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Tuning in and catching on? Examining the relationship between pandemic communication and awareness and knowledge of MERS in the USA

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ABSTRACT

Background Large-scale influenza outbreaks over the last decade, such as SARS and H1N1, have brought to global attention the importance of emergency risk communication and prompted the international community to develop communication responses. Since pandemic outbreaks are relatively infrequent, there is a dearth of evidence addressing the following questions: (i) Have the resources invested in strategic and routine communication for past pandemic outbreaks yielded public health preparedness benefits? (ii) Have past efforts sensitized people to pay attention to new pandemic threats? The Middle East Respiratory Syndrome (MERS) that was followed closely by major media outlets in the USA provides an opportunity to examine the relationship between exposure to public communication about epidemics and public awareness and knowledge about new risks.

Methods In December, 2013, we surveyed a nationally representative sample of 627 American adults and examined the associations between people's awareness to prior pandemics and their awareness of and knowledge about MERS.

Results Awareness of prior pandemics was significantly associated with awareness and knowledge of MERS. The most common sources from which people first heard about MERS were also identified.

Conclusions Communication inequalities were observed between racial/ethnic and socioeconomic positions, suggesting a need for more effective pandemic communication.

Keywords awareness, communication inequalities, disease outbreaks, MERS, pandemic, risk communication

Background

Public health practitioners face unique challenges when developing and implementing risk communication in times of emergencies, as there is limited information on the nature of the threat (including limited data regarding mortality and morbidity, transmission modes, and prevention measures), limited response time, the potential for severe health and economic consequences, media hype and public concern. All of these factors coalesce and intertwine with the diverse social and individual characteristics of the audience when developing emergency risk communication strategy.[1–5] The need for effective communication plans that enable coherent, credible and timely communication and community engagement during public health emergencies is increasingly being seen as integral to emergency response and planning.[6,7]

One area where emergency response and planning is key is with large-scale disease outbreaks. Over the last decade, there has been a succession of large-scale outbreaks of influenza, including the SARS, Avian Flu (H5N1), new bird flu (H7N9) and H1N1 pandemics. These outbreaks raised fears among both scientists and laypeople that an emerging influenza outbreak could repeat the devastation of the Spanish flu of 1918. Governments and public health agencies recognize the importance of emergency risk communication and have

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invested significant resources in the development and implementation of public health and communication responses to these outbreaks. The stakes of conducting emergency risk communication are even higher during the early stages of an outbreak, as a treatment and/or vaccine is unlikely to be available for at least several weeks or months after the start of a pandemic. Emergency risk communication, such as raising awareness of the disease and promoting health prevention behaviors like hand washing, social distancing and cautioning vigilance among others, plays a vital role in controlling disease transmission.[2,6,7] One key importance is to study the association between social and individual factors and communication inequalities—differences among people from different socioeconomic positions (SEPs), racial, ethnic and geographical backgrounds, to understand how individuals access, interpret and act on messages they have received [1,5,8–13] and to identify the best ways to quickly and effectively reach diverse populations with important preventive information. For example, low SEP individuals have been found to have lower levels of awareness and knowledge regarding pandemics, leading to poorer behavioral responses when dealing with an outbreak.[2,14–17]

However, as pandemic outbreaks are relatively infrequent, there has been a lack of evidence assessing whether the efforts and resources invested in the strategic risk communication during past pandemic outbreaks yielded public health benefits that improved preparedness. Gaining an understanding of whether or not the messages emphasized during the response to previous pandemics helped the public, particularly members of low SEP populations, become more aware and better prepared is invaluable. Therefore, the question that remains to be answered is: Does an awareness of past epidemic risk communication help people become more health aware of an emerging epidemic, or, on the contrary, have the past few pandemic communication experiences created a 'boy cries wolf' effect, making people less attentive to information provided concerning pandemic outbreaks?[18,19]

In late 2012, the Middle East Respiratory Syndrome (MERS), a viral illness caused by a coronavirus, was first reported in Saudi Arabia. Although this particular virus had a very low probability of impacting the USA, major media outlets followed it closely, providing the American general public with an opportunity to become familiar with the outbreak. In this study, we assessed people's awareness of previous pandemic outbreaks and how that awareness affected their awareness and knowledge of MERS. We identified other predictors of MERS awareness and knowledge and investigated the information sources from which people who had heard of MERS first learned about it. We also identified a subgroup of people who had have not heard of most or all risk communication messages regarding five pandemics (i.e. SARS, Avian Flu (H5N1), new bird flu (H7N9), H1N1, and MERS) which have erupted in the past decade. The analyses in this paper will help inform and calibrate strategic risk communication during a future pandemic.

Methods

The data for this study, collected from 17 to 31 December 2013, were drawn from a nationally representative sample of US adults aged 18 and older. The survey instrument was adapted from previously tested communication surveys we developed based on focus groups, cognitive testing results and the National Cancer Institute Health Information National Trends Survey.[20–22] Respondents participated in Knowledge Networks' KnowledgePanel® and were recruited using a dual sampling frame, which is a combination of random digit dial and address-based sampling, thus allowing for sampling of individuals with no telephone landlines. Once recruited into the study, participants completed an internet-based survey in their home including questions about demographics, pandemic awareness and MERS-specific topics. Households were provided with Internet access and necessary hardware if needed. Post-stratification weights were used to adjust for non-coverage and non-responder bias. The survey included an online field experiment that is not the focus of this analysis, including the experimental conditions as a covariate did not materially alter the pattern of findings and therefore they are not reported in this analysis.

Independent variables

- Awareness of previous pandemic outbreaks was assessed by asking the participants: 'Have you heard of [1] SARS, [2] H1N1 or swine flu, [3] Bird Flu or Avian Flu (H5N1), [4] new bird flu or Influenza A(H7N9) and [5] MERS (also called MERS-CoV, Middle East Respiratory Syndrome, Novel coronavirus, or NCoV), in the past 10 years?' Two awareness variables were created based on respondents' answers:
  - *Awareness of pandemic outbreaks prior to MERS:* Respondents were categorized into three groups based on their response to diseases (1) to (4): Low (heard of $\leq$2 outbreaks), Medium (heard of three outbreaks) and High (heard of all four outbreaks).
  - *Low pandemic awareness:* Including MERS and the four prior pandemics listed above, those who have heard of only one or none of any of them were labeled to be having low pandemic awareness.

- Age and gender.
- Race/ethnicity: Non-Hispanic White, Non-Hispanic Black and Hispanic
- SEP was measured by their household income (≥$50 000, $30 000–49 999, $15 000–29 999, ≤$14 999) and education (Bachelor's degree or higher, some college, high school, less than high school).

Dependent variables

For the purpose of this study, to measure respondents' knowledge about MERS and to ensure its accuracy and equal accessibility to all, we referred to Centers for Disease Control and Prevention[23] when developing outcome variables.

- Awareness of MERS outbreak was assessed by asking the participants: 'Have you heard of the following disease [MERS (also called MERS-CoV, Middle East Respiratory Syndrome, Novel coronavirus, or NcoV)] in the past 10 years?' (Yes = 1, No and Don't know = 0)
- Knowledge about MERS: Respondents could obtain a score of 0, 1 or 2. To account for randomly guessed responses, correct answers are discounted if the respondents also selected incorrect answers. A score of 2 was given if the following correct statements were checked: [someone can get MERS from] 'being in close contact with someone who has MERS (within arm's length of someone)' and 'No, there is not a vaccine against MERS' and none of the following wrong options were checked: [someone can get MERS from] 'eating chicken', 'coming in contact with chicken', 'eating pigs', 'coming in contact with pigs' or 'none of the above.' A score of 1 was given if either one of the two correct statements and none of the wrong ones were checked. A score of 0 was given to any other combination of responses.
- Source of initial MERS information: participants were asked to report the source where they first learned about MERS.

Analysis

A descriptive analysis was conducted to explore the characteristics of the surveyed sample (Table 1). In Table 2, logistic and ordered logistic regressions, respectively, were conducted to evaluate the associations between awareness of previous pandemic outbreaks in the past 10 years, socio-demographic factors and (i) awareness of MERS (Model 1) and (ii) knowledge levels about MERS (Model 2). Using cross-tabulations and χ^2, we identified the associations between respondents' socio-demographic characteristics and the sources from which they first received the information about MERS. Lastly, we ran logistic regression to determine the predictors of

Table 1 Sample characteristics

Socio-demographic characteristics	*Weighted percentage*[a] *(n = 627)*	
Demographic characteristics		
Age		
18–29	19	
30–39	15	
40–49	20	
50–59	20	
60+	26	
Gender		
Male	49	
Female	51	
Race/Ethnicity		
NH White	69	
NH Black	13	
Hispanic	17	
Social economic position		
Education		
Bachelor's degree or higher	29	
Some college	29	
High school	30	
Less than high school	12	
Income		
≥$50 000	58	
$30 000–$49 999	17	
$15 000–$29 999	15	
≤$14 999	10	
Risk communication outcomes	Frequency	Weighted percentage[a] (*n* = 627)
Awareness of pandemic outbreaks in the past decade (*n* = 627)		
Heard of SARS	405	75
Heard of H1N1	551	91
Heard of Avian Flu (H5N1)	495	87
Heard of new bird flu (H7N9)	327	59
Heard of MERS	144	33
Knowledge about MERS (*n* = 144)		
Score of 0 (No correct answer)	47	23
Score of 1 (One correct answer and no wrong answer)	35	25
Score of 2 (Two correct answers and no wrong answer)	62	52
No. of past pandemics heard (*n* = 627)		
Never heard of any	64	8
Heard of 1	37	2
Heard of 2	79	9
Heard of 3	164	21
Heard of 4	180	34
Heard of 5	103	25

[a]The columns of the table add up to 100% (there might be a very slight discrepancy due to rounding).

Table 2 Association between awareness of the communication messages regarding past pandemic outbreaks, social and individual determinants, and (i) awareness to information about MERS and (ii) knowledge about MERS

	Awareness of MERS				*Knowledge about MERS*			
	Weighted percent[a] *(n = 627)*	*OR*	*P value*	*95% CI*	*Weighted percent*[a] *(n = 144)*	*OR*	*P value*	*95% CI*
Awareness of previous pandemic outbreaks in the past 10 years								
Low (heard of ≤2 outbreaks)	20	1 (reference)			2	1 (reference)		
Medium (heard of 3 outbreaks)	28	9.82	**<0.001**	3.01–32.03	22	21.15	**<0.001**	4.28–104.45
High (heard of all 4 outbreaks)	52	20.08	**<0.001**	7.23–55.79	76	11.69	**<0.005**	2.68–51.02
Demographic characteristics								
Age								
18–29	20	1 (reference)			18	1 (reference)		
30–39	15	0.89	0.85	0.28–2.85	13	0.99	1.00	0.14–7.27
40–49	20	0.54	0.31	0.16–1.77	13	9.55	**0.03**	1.28–71.27
50–59	20	1.26	0.67	0.44–3.60	22	7.00	0.08	0.77–63.25
60+	26	1.48	0.45	0.53–4.09	34	7.81	**0.01**	1.53–39.90
Gender								
Male	49	1 (reference)			50	1 (reference)		
Female	51	0.87	0.69	0.45–1.71	50	2.04	0.26	0.59–6.99
Race/Ethnicity								
NH White	69	1 (reference)			82	1 (reference)		
NH Black	14	0.36	**<0.005**	0.19–0.70	7	0.13	**0.01**	0.03–0.57
Hispanic	17	0.46	**0.03**	0.23–0.91	11	0.90	0.88	0.24–3.41
Social economic positions								
Education								
Bachelor's degree or higher	29	1 (reference)			35	1 (reference)		
Some college	29	1.26	0.59	0.54–2.96	34	1.57	0.58	0.31–7.84
High school	30	0.54	0.29	0.17–1.68	16	0.37	0.16	0.09–1.48
Less than high school	12	1.42	0.57	0.43–4.70	15	0.19	0.13	0.02–1.62
Household income								
≥$50 000	58	1 (reference)			69	1 (reference)		
$30 000–$49 999	17	0.86	0.78	0.32–2.37	17	1.50	0.64	0.27–8.42
$15 000–$29 999	14	0.45	0.20	0.14–1.50	8	1.51	0.62	0.30–7.64
≤$14 999	10	0.75	0.45	0.36–1.57	6	0.74	0.61	0.23–2.38

[a]The columns of the table add up to 100% (there might be a very slight discrepancy due to rounding). Bold values are statistically significant at $P < 0.05$.

having very little awareness of previous major pandemic outbreaks (including MERS) in the past decade. The associations between low awareness of previous pandemic outbreaks and socio-demographic factors were examined, and the results are presented in Table 3. Stata® version 11 was used for all analyses.

Results

There were 627 respondents who participated in the study, reflecting a response rate of 31.5%. These respondents had a high awareness of the four pandemic outbreaks that affected international communities prior to MERS. The prior pandemics were SARS, H1N1, Avian Flu (H5N1) and the new bird flu (H7N9). More than half of the sample (52%) had heard of all four of them and about ninety percent (89%) were aware of at least two outbreaks. Specifically, the recent H1N1 pandemics are the best known outbreaks among the sample population, 91% ($n = 551$) of them have heard of H1N1, followed by Avian Flu (H5N1) (87%, $n = 495$), SARS (75%, $n = 405$) and the new bird flu (H7N9) (59%, $n = 327$). Only one-third of the respondents had heard of MERS (33%, $n = 144$); among those who have heard of MERS, more than half (52%) received a knowledge score of 2, one quarter had a

Table 3 Association between respondents with low awareness of pandemic outbreaks (including SARS, Avian Flu (H5N1), H1N1, new bird flu (H7N9) and MERS) in the past decade and social and individual determinants

	Low awareness of pandemic outbreaks			
	Weighted percent[a] *(n = 627)*	*OR*	*P value*	*95% CI*
Demographic characteristics				
Age				
18–29	20	1 (reference)		
30–39	15	1.75	0.36	0.53–5.80
40–49	20	0.29	**0.02**	0.10–0.85
50–59	20	1.22	0.73	0.39–3.77
60+	26	0.15	**<0.005**	0.05–0.50
Gender				
Male	49	1 (reference)		
Female	51	0.53	0.17	0.22–1.30
Race/Ethnicity				
NH White	69	1 (reference)		
NH Black	14	1.36	0.53	0.52–3.52
Hispanic	17	0.83	0.70	0.33–2.09
Social economic positions				
Education				
Bachelor's degree or higher	29	1 (reference)		
Some college	29	6.57	**0.01**	1.75–24.65
High school	30	15.18	**<0.0005**	3.44–66.91
Less than high school	12	6.35	**0.01**	1.65–24.40
Household income				
≥$50 000	58	1 (reference)		
$30 000–$49 999	17	1.97	0.27	0.59–6.56
$15 000–$29 999	14	1.49	0.59	0.35–6.31
≤$14 999	10	3.67	**0.01**	1.44–9.36

[a]The columns of the table add up to 100% (there might be a very slight discrepancy due to rounding). Bold values are statistically significant at $P < 0.05$.

knowledge score of 1, and the rest (23%), those who had no or incorrect knowledge about how MERS spreads, received a score of 0. More information on sample characteristics is presented in Table 1.

Awareness and knowledge of MERS

Our data indicate that having heard (awareness) of past pandemic outbreaks is significantly associated with awareness of a new public health threat, like MERS, and having knowledge about it. (Table 2) Compared with those who have a low awareness of previous pandemic outbreaks, respondents who have a medium or high awareness are 9.8 times (95% CI: 3.01, 32.03) and 20 times (95% CI: 7.23, 55.79), more likely, respectively, to have heard of MERS. Hispanics and Black Americans were 0.46 times (95% CI: 0.23, 0.91) and 0.36 times (95% CI: 0.19, 0.70) as likely as White Americans, respectively, to have heard of MERS (Table 2, Model 1). Similar results were observed when knowledge was examined about MERS among those who have heard of the MERS outbreak. Having high levels of awareness of previous pandemics, being aged 40–49 or 60 and older, and being a White American are strong predictors of having higher knowledge levels of MERS (Table 2, Model 2).

To inform future pandemics risk communication strategies for future pandemics, we further investigated the following: (i) Among those who had heard of MERS, what were the sources they used to first learn about it? (ii) Among those who have low awareness of pandemics, who are they and what are their background characteristics? Our data showed that national news network (18%) and local news television stations (14%), family and friends (8%) and internet-based search engine such as Google or Bing (6%) are the most

commonly used information sources from which the respondents first learned about MERS. Social media such as Facebook, Twitter, Google+, etc. had only minimal contributions as sources of pandemic information (<5%). Forty percent of those who had heard of MERS said that they could not recall where they first learned about the virus.

People with low awareness of pandemics in the past decade

Among the surveyed population, 8% ($n = 64$) had never heard of any of the pandemic outbreaks which had occurred in the past decade, including MERS and the four pandemics prior to it, as discussed above, and 2% ($n = 37$) had only heard of one outbreak, of which most respondents reported hearing of H1N1. The logistic regression analysis, seen in Table 3, shows that those with less than a bachelor's degree level of education and people with an annual household income of <$15 000 (OR = 3.67, 95% CI: 1.44, 9.36) are significantly more likely to have a low awareness of pandemics compared with other groups. On the other hand, people aged 40–49 year olds (OR = 0.29, 95% CI = 0.10, 0.85) and those aged 60+ (OR = 0.15, 95% CI = 0.05, 0.50) are more likely to have a greater awareness of pandemics compared with other age groups.

Discussion

What is already known on this topic?

The need for effective communication plans that enable coherent, credible and timely communication and community engagement during public health emergencies is increasingly being seen as integral to emergency response and planning.[6,7] Taking population diversity into consideration when developing risk communication plans has been shown to improve responding agencies' risk communication capabilities and, ultimately, the effectiveness of the response, especially in communities with limited local capacity.[24,25] This lesson was reinforced by the experience of recent international pandemic outbreaks of diseases and viruses such as the SARS, avian flu and H1N1 when the constructs of strategic risk communication such as public awareness, media exposure and knowledge about specific threats were further identified and assessed.[1,7,13,19,26–29] Studies confirmed that awareness of media reporting about current threats, general news exposure, people's attitudes and beliefs and people's knowledge about a specific threat are positively associated with a person's knowledge about a specific threat and their adoption of recommended prevention behaviors.[2,9,10,30–37]

Main finding of this study

In this study, awareness of prior pandemics was significantly associated with both awareness of a new threat, MERS, and higher knowledge levels regarding it; racial disparities were found in awareness and knowledge levels of MERS. There was no evidence that having heard about pandemics that occurred prior to MERS had a 'boy cries wolf' effect, in which people tuned out information about MERS. However, we found that individuals who were younger, had lower income or had less than a bachelor's degree were more likely to report having no awareness of previous pandemics compared with their counterparts.

National and local TV networks were the most commonly used information sources from which people first heard about MERS. This finding is consistent with previous studies, in which national news networks and/or local news television stations were found to be the most effective channels through which to convey public health messages, while the impact of social media was found to be surprisingly small.[4]

What this study adds?

Increasing awareness alone may not be enough to prompt preventive action, particularly among diverse groups. Pandemic communication need to contain clear, comprehensible information about the pandemic offered through trusted, commonly accessed media channels, such as national and local TV networks. Customizing messages about risk to one's intended audience and communicating these messages to them via appropriate information channels are instrumental to running an effective communication campaign.[38–44] It is notable that minority participants had both lower awareness of and less correct knowledge about MERS and that individuals with lower education and lower income were less likely to have an awareness of any pandemic, indicating the presence of communication inequalities in pandemic awareness among these subgroups. More research is needed on the awareness and knowledge of future pandemics in a diverse low SEP sample to best understand the impact of communication inequalities and how to address them through targeted campaigns. The current findings indicate a need to pay attention to segments that may not be actively seeking out information and to deliver it via channels that they use. Given the fact that few people reported that they had first learned about MERS through social media, our data suggested that national media such as TV are still important and social media, at least in times of pandemics, appear to be less effective. Emergency risk communication has to be strategic, evidence-based and must take into account potential communication inequality.

Limitations of this study

The data for this study are cross-sectional in nature and thus limit us from drawing a causal relationship between the independent and dependent variables. Nevertheless, this study finds a link between having heard of prior pandemics and knowledge and awareness of a subsequent pandemic (i.e. MERS) that should be further investigated. Future studies using experimental, longitudinal or case–control designs could help provide evidence for causal relationships. Although the data rely on self-reporting, our survey items were adopted from widely tested national surveys and validated by cognitive testing. The response rate for the survey was 31.5%. Post-stratification weights were used to adjust for non-coverage and non-responder bias.

In the case of the 2009/2010 H1N1 flu pandemics, Mexicans and other Latinos living in the USA were more likely to be stigmatized by non-Hispanic Americans as carriers of the virus, partly because of news reports on the outbreak's alleged origin in Mexican pig farms.[3] Hispanic Americans also reported higher levels of risk perceptions of the flu.[45] Therefore, in light of the origin of MERS, it could be useful for emergency risk communication scientists to further investigate the possible association between knowledge and awareness levels of the MERS virus and subsets of populations in the USA with potential personal or family ties to the outbreak regions (e.g. Middle Eastern migrants).

Conclusion

This study found that awareness of past pandemics was associated with higher awareness of and correct knowledge about the 2012/2013 MERS outbreak. Despite these associations, the overall level of awareness of this new threat was low and communication inequalities were observed between racial/ethnic and low SEP groups. Results suggest that awareness of past pandemics might indicate that an individual is more likely to have heard about a new threat, and that more research is needed to discover barriers to awareness that may be present in lower SEP samples. Emergency risk communication has to be strategic, evidence based and must take into account potential communication inequality.

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