cooperation agreement between countries in West Africa that allows freedom of movement without border restrictions. Although attempts were made to tighten human movement and border controls in the wake of the outbreak, they were not very effective.[5] Possibly the highest risk is that the virus is new to the West African subregion. Many know little about it, but knowledge is necessary for behaviour change, health promotion and prevention of diseases.

Worse still, the lack of knowledge allows myths and misconceptions to thrive. For instance, at the outset of the epidemic in Liberia, some members of the clergy described EVD as a 'curse from God' that resulted from the pervasiveness of corruption and homosexuality in the country.[6] Such myths will clearly undermine valid attempts at prevention.

Few studies have examined the knowledge, attitudes and perceptions of EVD in West Africa, and those few are mostly descriptive, examining knowledge and risk perceptions without showing how these psychosocial factors influence Ebola-preventive behaviours.[7,8] They have focused on affected countries, including Nigeria, Liberia and Sierra Leone, without considering unaffected ones, such as Ghana,[2,3,8,9] and have limited their analysis to the individual level, not looking at community-level factors.[7,10] Notwithstanding their lacunae, these studies have interesting findings; in the main, their respondents lacked comprehensive knowledge about the spread of EVD, given that this was their first experience, had low risk perceptions and displayed very high levels of stigma towards those who had recovered from the disease.[9,10] While research on affected countries is important, the lack of focus and dearth of knowledge on unaffected but high-risk countries is problematic, as it undermines prevention of a disease that nearly devastated the West African subregion. Thus this article has two important objectives. First, it will examine the effects of knowledge, attitudes and perceptions on Ebola-preventive behaviours using data from Ghana, a high-risk but hitherto unaffected country. Second, it will explore the effects of contextual and community-level factors on Ebola-preventive behaviours.

Background and context

This study does not use a specific psychosocial model, but borrows aspects from psychosocial theories of disease prevention that acknowledge knowledge, perceptions and attitudes as crucial for behaviour change and disease prevention. Such theories, including the Information–Motivation–Behavioral Skills (IMB) model[11] and the Health Belief Model (HBM),[12] emphasize knowledge and perceptions of risks as significant to disease containment and prevention. As Bandura argues,[13] a lack of awareness of how diseases are spread could undermine preventive efforts and behaviours. Knowledge may affect disease prevention directly, in that those equipped with knowledge will practise the proper avoidance behaviours. It may also have an indirect effect, through risk perception. It is often argued that individuals equipped with knowledge about diseases make better assessments/evaluations of their risk of contracting those diseases.[14] Thus knowledge may be considered a form of self-empowerment, influencing one's risk perception and promoting the awareness required for behaviour change. Similarly, knowledge affects attitudes towards diseases. Zanna and Rempel[15] view attitudes as a variable that changes based on internal or external cues. Information and knowledge dissemination form part of these external cues, but such information may only change attitudes and behaviours in the right direction when it is factual, correct, consistent and congruent.

The assumptions underlying psychosocial models are often rooted in a biomedical understanding of diseases that considers individuals as rational actors who may act to protect themselves if they are highly knowledgeable and perceive themselves at risk of contracting a disease. However, as demonstrated in the recent West African experience of Ebola, there can be tensions between traditional/cultural norms and biomedical preventive measures. For instance, a major bone of contention was the handling of dead bodies infected or suspected to have been infected by the Ebola virus. To avoid transmission, the WHO recommended that individuals and communities use protective equipment, refrain from contacting dead bodies and ensure immediate burial by a trained team.[1] Despite their protective thrust, these recommendations required African communities to change the way they mourned the dead, including the performance of elaborate rituals and burial services and contact with the remains of the deceased.[16,17] Such cultural proscriptions are sometimes made more complex by accompanying religious doctrines. Among Muslims, for example, dead bodies are washed and carefully wrapped by immediate family members or an individual chosen by the deceased,[18] but these are high-risk behaviours in a biomedical understanding of Ebola.

A major critique of psychosocial models is their focus on cognitive predictors, with limited attention to contextual or community-level factors.[2] Recent research on Ebola has rarely measured the effects of neighbourhood- and community-level influences on Ebola-preventive behaviours. The focus may be about to change, however, as the WHO has adopted a community-based response to containment. This approach owes much to the nature and spread of EVD in the recent outbreak. More specifically, unlike earlier outbreaks, this one ravaged whole communities and neighbourhoods.[1,19] In addition, previous outbreaks were confined to rural areas, but this one hit major cities. In response, some authors are now recommending an integrated community-based approach to prevent future outbreaks, especially in high-risk areas.[19] As yet, such studies are in their infancy, prompting the present decision to examine community-level influences on preventive behaviours.

Materials and methods

Description of the study area, population and sample

This study employed survey methods, creating and drawing on a representative cross-sectional sample of about 800 persons 18–69 years of age, thus the study design is observational and cross-sectional in nature. Respondents were sampled in four randomly selected districts in one of the 10 administrative regions in Ghana, the Greater Accra Region (GAR). The GAR is one of the smallest regions, with a total land surface of 3245 sq km, about 1.4% of the total land area in Ghana.[20] The latest census figures indicate a population of more than 4 million people in the GAR, representing 16.3% of the total Ghanaian population. The region remains the most densely populated in Ghana (1235.8 persons/km_2), thus increasing the potential for Ebola spread in the event of any infection. The district capital of the GAR is Accra, which is also the capital of Ghana and the seat of government. The GAR was chosen for this research partly because it reflects the socio-economic and demographic diversity of the general Ghanaian population. For instance, although a Ga-dominated area, the region is urban and has a significant proportion of other major Ghanaian ethnic groups, including Akans, Ewes and the northern tribes. While Christians constitute the majority, Muslims and adherents of the traditional African religion are well represented. This makes the GAR a cosmopolitan urban

setting with diverse ethnic and religious communities. Similar to other urban areas in Ghana, households and communities in the GAR have a much lower average rate of poverty compared with those in rural areas. Meanwhile, urban poverty is relatively high in Accra.[20] The ethnic, religious and socio-economic diversity in the GAR provides important context, especially as we seek to examine the knowledge and perceptions of the risks of respondents in this urban setting.

As the district with the national capital, the GAR has enormous social infrastructure and can boast of important national edifices and tourist attractions, including the Kwame Nkrumah Mausoleum, Kotoka International Airport and the Dubois Memorial Center.[20] Also, the transportation network is well developed and includes a regional highway that links Accra to other countries in the West African subregion. These have made Accra and Ghana highly accessible to foreigners and have increased trade and other major economic activities with neighbouring countries. Thus the context as described could expose Accra and Ghana to the Ebola virus possibly through international travel and trade.

The GAR is administered by a local government system and is divided into 16 districts. Simple random sampling was used to select 4 of the 16 identified districts: the Adenta municipal district, the Ga West municipal district, the Ga South municipal district and the Ledzokuku-Krowor municipal district. Simple random sampling was then used to select 10 neighbourhoods/communities each within the four identified municipal districts, for a total of 40. Neighbourhoods/communities were defined as distinct population clusters with locally recognized status.[20] Communities/neighbourhoods were accessed from the most recent version of the Ghana Statistical Service's Gazetteer. Overall, about 800 communities /neighbourhoods were identified in four randomly selected districts. An average of 20 respondents were then randomly selected systematically from households and interviewed from each of the 10 selected communities/neighbourhoods in the four identified districts, for a total of 800 respondents.

Data collection and protocol

Data collection for this study began in June 2016 and ended in August 2016. Four research assistants (RAs) and data enumerators were trained at the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, to help with data collection. Each RA was assigned to a district. Several training sessions were held with RAs prior to data collection at ISSER. Questionnaires were written in English and RAs could speak English and other major Ghanaian languages (Akan, Ga, Ewe) fluently. All RAs had participated in several research projects in the past and had the experience, cultural and language skills required to communicate with respondents. Before data collection, questionnaires were pre-tested with an artificial sample constituting about 10% of the original sample. Questionnaires were modified based on pre-test results. Respondents used in the pre-testing phase were not included in the main study. The questionnaires were administered face to face by the RAs. While collecting data this way is time-consuming, it is appropriate in contexts where the population is not very literate, and it allows interviewers to cross-check inconsistent answers before data cleaning. Ethical clearance for this study was received from the Interdisciplinary Committee on Ethics in Human Research (ICEHR) at Memorial University of Newfoundland.

Measures

Two outcome variables capturing Ebola-preventive behaviours were used, given the focus of this study. The first asked respondents, 'Have you ever taken any action to avoid being infected by Ebola?' and the second asked, 'If a family member died of Ebola, would you accept other ways of funeral/burial that would not involve the touching or washing of the dead body?' Both outcome measures are dichotomous, with response categories coded as yes=1 and no=0.

Predictor variables were at both the individual and community levels. Individual-level variables included respondents' risk perceptions, knowledge of Ebola, myths surrounding Ebola transmission, concerns about an Ebola outbreak in Ghana and the sociodemographic characteristics of respondents. Regarding risk perceptions, respondents were asked, 'What in your opinion was your level of risk of contracting EVD in May 2014 when several cases were reported in neighbouring countries?' Following this, they were asked, 'What in your opinion is your risk of contracting EVD now?' Response categories for both predictors included 'no risk', 'low risk', 'medium risk' and 'high risk'. Further, respondents were asked to assess their concerns about an Ebola outbreak in Ghana with the question, 'Are you concerned that there will be a large outbreak of Ebola in the future, or are you not concerned about that?' Response categories included 'very concerned', 'somewhat concerned', 'not very concerned' and 'not concerned at all'.

'Knowledge about Ebola' was created from four items asking respondents if Ebola can be prevented by avoiding contact with blood and bodily fluids; regular washing of hands with soap and practising personal hygiene; avoiding eating bush meat such as bats, antelopes, etc., and avoiding funeral or burial rites that require handling the body of someone who has died from Ebola. Response categories were yes=1 and no=0. Principal component analysis (PCA) was used and the weighted factor scores extracted as a variable. Factor loadings for the latent variable 'knowledge about Ebola' ranged between 0.617 and 0.679. The reliability coefficient (Cronbach's α) was estimated as 0.507. Positive values on the scale indicate high knowledge about Ebola and negative values indicate low knowledge.

'Myths about Ebola transmission' was measured by variables asking if Ebola can be transmitted through air and water, mosquito bites or food and fruits. Response categories for all variables were yes=1 and no=0. All four variables were combined into a weighted composite index using PCA. Factor loadings for this index/scale ranged between 0.559 and 0.753, and the reliability coefficient (Cronbach's α) was estimated as 0.651. Sociodemographic variables included the educational background of respondents, ethnicity, religious denomination, marital status, gender and age of respondents.

Community-level data were generated by aggregating individual-level survey responses for the 40 different communities within the four sampled districts. The median scores of respondents living within similar social contexts were assigned for each selected community, using three community-level variables: 'communities' knowledge about Ebola', 'communities'

endorsement of myths' and 'communities' worry about a potential Ebola outbreak'. Indicators used to create the first two variables are given above. This time, however, the variables were aggregated and the median scores were assigned as community-level data. 'Communities' worry about potential Ebola outbreak' was measured by asking the following: 'In case of an Ebola outbreak in Ghana, how worried will you be about getting Ebola if you do the following: touch the bedding/clothing of a person suspected to have Ebola; eat with a person suspected to have Ebola; use the same utensils with a person suspected to have Ebola; share a bathroom with a person suspected to have Ebola?' All variables were measured on a 5-point Likert scale ranging from not worried at all=0 to very worried=5. PCA was used to create a weighted scale (Cronbach's α=0.862) and the scores were aggregated for the 40 communities.

Data analysis

Hierarchical linear modelling was used to examine the effects of both individual- and community-level predictors on both outcomes measuring Ebola preventive behaviours. Hierarchical linear modelling, also known as multilevel modelling, was appropriate for two reasons. First, it allowed the estimation of the magnitude and significance of clustering. This is important, as clustering may affect standard errors and bias parameter estimates.[21] Second, it allowed variance to be partitioned at both the individual and community levels and helped us assess its ability to explain the two outcomes. Four models were computed, two for each outcome variable. The effects of individual-level variables on the outcomes were examined in models 1 and 3. Community-level variables were added to models 2 and 4 (final models). In all models, intraclass correlation coefficients (ICCs) were estimated. Hierarchical linear modelling and non-linear modelling software were used for the analysis.

Results

Descriptive findings in Table 1 show that the majority of respondents indicated they had taken action to avoid Ebola (77.8%). Similarly, the majority indicated they would accept other ways of funeral/burial that would not involve washing or touching if a family member died of Ebola (82.5%). When asked to provide a retrospective account of their risk perceptions during the Ebola outbreak, about 42% indicated they were at high risk of contracting the disease, while 33% perceived themselves to have had no risk. However, when asked about their current risk perceptions, the majority (62%) indicated they had no risk of contracting Ebola, while a much smaller portion (about 9%) self-identified as being at high risk. Even with this change in risk perceptions, the majority still said they were concerned about a large outbreak of Ebola in the future. Although knowledge about Ebola prevention was high, myths surrounding transmission of the virus were equally prevalent.

Bivariate results in Table 2 show the gross effects of individual- and community-level variables on the outcome measures. As the table shows, knowledge about Ebola prevention was significantly associated with Ebola-preventive behaviours. Respondents with high knowledge levels were more likely to have taken actions to

Table 1. Percent distribution and median scores for selected dependent and independent variables (N=800)

Variables	%	Median
Have you ever taken any action to avoid Ebola?		
No	22.2	—
Yes	77.8	—
Funerals that involve touching dead body		
No	17.5	—
Yes	82.5	—
Individual-level variables		
Risk perception in the wake of Ebola outbreak		
No risk	33.1	—
Low risk	9.9	—
Medium risk	15.3	—
High risk	41.8	—
Risk perception now (at the time of the survey)		
No risk	62.1	—
Low risk	22.9	—
Medium risk	6.5	—
High risk	8.5	—
Knowledge about Ebola prevention	—	0.574
Myths related to transmission	—	0.034
Concern about Ebola outbreak in Ghana		
Very concerned	61.5	—
Somewhat concerned	13.0	—
Not very concerned	11.6	—
Not at all concerned	13.9	—
Educational background		
No education	3.9	—
Primary education	6.4	—
Junior high school	22.4	—
Senior high school	35.9	—
Tertiary education	31.5	—
Ethnicity		
Akan	49.6	—
Ga/Adangbe	25.6	—
Ewe	18.8	—
Northern ethnic groups	6.0	—
Religious denomination		
Christian	92.8	—
Muslim	5.8	—
Traditionalist	1.5	—
Marital status		
Married	39.4	—
Never married/single	54.6	—
Divorced/separated/widowed	6.0	—
Gender		
Male	42.3	—
Female	57.7	—
Age of respondents	—	31.2
Community-level variables		
Community myths related to transmission	—	0.017
Communities' worry related to sharing	—	0.386
Communities' knowledge about prevention	—	0.574

Table 2. Multilevel bivariate logit models of Ebola prevention in Ghana, 2016

Individual-level variables (level 1)	Action to avoid Ebola	Funerals
Risk perception in the wake of Ebola outbreak	Exp(b)	Exp(b)
No risk	1.00	1.00
Low risk	0.912 (0.343)	0.701 (0.329)
Medium risk	1.52 (0.322)	1.14 (0.315)
High risk	1.33 (0.244)	1.14 (0.236)
Risk perception now (at the time of the survey)		
No risk	1.00	1.00
Low risk	0.972 (0.237)	0.763 (0.229)
Medium risk	1.13 (0.333)	0.475 (0.226)***
High risk	1.80 (0.399)	0.505 (0.416)
Knowledge about Ebola prevention	1.46 (0.081)***	1.40 (0.074)***
Myths related to transmission	1.21 (0.103)	1.32 (0.105)***
Concern about Ebola outbreak in Ghana		
Very concerned	1.00	1.00
Somewhat concerned	0.689 (0.276)	0.858 (0.347)
Not very concerned	0.479 (0.282)***	0.660 (0.385)
Not at all concerned	0.769 (0.281)	1.13 (0.334)
Educational background		
No education	1.00	1.00
Primary education	1.77 (0.534)	1.42 (0.679)
Junior high school	1.98 (0.485)	1.47 (0.535)
Senior high school	1.56 (0.455)	1.27 (0.536)
Tertiary education	2.40 (0.459)**	1.33 (0.543)
Ethnicity		
Akan	1.00	1.00
Ga/Adangbe	0.929 (0.208)	1.06 (0.234)
Ewe	0.718 (0.303)	1.23 (0.319)
Northern ethnic groups	0.940 (0.330)	2.07 (0.457)
Religious denomination		
Christian	1.00	1.00
Muslim	0.652 (0.278)	0.623 (0.393)
Traditionalist	0.798 (0.824)	1.67 (0.872)
Marital status		
Married	1.00	1.00
Never married/single	0.680 (0.222)	0.834 (0.193)
Divorced/separated/widowed	0.627 (0.308)	0.533 (0.326)**
Gender		
Male	1.00	1.00
Female	0.953 (0.206)	1.46 (0.199)*
Age of respondents	0.998 (0.001)	0.997 (0.001)
Community-level variables (level 2)		
Community myths related to transmission	1.23 (0.204)	2.54 (0.301)***
Communities' worry related to sharing	2.54 (0.374)***	3.37 (0.468)***
Communities' knowledge about prevention	0.717 (0.402)	2.95 (0.597)*

*p<0.1; **p<0.05; ***p<0.01. Robust standard errors in parentheses.

avoid Ebola. Similarly, those with high knowledge were significantly more likely to say they would accept other ways of burying a family member who died of Ebola that involved not touching or washing the body. It was surprising to find those endorsing Ebola myths were rather more likely to say they would accept alternative burial strategies. Compared with those who felt no sense of risk, respondents who saw themselves as having a high risk of contracting Ebola at the time of the survey were more likely to accept alternative burial strategies. However, those who perceived a medium level of risk were less likely to accept

alternative strategies. Compared with respondents who were very concerned about an Ebola outbreak in Ghana, those who were not so concerned were less likely to have taken actions to avoid Ebola. Finally, sociodemographic variables, including education and marital status, were significant predictors of Ebola preventive behaviours, while some community-level variables were statistically associated with them.

Multivariate analyses are shown in Table 3. Consistent with the bivariate results, knowledge and risk perceptions were significant predictors of Ebola preventive behaviours. Respondents with high knowledge about Ebola were significantly more likely to have taken actions to avoid infection. They were also more likely to accept alternative burial strategies. Respondents' risk perception was significantly associated with Ebola preventive behaviours, but the effect was different over time. For instance, compared with those who identified as having no risk, respondents with perceptions of high risk during the Ebola outbreak were more likely to accept alternative burial arrangements, but only marginally so. In contrast, those who saw themselves at high risk at the time of the survey were rather less likely to accept alternative burial methods.

Consistent with the bivariate findings, the multivariate results showed that compared with respondents concerned about an outbreak, those not concerned were less likely to have taken any actions to avoid Ebola. Compared with those with no education, respondents with higher education were more likely to say they took actions to avoid Ebola. However, the never married were less likely to have done so than the married. Compared with Christians, Muslims were less likely to accept burial arrangements that would not involve touching or washing dead bodies. It should be noted, however, that respondents who belonged to the northern tribes were significantly more likely to accept burial arrangements with less risk.

The variance components for both outcomes indicated significant differences across communities. There were significant reductions in the variance for outcome measures as community-level variables were added to the models predicting both outcomes. Communities who expressed worry about a potential Ebola outbreak through sharing were significantly more likely to engage in Ebola-preventive behaviours.

Discussion

It has been 2 years since the world, specifically West Africa, was confronted by EVD. With virtually no new cases and all affected countries now declared Ebola free, the WHO has accepted that Ebola no longer represents a major public health threat. Thus the discourse has changed from dealing with Ebola as a health emergency to preventing future outbreaks, including other emerging infectious diseases. This has meant investing in behaviour change programmes, especially in areas where the social and cultural contexts create ideal conditions for spread of the virus.[22] It is against this backdrop that studies examining knowledge and risk perceptions have become relevant. Although a few studies have examined knowledge, attitudes and risk perceptions in both affected[7,9] and unaffected countries, none has explored how psychosocial factors may influence Ebola-preventive behaviours. This study is one of the few to investigate these links and, as such, it makes an important contribution to the literature.

The results are largely consistent with psychosocial models of health behaviours that identify knowledge about diseases as rudimentary and necessary for disease prevention and health promotion. The finding that knowledge influences Ebola-preventive behaviours corroborates both previous and emerging studies.[23] Risk perception is often considered an important predictor of behaviour change. Sociocognitive and behaviour change models such as the HBM and IMB assume that with increased susceptibility to disease, individuals will engage in preventive behaviors.[11,12] The findings demonstrate that a large proportion of Ghanaians in this sample perceived themselves as susceptible to Ebola during the outbreak, but these perceptions changed over time, with the majority indicating they were not at risk at the time of data collection. The change in perceptions may be the result of a decrease in the incidence of Ebola cases and the concomitant drop in media attention. Importantly, respondents who thought they were at risk in the midst of the outbreak were significantly more likely to engage in Ebola-protective behaviours, such as accepting burial arrangements that would not involve touching or washing the bodies of Ebola-infected persons. However, those who considered themselves at high risk of the disease at the time of the survey were significantly less likely to adopt such Ebola-protective behaviours. It is clear from the findings that respondents interpreted their risk based on the prevalence and incidence of Ebola cases in neighbouring countries and their sense of the possibility of an outbreak in Ghana. As the cases diminished, their risk perceptions changed. Obviously, further research on the relationship between risk perception and Ebola-preventive behaviours is required.

The effects of education, ethnicity, marital status and religion on Ebola-preventive behaviours are noticeable. Respondents with tertiary education were more likely to take actions to avoid Ebola than those with no education. This finding is consistent with the well-documented positive relationship between education and health.[22] The more educated may be better informed about Ebola and less likely to endorse myths that undermine preventive behaviours. Moreover, the educated may better appreciate the repercussions of infection than the uneducated. The finding that the never married and divorced were significantly less likely to take action to avoid Ebola than the married corroborates the similarly well-documented effects of marriage on health-preventive behaviours.[24] Past and more recent studies show marriage regulates health behaviours.[25] With Ebola, the married may think about the implications of infection for their immediate family, especially the children in the family unit.

The recent West African Ebola outbreak had a wide geographical and demographic reach.[26] Although Ebola affected Christians and Muslims alike, studies on the religious demography of the outbreak showed Muslims were more severely affected, especially in Guinea and Sierra Leone.[27,28] Among other things, religious doctrines guiding funeral and burial practices might have influenced the spread of the disease among this demographic group. For example, the Islamic faith requires dead bodies to be washed and wrapped by immediate family members.[18] It was thus not surprising to learn Muslims were significantly less likely to accept burial arrangements and practices that did not involve washing and touching than were

Table 3. Multilevel logit models of Ebola prevention in Ghana, 2016

Individual-level variables (level 1)	Action to avoid Ebola		Funerals	
	Model 1	Model 2	Model 3	Model 4
Risk perception in the wake of Ebola outbreak				
No risk	1.00	1.00	1.00	1.00
Low risk	0.834 (0.353)	0.789 (0.362)	0.819 (0.317)	0.817 (0.331)
Medium risk	1.38 (0.306)	1.30 (0.305)	1.54 (0.314)	1.52 (0.320)
High risk	1.11 (0.234)	1.08 (0.245)	1.64 (0.275)*	1.59 (0.274)*
Risk perception now (at the time of survey)				
No risk	1.00	1.00	1.00	1.00
Low risk	1.04 (0.264)	1.03 (0.264)	0.769 (0.236)	0.785 (0.236)
Medium risk	1.07 (0.372)	1.08 (0.371)	0.340 (0.263)***	0.369 (0.285)***
High risk	1.74 (0.400)	1.69 (0.398)	0.365 (0.483)**	0.358 (0.471)**
Knowledge about Ebola prevention	1.49 (0.089)***	1.50 (0.090)***	1.35 (0.077)***	1.34 (0.076)***
Myths related to transmission	1.15 (0.107)	1.14 (0.119)	1.23 (0.110)	1.17 (0.115)
Concern about Ebola outbreak in Ghana				
Very concerned	1.00	1.00	1.00	1.00
Somewhat concerned	0.654 (0.295)	0.666 (0.302)	0.767 (0.363)	0.794 (0.359)
Not very concerned	0.468 (0.302)***	0.444 (0.304)***	0.627 (0.400)	0.621 (0.402)
Not at all concerned	0.810 (0.306)	0.724 (0.303)	1.06 (0.397)	0.937 (0.417)
Educational background				
No education	1.00	1.00	1.00	1.00
Primary education	2.10 (0.463)	2.15 (0.483)	1.21 (0.715)	1.15 (0.701)
Junior high school	2.11 (0.401)	2.10 (0.424)	1.54 (0.498)	1.46 (0.495)
Senior high school	1.75 (0.379)	1.68 (0.400)	1.35 (0.527)	1.26 (0.533)
Tertiary education	2.99 (0.407)***	2.92 (0.430)***	1.55 (0.548)	1.51 (0.567)
Ethnicity				
Akan	1.00	1.00	1.00	1.00
Ga/Adangbe	0.902 (0.255)	0.905 (0.256)	0.987 (0.257)	1.01 (0.259)
Ewe	0.698 (0.305)	0.683 (0.319)	1.35 (0.297)	1.26 (0.285)
Northern ethnic groups	1.09 (0.398)	1.06 (0.409)	5.08 (0.551)***	4.81 (0.561)***
Religious denomination				
Christian	1.00	1.00	1.00	1.00
Muslim	0.443 (0.293)***	0.469 (0.298)***	0.239 (0.484)***	0.258 (0.479)***
Traditionalist	0.691 (0.892)	0.649 (0.873)	1.68 (1.01)	1.40 (1.08)
Marital status				
Married	1.00	1.00	1.00	1.00
Never married/single	0.576 (0.247)**	0.577 (0.247)**	0.960 (0.247)	0.977 (0.249)
Divorced/separated/widowed	0.670 (0.341)	0.639 (0.352)	0.455 (0.369)**	0.433 (0.365)**
Gender				
Male	1.00	1.00	1.00	1.00
Female	0.846 (0.229)	0.823 (0.219)	1.37 (0.207)	1.31 (0.213)
Age of respondents	0.985 (0.011)	0.984 (0.011)	0.996 (0.011)	0.995 (0.011)
Community-level variables (level 2)				
Community myths related to transmission		1.06 (0.257)		1.61 (0.289)
Communities' worry related to sharing		2.96 (0.350)***		2.42 (0.455)**
Communities' knowledge about prevention		0.381 (0.382)		1.23 (0.534)
Variance component	0.586***	0.445***	0.508***	0.389***
ICC	15.1	11.9	13.4	10.6

*p<0.1; **p<0.05; ***p<0.01. Robust standard errors in parentheses.

Christians. Respondents who identified with the northern ethnic groups were more likely to accept such burial arrangements than Akans. This finding was intriguing, as the northern region of Ghana has a substantial Muslim population. It should be noted, however, that the sample for this study was from the GAR, where many respondents identifying as northerners may be Christians. In fact, cross-classification analysis showed that a significant proportion of respondents belonging to northern ethnic groups identified as Christian. Interestingly, respondents who identified as belonging to northern ethnic groups were also the most concerned about a possible Ebola outbreak in Ghana.

An important objective of the study was to look for differences in preventive behaviour across communities that might be explained by the communities' respective knowledge about Ebola, their endorsement of myths about transmission of the disease and/or their fears of a possible Ebola outbreak. We found that communities expressing worry about a potential Ebola outbreak were significantly more likely to adopt preventive behaviours. This means behaviour change models aimed at containing and managing outbreaks should adopt multilevel interventions. Communities must be informed and programmes should aim at raising awareness of the potential risks, as this may evoke the expected behaviour change in the event of an outbreak. On the one hand, the findings suggest existing psychosocial models of health promotion for such diseases as human immunodeficiency virus/acquired immune deficiency syndrome may be applied to EVD. On the other hand, they emphasize the need to consider community-oriented preventive approaches, with a nuanced appreciation of the cultures of the people they are expected to benefit.

Generally, African countries, including Ghana, have in the past faced severe challenges dealing with health emergencies such as cholera outbreaks, meningitis, yellow fever and, more recently, EVD. At the heart of these epidemics are health systems that are largely under-resourced and ill-equipped to deal with the many challenges these diseases pose. Even more serious is the paralysis of the health systems and the unpreparedness demonstrated by health care workers in emergency situations.[29] This notwithstanding, preparations towards EVD in Ghana and the public's response towards preventing the potential spread was quite different from those witnessed for some other epidemics in the past. Health education and social mobilization towards Ebola prevention in Ghana was intense. Religious heads and representatives of other faith-based organizations crafted a religious edict on EVD that was circulated in churches, mosques and other religious gatherings.[30] It is possible that these social mobilization initiatives led to increased knowledge and awareness and changed the risk perceptions of Ghanaians, as demonstrated in this study. Most important is that with increased knowledge and high risk perceptions, our respondents were willing to engage in behaviours that protect against the spread of EVD. Probably the social response to EVD in Ghana was motivated by fear, especially given the high fatality rates associated with the disease. However, it is important that such social mobilization efforts be sustained for similar epidemics in the future amidst strong health system support from the government.

The findings from this study are useful for policymakers who are designing behaviour change interventions, but the study has some limitations. The data were cross-sectional, thus we limited our interpretations to associations and refrained from making 'causal' inferences. It is important to be cautious about generalizing the findings to the whole country, especially since data were collected from only 1 of the 10 administrative regions of Ghana. In particular, we acknowledge the limitations of focusing our study on four districts in an urban setting and the communities/neighbourhoods within these districts. This means our sample might have been more homogeneous than heterogeneous. Up until the West African epidemic, Ebola was largely confined to rural areas with a few scattered cases in cities.[31] However, the recent West African experience showed that once started, the virus can spread rapidly in cities and densely populated areas. Future research should focus on community-level influences using nationally representative data with rural and urban samples.

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References

1 World Health Organization. Ebola virus disease. http://www.who.int/mediacentre/factsheets/fs103/en/ [accessed 09 August 2016].

2 United Nations Economic Commission for Africa. Economic report on Africa 2015: Industrialising through trade. Addis Ababa, Ethiopia: Economic Commission for Africa, 2015.

3 ACAPS. Ebola in West Africa: impact on health systems. ACAPS Briefing Paper, 28 February 2015. Geneva: ACAPS. http://reliefweb.int/sites/reliefweb.int/files/resources/20150226_ebola_health_system.pdf.

4 Tambo E, Ugwu EC, Ngogang JY. Need of surveillance response systems to combat Ebola outbreaks and other emerging infectious diseases in African countries. Infect Dis Poverty 2014;3:29.

5 Myjoyonline. GHS demand military presence at unapproved borders to check Ebola, 2014. http://webcache.googleusercontent.com/search?q=cache:HxlWXHpCJHAJ:https://www.myjoyonline.com/news/2014/August-15th/ghana-health-service-demand-military-presence-at-unapproved-borders-to-check-ebola.php&num=1&hl=en&gl=ca&strip=0&vwsrc=0.

6 Davies BC, Bowley D, Roper K. Response to the Ebola crisis in Sierra Leone. Nurs Stand 2015;29(26):37–41.

7 Gidado S, Oladimeji AM, Roberts AA et al. Public knowledge, perception and source of information on Ebola virus disease – Lagos, Nigeria; September, 2014. PLoS Curr Outbreaks. 2015 Apr 8. Edition 1. doi: 10.1371/currents.outbreaks.0b805cac244d700a47d6a3713ef2d6db.

8 United Nations Development Programme. Assessing the socio-economic impacts of Ebola virus disease in Guinea, Liberia and Sierra Leone: the road to recovery. New York: United Nations Development Program, 2014. http://www.africa.undp.org/content/dam/rba/docs/Reports/EVD%20Synthesis%20Report%2023Dec2014.pdf.

9 Centre for Public Policy Alternatives. Study on the Ebola Virus Disease (EVD): knowledge, attitudes and practices of Nigerians in Lagos State. Lagos, Nigeria: Centre for Public Policy Alternatives, 2014. http://cpparesearch.org/wp-content/uploads/2015/01/Knowledge-Attitude-Practices-of-Nigerians-on-the-EVD_Survey-Report_2014.pdf.

10 Davtyan M, Brown B, Folayan M. Addressing Ebola-related stigma: lessons learned from HIV/AIDS. Glob Health Action 2014;7:26058.

11 Fisher JD, Fisher WA. Theoretical approaches to individual-level change in HIV risk behavior. In: Peterson JL, DiClemente RJ, eds. Handbook of HIV prevention. Boston: Springer, 2000:3–55.

12 Rosenstock IM. Historical origins of the Health Belief Model. Health Educ Monogr 1974;2(4):328–35.

13 Bandura A. Health promotion from the perspective of social cognitive theory. Psychol Health 1998;13(4):623–49.

14 Tenkorang EY, Maticka-Tyndale E. Assessing young people's perceptions of HIV risks in Nyanza, Kenya: are school and community level factors relevant? Soc Sci Med 2014;116:93–101.

15 Zanna M, Rempel JK. Attitudes: a new look at an old concept. In: Bar-Tal D, Kruglanski AW, eds. The social psychology of knowledge Cambridge: Cambridge University Press, 1988:315–34.

16 Alehegn E, Chanie M, Mengesha D. Ebola hemorrhagic fever as emerging zoonotic disease. World J Med Sci 2014;11(3):324–33.

17 Kinsman J. 'A time of fear': local, national, and international responses to a large Ebola outbreak in Uganda. Glob Health 2012;8:15.

18 Rubin SS, Yasien-Esmael H. Loss and bereavement among Israel's Muslims: acceptance of God's will, grief, and the relationship to the deceased. OMEGA J Death Dying 2004;49(2):149–62.

19 Alexander KA, Sanderson CE, Marathe M et al. What factors might have led to the emergence of Ebola in West Africa? PLoS Negl Trop Dis 2015;9(6):e0003652.

20 Ghana Statistical Service. The 2010 population and housing census: summary report of final results. Accra, Ghana: Ghana Statistical Service, 2012.

21 Thompson SB. Simple formulas for standard errors that cluster by both firm and time. J Financial Econ 2011;99(1):1–10.

22 Adongo PB, Tabong PTN, Asampong E et al. Beyond knowledge and awareness: addressing misconceptions in Ghana's preparation towards an outbreak of Ebola virus disease. PLoS One 2016;11(2):e0149627.

23 Cutler DM, Lleras-Muney A. Education and health: evaluating theories and evidence. Working paper 12352. Cambridge, MA: National Bureau of Economic Research, 2006.

24 Ross CE, Wu CL. The links between education and health. Am Sociol Rev 1995;60(5):719–45.

25 Schone BS, Weinick RM. Health-related behaviors and the benefits of marriage for elderly persons. Gerontologist 1998;38(5):618–27.

26 Raka L, Guardo M. Ebola in West Africa. Open Access Maced J Med Sci 2015;3(1):174–5.

27 Bah SM, Aljoudi AS. Taking a religious perspective to contain Ebola. Lancet 2014;384(9947):951.

28 Marshall K, Smith S. Religion and Ebola: learning from experience. Lancet 2015;386(10005):e24–5.

29 Ofori-Adjei D, Koram K. Of cholera and Ebola virus disease in Ghana. Ghana Med J 2014;48(3):120.

30 Systems for Health Team. Religious leaders in Ghana unite against Ebola virus disease. November 2014. http://www.urc-chs.com/news/religious-leaders-ghana-unite-against-ebola-virus-disease [accessed 21 December 2017].

31 Richards P. Ebola: how a people's science helped end an epidemic. London: Zed Books, 2016.