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Be aware of superbugs: Newspaper coverage of NDM-1 in India, UK, and the USA

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ABSTRACT

Marrying the psychometric paradigm with the community structure theory, this paper examines the coverage of a superbug (NDM-1) in newspapers in India, the UK, and the USA. It identifies several community structure characteristics: level of vested economic interest, level of health care available, and size of health care stakeholders as factors influencing how risks of NDM-1 are portrayed in terms of the level of dread, controllability, familiarity, and uncertainty. The finding provides baseline data for the scientific community and public health professionals in creating more effective messages to inform the public about the risks of superbugs.

Superbugs, or antibiotic-resistant bacteria, are a serious global health threat. One of the greatest achievements of modern medicine is the discovery of penicillin and other antibiotics to treat deadly infections caused by bacteria (Nerlich & James, 2009). However, the past several decades have witnessed an increase in the number of antibiotic-resistant superbugs such as methicillin-resistant *Staphylococcus aureus* (MRSA), *Enterococcus faecium*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* species (Moellering, 2010). These superbugs make standard medical treatment ineffective and lead to extended illness and higher mortality rates (DeSilva, Muskavitch, & Roche, 2004). In the USA, each year around 2 million people developed hospital-acquired infections, mostly due to antibiotic-resistant pathogens, and 99,000 of them will die (Infectious Diseases Society of America, 2011). Antibiotic-resistance costs the US health system $20 billion annually (Centers for Disease Control and Prevention, 2011). In the European Union, more than 25,000 people die from antibiotic-resistant bacterial infections each year, and the annual economic loss is estimated to reach at least 1.5 billion Euros (World Health Organization [WHO], 2011a). Superbugs present an especially pressing risk in developing countries, where lack of regulation on antibiotic use has been a major cause of the emergence and spread of superbugs (Sosa, 2005). Due to the high risks of superbugs, the World Health Organization launched a worldwide

campaign calling on governments to combat the global threat posed by antibiotic resistance in 2011 (WHO, 2011b).

One recent superbug is New Delhi metallo-ß-lactamase-1 (NDM-1), a pan-resistant enzyme that makes bacteria resistant to a broad range of antibiotics (Moellering, 2010). First identified in New Delhi, India in 2008 (Moellering, 2010), antibiotic-resistant bacteria containing the NDM-1 enzyme have struck other areas of India, Pakistan, and the UK. To date, infections caused by bacteria carrying NDM-1 have been reported in many other countries, including the USA, Canada, Australia, France, Germany, Belgium, Sweden, Denmark, the Netherlands, Norway, Oman, Kenya, China, South Korea, Japan, among others (Luo et al., 2013; Yoo et al., 2013).

News media play a pivotal role in communicating health-related risks to the public, especially to non-expert audiences (Courtney, 2004). Framing theory suggests that the manner in which an issue is presented in news reports can make a big difference on how it is received. By representing reality from different angles, media reports largely determine people's perception of reality in relation to the issue as well as how they make judgments and decisions about it (Scheufele, 1999; de Vreese, 2005). Therefore, news media's portrayal of superbugs can shape individuals' risk perceptions and behaviors. Therefore, news media's portrayal of superbugs can shape individuals' risk perceptions and behaviors. It can also influence public polices and funding decisions related to scientific research on superbugs as well as public health campaigns to educate the public about such risks. Nerlich and James (2009) analyzed the popular antibiotic apocalypse discourse and argued that, with metaphors such as war, battle, apocalypse, kill, fight, race, and contest, this discourse could highlight the seriousness of the issue, create public fear of superbugs, influence policy-makers' judgments and help scientists to secure research funding. However, science communication researchers have yet to study how media contribute to this discourse. To fill in the gap in the literature, the current study evaluates the coverage of NDM-1 in English-language newspapers in India, the UK, and the USA.[1] It unpacks the dimensions of risk communicated in the newspaper coverage of NDM-1 in India, the UK, and the USA based on the psychometric paradigm. Furthermore, it adopts the community structure approach to study the communication of health risks of NDM-1 and identifies several community level variables that might explain how risks of NDM-1 are communicated differently in different countries. Theoretically, the case of NDM-1 supports the community structure approach in its prediction that characteristics of media coverage are consistent with specific communication structure features. Practically, the findings of this study provide extensive descriptions of the news coverage of NDM-1, which are not only of interest to the scientific community but also useful to policy makers in both developing and developed countries.

Literature review

Psychometric paradigm

People's perception of risk has an enormous impact on their decision-making process and risk management behaviors (Slovic, 2000). The psychometric paradigm is the predominant model used in studying public's perceptions of various risks associated with technologies and natural hazards such as nuclear power, mad cow disease, avian flu, and so on.

This model identifies a set of risk characteristics that determine the level of perceived risk, including dread, catastrophic potential, controllability, and familiarity, among others. It also predicts public's acceptance of the risk based on these characteristics (Slovic, 2000).

Recently, researchers have started to apply the psychometric paradigm to the study of media coverage of risks (e.g. Fung, Namkoong, & Brossard, 2011). People's risk perceptions can be influenced by how the risk is portrayed in the media, especially when the coverage is biased (Slovic, 2000). For example, Fung et al. (2011) used the psychometric paradigm to guide their analysis of the news coverage of avian flu in terms of five risk characteristics (catastrophic potential information, dread-evoking information, uncertainty, controllability, and familiarity). Furthermore, they examined the relationship between social proximity and level of risk presented and found that social factors, such as geographic distance and journalistic culture, strongly influenced how the risk of avian flu was covered in the news. Based on the original theorization of the psychometric paradigm and Fung et al. (2011)'s initial attempt to apply it to the context of news reporting, this paper identifies several factors as especially relevant in examining how media construct the risk associated with superbugs, including dread, uncertainty, familiarity, and uncertainty.[2]

Dread: Dread measures the extent to which a risk evokes fear and terror. Perception of dread is amplified if the risk is potentially fatal, unfairly distributed, or globally catastrophic (Slovic, 1987). The higher a hazard's score on the dimension of dread, 'the higher its perceived risk, the more people want to see its current risks reduced and the more they want to see strict regulation employed to achieve the desired reduction in risk' (Slovic, 1987, p. 283). The effect of covering health risks as dreadful has been extensively examined in the studies of the use of fear appeals in the social influence literature (Dillard & Anderson, 2004). The level of dread in a health message might influence how it is processed: too much or too little fear might turn audiences away from the message. Furthermore, people's prior knowledge or attitude might mediate the relationship between the level of fear and information processing route used (Averbeck, Jones, & Robertson, 2011).

Uncertainty: Uncertainty is another dimension of risk perception based on the psychometric paradigm. Uncertainty arises because information is 'inadequate, unavailable, or inconsistent' (Goodall, Sabo, Cline, & Egbert, 2012, p. 342). The public may feel uncertain about the dangers, outcomes, and solutions of an emerging disease, especially when the disease has the potential to become a pandemic (Fung et al., 2011). Sustained representation of uncertainty increases audience's sense of risk. According to Brashers (2001), covering health risks as highly uncertain might lead to negative emotions such as anxiety or fear, which, in turn, might result in people avoiding seeking further information. Other scholars argue, however, high uncertainty might motivate people to reduce uncertainty by seeking out additional information (Afifi & Weiner, 2004).

Familiarity: A familiar risk is more acceptable than an unfamiliar one. According to the psychometric paradigm, the following factors will influence the perceived familiarity of a risk: (1) perceived difficulty in observing the risk, (2) immediacy of consequences, (3) novelty of the issue, (4) lay people's knowledge about the risk, and (5) experts' knowledge about the risk (Slovic, 1987). An unfamiliar risk is especially difficult to deal with, as the public cannot compare it to known and familiar risks that they have encountered previously (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). Bomlitz and Brezis (2008)

argued that a novel and emerging health risk is more likely to be considered more journalistically newsworthy than other commonly known risks.

Controllability: Controllability is the extent to which a health risk can be contained on individual or collective levels. Perceived uncontrollability leads to emotional stress (Freudenburg, 1988). According to the theory of planned behavior, presenting a health risk as controllable might increase the audience's perceived behavior control, which, in turn, increases their intentions to perform the recommended preventative measures (Ajzen, 2002).

To examine these four dimensions of risk communicated in newspaper coverage of NDM-1 in India, the UK, and the USA, we ask the first research question:

> Research Question (RQ)1: How do newspapers in India, the UK, and the US communicate the dread, uncertainty, familiarity, and controllability in covering the risk associated with NDM-1?

Community structure approach

The community structure approach examines how demographic characteristics of a community are related to the contents of its newspapers (Frey, Botan, & Kreps, 2000). The theory has mostly been used in studying characteristics of major cities in the USA to identify the 'antecedents of newspaper content' (Pollock & Yulis, 2004, p. 284). The same logic, however, can be applied to the study of news coverage on the national level. For instance, Pollock et al. (2008) studied the news coverage of AIDS in a number of African countries and found that community demographic variables such as poverty level, size of population living with AIDS, and health access were negatively correlated with the use of the community responsibility frame, while infant mortality rate was positively correlated with the use of the progress frame. Several variables identified in existing community structure literature are especially relevant in the current study comparing the reporting of risks associated with NDM-1 in different countries. These variables will be discussed in detail next.

Vested economic interest

Vested economic interest is a prominent community structure feature that influences the media coverage of critical issues. According to the protection hypothesis of the community structure approach, the more economically vested a community is in an issue, the more likely its news coverage of the issue will favor its interests (Pollock & Yulis, 2004). When a community has a heavy reliance on a risk-related industry, media discourse about that risk can become highly sensitive (Griffin & Dunwoody, 1995). However, the direction of the relationship between economic interest and risk coverage can be very complex. For instance, in studying the news coverage of the North American Free Trade Agreement (NAFTA), Pollock (1995) found that the higher the percentage of labor force employed in the manufacturing industries in a city, the more positive the city's news coverage of NAFTA was, as the latter was believed to bring jobs and incomes to the manufacturing sector. In another study of the newspaper coverage of local toxic releases from manufacturing industries, Griffin and Dunwoody (1995) found a curvilinear relationship between a community's reliance on manufacturing and the amount of newspaper coverage of toxic releases so that communities with a moderate reliance on manufacturing were mostly likely to see such reportage.

In reporting health risks, it can be logically deduced that the economic interests associated with a risk will influence the extent to which news coverage of the risk is likely to emphasize its dreadfulness. Compared to the UK and the USA, India is likely to have the highest vested interests in NDM-1. By September 2011, there were 143 NDM-1 cases in India, 88 cases in the UK (Health Protection Agency, 2011), and 13 cases in the USA (Hardy, Mermel, Chapin, Vanner, & Gupta, 2012). On the one hand, when a risk is likely to have a high impact on a community's economic interest, its news media might emphasize the dreadfulness of the risk to raise awareness about it. On the other hand, it might also be possible that the news media are going to downplay the dreadfulness of the risk to protect the community's interests. This leads to RQ2:

RQ2: How does the news coverage of NDM-1 in India, the UK and the US differ in terms of the level of dread communicated?

Level of health care available

According to the community structure approach, the extent to which people have access to health care in a community influences the favorability of the news coverage of medical issues (Pollock & Yulis, 2004). In terms of the coverage of health risks, level of health care available might affect the level of controllability communicated. In a community where health care infrastructure is highly developed and health care is readily available to its population, the risk might be reported as more controllable.

The UK and the USA have much more developed health care systems than India. In terms of governmental expenditure on health, the UK and the USA spend 15.1% and 18.7%, respectively, of their government budgets on health, while India only spends 4.4% (World Health Statistics, 2011). The National Health Service (NHS) of the UK provides preventive medicine, primary care, and hospital services to all citizens and legal residents of the country (Boyle, 2011), and the government pays for 82.6% of the country's health expenditure (World Health Statistics, 2011). The USA spent more money on health care per capita than any other countries, yet it still faces challenges to expand health insurance coverage and to reduce financial burden for many families (Murray & Frenk, 2010). About 47.8% of the health expenditure in the USA is paid by the government (World Health Statistics, 2011). Indian government only pays for about a third of the country's health expenditure and only an estimated 3–5% of Indians have any form of health insurance (Rao, 2005, p. 5). As a result, individuals' out-of-pocket expenditure is high, although India has a large impoverished population (WHO, 2006). Hence, health care is more readily available in the UK and the USA than in India, which leads to the first hypothesis:

Hypothesis 1 (H1): News coverage of NDM-1 in the US and UK is more likely to present the risk as more controllable than news coverage in India.

Health care stakeholder

Health care stakeholders refer to those who are affected by a particular disease or health risk. For instance, senior citizens are health care stakeholders on the issue on physician-assisted suicide because they are more likely to be affected by its legalization (Pollock & Yulis, 2004). According to the community structure approach, the larger the number of

stakeholders on a particular health issue in a community, the more likely its news coverage will emphasize the issue and represent the interests of the stakeholders (Pollock & Yulis, 2004). When only a small percentage of people are affected by a health risk such as a superbug, journalists tend to lack precise first-hand information about the risk. Consequently, news coverage of the risk tends to be uncertain. Similarly, when only relatively small percentage of the population is at risk, the news media are likely to present the risk as unfamiliar, and thus, are more likely to compare the risk to other known risks as well as the same risk in other communities.

Among the three countries examined in this study, India is most threatened by NDM-1. Not only was the superbug first found in India, the country has the most reported cases of NDM-1 infection. Furthermore, the Indian population is at larger risk because of the misuse of antibiotics. Research has found that inappropriate use of antibiotics creates an ideal environment for superbugs to emerge and spread (Sosa, 2005; WHO, 2011a). India has the highest rate of antibiotics usage at 39–43% (Kotwani & Holloway, 2011), compared to 24% in the USA and 15% in the UK (Center for Disease Dynamics, Economics & Policy, 2007, p. 8).[3] India, like many other developing countries, lacks regulation on the use of antibiotics. According to a 2011 WHO study, 53% of Indians take antibiotics without a doctor's prescription (WHO Regional Office for South-East Asia, 2011).

Thus, based on the reported cases of NDM-1 and the prevalence of antibiotic abuse, it can be deduced that a larger proportion of Indian population are at risk compared to those in the UK and the USA. Based on this comparison, we propose the second and third hypotheses:

> H2: News coverage of NDM-1 in the UK and the US is more likely to be more uncertain than the coverage in India.
> H3: News coverage of NDM-1 in the UK and the US is more likely to present it as unfamiliar by referring to other superbugs and other countries than the coverage in India.

In summary, based on the community structure approach, we propose that three communication structure characteristics: level of vested economic interest, level of health care available and size of health care stakeholders, are likely to influence how the risks associated with NDM-1 are covered in the news in terms of level of dread, controllability, familiarity, and uncertainty communicated.

Method

Sampling

We chose to examine the coverage of NDM-1 in newspapers. Compared to other media such as radio or television, newspapers have the ability to communicate lengthy, complex, and detailed information (Rains, 2007). Newspaper was chosen also because of the availability of news articles published in multiple countries in electronic databases.

Newspaper articles were retrieved from the LexisNexis Academic database using the key terms 'NDM-1' and 'NDM1'. Only English-language newspapers were included in this study due to the following reasons. First, newspapers in India are published in not only English and Hindi, the two official languages of the country, but also nearly 30 other vernacular languages. Those vernacular newspapers are usually only consumed by a local readership. The only nationally circulated newspapers are the English-language

press (Billett, 2010, p. 4). English newspapers also hold the largest market share of revenues and the most powerful economic influence. During the period studied in this paper, English-language newspapers in India occupied 40% of the market, outpacing the Hindi and any other vernacular language markets (Kumar & Sarma, 2015). Furthermore, we chose to study the English-language newspapers in India so that we can compare the languages used in communicating the risks associated with this superbug in these newspapers with the newspapers in the USA and the UK, which were also published in English. Such comparative study allowed us to create a list of *loaded words* and a list of *uncertain words* for future research, as well as to make comparisons across the three countries. This could not have been done if multiple languages were involved. Finally, we chose to analyze the English-language newspapers only due to the constraints of the database used. LexisNexis was used in collecting our data, which only included English-language newspapers published in India. Thus, the sample for this analysis came from English-language newspapers published in India, the UK, and the USA between August 2009 (when the first newspaper article covering the issue appeared in *The Guardian*) and December 2011 (when data were collected). Duplicated and unrelated articles were excluded. Only hard-news stories, features, or health column stories were included for analysis, meaning that incidental mentions, letters to editor, and corrections to former news reports were excluded.

Codebook

Based on the instruments developed by Fung et al. (2011), eight variables were coded to measure the four dimensions of risks. Four variables were coded to measure dread: worst-case scenarios, loaded words, risk magnitude information about human infection/death, risk magnitude information about financial loss to society. Two variables were coded to measure controllability: personal protection information and societal protection information. The use of uncertain words was coded to measure uncertainty. Two variables were coded to measure unfamiliarity: comparison to other known superbugs, and comparison to other countries.

Worst-case scenario: This variable examined whether or not a news article provided information on the most negative possible outcome of NDM-1 (Dudo, Dahlstrom, & Brossard, 2007). For example, a statement such as the following would be coded as worst-case scenario information: 'We are essentially back to an era with no antibiotics.'

Loaded words: This variable examined whether a news article used 'emotionally charged language' (Dudo et al., 2007, p. 438). We used the list of emotionally loaded words identified in Dudo et al. (2007) and Fung et al. (2011) as a starting point, including words such as life-threatening, fatal, deadly, kill, alarming, untreatable, etc. Each article was coded for whether or not it included these loaded words. We used a grounded theory approach to allow additional loaded words to emerge in the process.[4]

Risk magnitude information about human infection/death: This variable examined whether a news article provided information on the extent of human infection or death. This could include narrative discussion or statistics (e.g. 'at least 3% of people infected') (Fung et al., 2011).

Risk magnitude information about financial loss to society: This item examined whether a news article provided information on the financial consequence of the

NDM-1 superbug. This could include narrative discussion (e.g. 'suffered a deadly blow') or statistics (e.g. 'dropped by 30%') (Fung et al., 2011).

Uncertain words: This item examined whether a news article used any words to describe NDM-1 related issues as uncertain or unknown based on the list developed by Fung et al. (2011), such as not sure, unsure, unknown, questionable, undetermined, remains to be determined, remains to be seen. We used a grounded approach to allow additional words to emerge and recorded them.[5]

Personal protection information: This variable examined whether a news article included personal protection measures to decrease personal risk of NDM-1, such as washing hands and using antibacterial surface wipes (Dudo et al., 2007; Evensen & Clarke, 2012).

Societal protection information: This variable examined whether a news article contained information on any actions that would be taken by domestic and/or foreign governments or international organizations to prevent NDM-1 (Evensen & Clarke, 2012; Fung et al., 2011). For example, statements such as the following would be coded as societal protection information: 'The government began to make efforts to reduce antibiotic abuse' or 'The World Health Organization warns on misuse of antibiotics on World Health Day, today.'

Unfamiliarity: This variable included two questions: (1) whether a news article compared NDM-1 to other superbugs (e.g. MRSA, MSSA (methicillin-sensitive *S. aureus*), *C. difficile*), and (2) whether it discussed NDM-1 in other countries (Fung et al., 2011).

Coding and intercoder reliability

Two graduate students served as coders for this study. First, both coders coded 20 randomly selected articles for a pilot coding. The intercoder agreement was good for most questions, except for two items: worst-case scenarios and societal protection information. After further discussion and training, both coders independently coded another 20 articles. Cohen's Kappa was calculated based on the first 40 articles coded: worst-case scenario (.71), loaded words (.89), risk magnitude information about human infection/death (.87), risk magnitude information about financial loss to society (.85), uncertain words (.90), personal protection information (.87), societal protection information (.71), comparing NDM-1 to other superbugs (.90), and discussion of NDM-1 in other countries (.95). In general, a κ statistic between .61 and .80 is interpreted as substantial agreement, and a κ between .81 and 1 is considered almost perfect agreement (Landis & Koch, 1977). Finally, one coder coded about one third of the remaining 226 articles (70 articles) and the other coder coded two thirds (156 articles).

Results

Among the 266 news articles included in the sample, 55.6% were published in India ($n = 148$), 36.5% were published in the UK ($n = 97$), and 7.9% were published in the USA ($n = 21$). The average lengths of news articles measured by word count in India, the UK, and the USA were 511.95 (SD = 259.35), 422.36 (SD = 319.44), and 572.86 (SD = 339), respectively. Among the Indian newspapers included in the source list were *The Times of India* (*TOI*), *Hindustan Times*, *Indian Express*, *The Pioneer*, and so on. The UK sample of newspapers included *The Guardian*, *Daily Mail*, *The Daily Express*, and

so on. The US sample of newspapers included *The New York Times*, *The Washington Post*, *San Jose Mercury News*, among others.

First, descriptive statistics were calculated and a series of chi-square tests were run to answer RQ1 and to offer an overall comparison of the risk characteristics communicated in newspapers in India, the UK, and the USA (please see Table 1 for descriptive statistics and results of chi-square tests). Holm's sequential Bonferroni procedure was used to adjust the *p*-value as multiple tests were run simultaneously (Abdi, 2010).

Dread is one of the most important dimensions of risk identified by the psychometric model. The level of dread carried in newspapers' coverage of health risks is influenced by several factors: the discussion of the worst-case scenario, the discussion of risk magnitude (human infection risk and financial loss), and the use of emotionally loaded words that instill fear. It was found that 17.3% of the articles ($n = 46$) evoked worst-case scenarios, and 69.5% of the articles ($n = 185$) used emotionally loaded words that can induce fear. Human infection consequences ($n = 160$, 60.2%) were discussed much more than financial losses ($n = 5$, 1.9%). A series of chi-square tests indicated that overall there were significant differences among the newspapers in these three countries in the discussion of human infection risk $\chi^2(2, n = 266) = 57.28$, $p = .00$, adjusted $p = .00$; and the use of emotionally loaded words, $\chi^2(2, n = 266) = 34.67$, $p = .00$, adjusted $p = .00$. There was no significant difference among their discussion of worst-case scenarios or financial losses.

Uncertainty is another important aspect of the psychometric model. Overall, the news coverage of NDM-1 showed low level of uncertainty. Words indicating uncertainty were only found in 10.5% of the articles ($n = 28$). In addition, there was significant overall difference among newspapers in India, the UK, and the USA in their use of uncertain words, $\chi^2(2, n = 266) = 22.78$, $p = .00$, adjusted $p = .00$.

Presenting a health risk as controllable mitigates the potential dread the audience might feel. Discussion of personal protection measures and social protection measures can potentially increase perceived controllability. Our data suggested that societal protection measures were mentioned more frequently ($n = 115$, 43.2%) than personal protection measures ($n = 40$, 15.0%). Furthermore, there was significant overall difference among the newspapers in the three countries in their discussion of social protection measures,

Table 1. Overall comparison of NDM-1 coverage in newspapers in India, the UK, and the USA.

Risk characteristics	India n (%)	UK n (%)	USA n (%)	χ^{2*}	p	Adjusted p
Dread						
Worst-case scenario	18 (12.16)	22 (22.68)	6 (28.57)	6.56	.03	.07
Human infection consequence	59 (39.86)	83 (85.57)	18 (85.17)	57.28	.00	.00*
Financial loss	3 (2.02)	1 (1.03)	1 (4.76)	1.34	.36	.51
Loaded words	81 (54.72)	86 (88.66)	18 (85.71)	34.67	.00	.00*
Uncertainty						
Uncertain words	17 (11.49)	3 (3.09)	8 (38.09)	22.78	.00	.00*
Controllability						
Personal protection measures	15 (10.14)	19 (19.59)	6 (28.57)	7.37	.03	.08
Societal protection measures	43 (29.05)	64 (65.97)	8 (38.09)	32.80	.00	.00*
Familiarity						
Discussion of other superbugs	26 (17.57)	44 (45.36)	7 (33.33)	22.22	.00	.00*
Discussion of other countries	64 (43.24)	73 (75.26)	17 (80.95)	29.61	.00	.00*

Note: Degree of freedom of each chi-square test is 2.
*Adjusted *p*-value < .01.

$\chi^2(2, n = 266) = 32.80$, $p = .00$, adjusted $p = .00$. The difference among the three countries in their newspapers' discussion of personal protection measures was no longer significant after being adjusted for multiple testing, $\chi^2(2, n = 266) = 7.37$, $p = .03$, adjust $p = .07$.

In covering NDM-1, newspapers can refer to other superbugs and refer to the spread of the bacteria in other countries to increase perceived familiarity. Our data indicated that 28.9% of the articles ($n = 77$) in the sample referred other superbugs in reporting NDM-1, and 57.9% mentioned NDM-1 in other countries ($n = 154$). News articles published in India, the UK, and the USA showed significant overall differences in terms of the reference to other superbugs, $\chi^2(2, n = 266) = 22.22$, $p = .00$, adjusted $p = .00$, and the reference to other countries, $\chi^2(2, n = 266) = 24.36$, $p = .00$, adjusted $p = .00$.

RQ2 asked how newspapers in India, the UK, and the USA portrayed the dreadfulness of NDM-1 differently. The overall comparison has been discussed in answering RQ1. Pairwise tests were conducted to further explore the differences among these three countries in terms of their newspapers' discussion of the worst-case scenario, human infection consequences, financial losses, and their use of loaded words. It was found that India newspapers differed significantly from newspapers published in the UK and the USA in conveying dread. More specifically, news articles published in Indian newspapers were less likely to discuss human infection consequences than news articles published in the UK, $\chi^2(1, n = 245) = 50.23$, $p = .00$, adjusted $p = .00$, or news articles published in the USA, $\chi^2(1, n = 169) = 15.59$, $p = .00$, adjusted $p = .00$. Furthermore, news articles published in India were less likely to use emotionally loaded words than those published in the UK, $\chi^2(1, n = 245) = 31.09$, $p = .00$, adjusted $p = .00$, or those published in the USA, $\chi^2(1, n = 169) = 7.28$, $p = .01$, adjusted $p = .03$. There was no significant difference between the news articles in the USA and the UK on any of the four dimensions of dread (see Table 2 for a summary of the results of pairwise tests). Overall, UK and US newspapers were more likely to convey a higher sense of dread than Indian newspapers.

H1 predicted that news coverage of NDM-1 in the USA and UK was more likely to present its risk as more controllable than news coverage in India. Pairwise comparisons indicated that UK newspapers, $\chi^2(1, n = 245) = 4.38$, $p = .04$, adjusted $p = .04$ and US newspapers, $\chi^2(1, n = 169) = 5.74$, $p = .02$, adjusted $p = .04$, were significantly more likely to discuss personal protection measures than Indian newspapers. In terms of the discussion of societal protection measures, it was found that UK newspapers were more likely to discuss societal protection measures than Indian newspapers, $\chi^2(1, n = 245) = 32.49$, $p = .00$, adjusted $p = .00$, as well as US newspapers, $\chi^2(1, n = 118) = 5.64$, $p = .02$, adjusted $p = .02$. There was no significant difference between Indian and US news articles in their mentioning of societal protection measures. H1 was partially supported.

Table 2. Pairwise comparison of the representation of dread in the coverage of NDM-1 in newspapers in India, the UK and the USA.

	Compare India and UK			Compare India and UK			Compare UK and USA		
	χ^2	p	Adjusted p	χ^2	p	Adjusted p	χ^2	p	Adjusted p
Worst-case scenario	4.745	.03	n.s.	4.64	.04	n.s.	0.33	.56	n.s.
Human infection consequences	50.23	.00	.00*	15.59	.00	.00*	0	.99	n.s.
Financial losses	0.36	.55	n.s.	0.60	.44	n.s.	1.44	.23	n.s.
Loaded words	31.09	.00	.00*	7.27	.01	.03*	0.143	.705	n.s.

Note: The degree of freedom of all chi-square tests is 1.
*Adjusted p-value < .05.

According to H2, news coverage of NDM-1 in India was likely to convey a higher sense of certainty than the coverage in the UK and the USA. Pairwise comparison showed that US newspapers were significantly more likely to use uncertain words than Indian newspapers, $\chi^2(1, n = 169) = 10.33$, $p = .00$, and UK newspapers, $\chi^2(1, n = 118) = 25.02$, $p = .00$. However, Indian newspapers were more likely to use uncertain words than UK newspapers, $\chi^2(1, n = 245) = 5.51$, $p = .02$. Thus, H2 was partially supported.

Finally, H3 predicted that compared to newspapers in India, newspapers in the UK and the USA were more likely to portray NDM-1 as unfamiliar and thus more likely to refer to other superbugs and NDM-1 infections in other countries to reduce this unfamiliarity. Our results showed that Indian newspapers were less likely to mention other superbugs than UK newspapers, $\chi^2(1, n = 245) = 22.18$, $p = .00$, adjusted $p = . 00$. Indian newspapers were also less likely to mention other superbugs than US newspapers, but the difference was not statistically significant. Furthermore, news articles published in India were less likely to refer to NDM-1 in other countries than news articles published in the UK, $\chi^2(1, n = 245) = 24.36$, $p = .00$, adjusted $p = . 00$, or the USA, $\chi^2(1, n = 169) = 10.48$, $p = .00$, adjusted $p = . 00$. Thus, H3 was mostly supported.

Discussion

Overall newspapers in the UK and the USA communicated a much higher level of dread associated with NDM-1 in comparison to newspapers published in India by emphasizing human infection consequences and using emotionally loaded words. In addition, news coverage of NDM-1 in the UK and the USA was also more likely to convey a higher level of controllability, especially in terms of personal protection measures. According to the framing theory, how the media reporting of risks posed by an emerging superbug may affect people's perception and judgment of the superbug in different countries.

Furthermore, the findings of this study supported the notion that community structure variables (e.g. economic power) are major factors affecting newspaper activities of health-related issues on the national level. Vested economic interest and level of health care available resulted in low level of dread and controllability as well as high level of uncertainty associated with NDM-1 in Indian coverage, while the amount of stakeholders had a profound influence on the coverage pattern when combined with other two community structure characteristics.

Although the study is limited to one single type of superbug, the analysis holds important implications for future cross-national research for other epidemic diseases. Most communicable diseases are initially regional when discovered, with the possibility to cross-national and regional boundaries. Effective control of infectious diseases requires international information exchange and cooperation. Thus, the theoretical implication of the study is the use of a sociocultural perspective to understand unusual press coverage patterns of emerging diseases in the future.

Dread-evoking information

Worst-case scenarios, loaded words, and information about the human infection or death, and information about financial losses related to NDM-1 invoke dread among media consumers. This study showed that UK and US newspapers were more likely to communicate

dread than Indian newspapers through the discussion of human infection consequences and the use of emotionally loaded words. Such a difference might be explained in terms of the frames used in covering NDM-1 in these three countries. In the UK and the USA, coverage of NDM-1 has mostly adopted a public health frame, discussing the superbug as a health threat. On the contrary, NDM-1 has mainly been reported through a business frame in Indian newspapers. A considerable number of Indian articles published in 2010 rejected the health threat of NDM-1 as international slander. They criticized the naming of the superbug after the Indian capital of New Delhi and discussed how it would affect India's medical tourism. The risk of NDM-1 gradually became recognized in India in 2011, with articles published bearing the titles such as 'Delhi Superbug Is New Global Health Threat' or 'Wake Up! The "Superbug" Threat Is Real.' Based on the community structure approach, the difference among newspapers in India, the UK, and the USA in terms of the level of dread communicated can be explained as Indian newspapers were trying to protect the country's vested economic interest in medical tourism, which was threatened by the labeling of the superbug and the wide publicity. As a result, Indian newspapers tended to downplay the risk of NDM-1 and were less likely to portray it as dreadful. This finding reinforced the notion that local economic powers may 'dampen the press' "watchdog" function' in health risk coverage (Griffin & Dunwoody, 1995, p. 282).

Uncertainty

Uncertainty is common in reporting emerging health risks, as the scientific community has not reached a definition assessment of the risk and science and health reporters may lack first-hand information about the risk (Freimuth, 2006). Of the 266 articles examined in the current study, only 28 used words implying uncertainty such as 'unknown' or 'unclear'. Covering the risks of NDM-1 with such a high level of certainty may mitigate the negative emotions readers may experience when reading such news articles. It will increase readers' perceived self-efficacy in taking personal measures to prevent infection (Hurley, Kosenko, & Brashers, 2011). However, it may also discourage readers from further information seeking (Brashers, 2001). US newspapers were most likely to use uncertain words, followed by Indian newspapers and UK newspapers. As the USA has the smallest population that had been potentially affected by NDM-1, the high level of uncertainty communicated in US newspapers was consistent with the prediction of the community structure approach. However, one surprising finding was that news coverage of NDM-1 in India was more likely to contain words that imply uncertainty than the news coverage in UK, even though this superbug was first identified in India and most cases of infection were reported in India. One possible explanation of this discrepancy is that even though NDM-1 was first found, and has most reported cases in India, it was the British researchers who first conducted and published scientific studies on NDM-1. Hence, journalists in UK actually might possess more accurate and definite information than their Indian counterparts.

Controllability

The extent to which a risk can be controlled influences the perceived risk level. In this study, we examined the controllability communicated on the personal level and the

societal level. Overall, our finding was consistent with Evensen and Clarke's (2012) study of news coverage of West Nile virus and avian flu in the USA that societal protection information was more salient than individual protection information in all three countries. However, based on the data in Evensen and Clarke (2012) and the current study, readers are much less likely to learn about both societal and personal protections measures related to NDM-1 than those related to either West Nile virus or avian flu. Evensen and Clarke (2012) found that a respective 64% and 51% of the articles covering West Nile virus mentioned societal and personal protection information; similarly, in covering avian flu risk, 81% articles reported societal protection information and 55% offered personal protection information. In the case of NDM-1, personal protection measures were only mentioned in 10.14%, 19.59%, and 28.57% of news articles in India, the UK, and the USA, while societal protection measures were discussed with a little higher frequency, appearing in 29.05%, 65.97%, and 38.09% of news articles in India, the UK, and the USA. News articles in all three countries rarely mentioned that basic sanitation practices were the most important personal protection measures, suggesting that science and health reporters should be encouraged to promote hygiene practices like hand washing in covering NDM-1 and other infectious diseases. In terms of societal protection messages, our finding indicated these three countries' unreadiness to engage in preventative measures toward a new risk. Furthermore, very few news articles in the three countries told their readers to avoid overuse or inappropriate use of antibiotics, suggesting that more measures should be taken to raise awareness about antibiotic misuse. Overall, our finding highlighted the need for more in-depth research into why certain types of protection measures are more accessible than others (Evensen & Clarke, 2012).

Newspapers in the UK and the USA were significantly more likely to present the risk of NDM-1 as more controllable than those published in India both in terms of personal protection measures and societal protection measures. This was consistent with the hypothesis based on the community structure approach: when health care is readily available, newspapers tend to frame health risks as controllable. UK newspapers were most likely to mention societal protection information such as actions taken by governments to prevent NDM-1; a significantly smaller proportion of news articles in India and the USA mentioned such information. One possible explanation is that the UK has an NHS that guarantees all citizens access to health care service; hence the risk of NDM-1 as portrayed as most controllable in the UK.

Familiarity

When presenting a risk as unfamiliar, newspapers are likely to compare it to known risks (Fung et al., 2011). Our data indicated that news articles about NDM-1 in the UK and the USA were more likely to include comparisons to known risks and comparison to other countries than news articles published in India. Previous research suggested that presenting a risk as familiar makes it appear to be much less worrisome and reduces the level of perceived risk (Fischhoff et al., 1978). Our data suggested that newspapers in the UK and the USA tend to portray NDM-1 as unfamiliar, which might increase its perceived risk.

Limitations and directions for future research

Several limitations of this study should be noted. First, this study only examined several community structure variables. There might be other factors that still need to be examined, such as culture. Little scholarly attention has been paid to how differences in cultures may affect the journalistic practices in reporting health-related risks. One exception is Tang and Peng (2014), which found that newspaper coverage of major diseases (such as cancer or HIV/AIDS) and health risk factors (such as the side effects of medicine) in the USA and China was affected by their respective cultures in terms of attribution, temporal orientation, citation patterns and the use of statistics. For this study, it is possible that the differences in some risk dimensions were also due to journalistic and cultural differences. For instance, uncertainty avoidance is a major dimension of national culture and might affect how a country's news media approach highly uncertain health risks such as superbugs. Moreover, as described in the methods section, this study examined Indian newspapers' coverage of NDM-1 by analyzing the English-language newspaper articles available through an online database. Although the choice of English-language newspapers allows us to make comparisons across the three countries and to create a list of *loaded words* and a list of *uncertain words* for future research, the current analysis of Indian media's responses is limited by the exclusion of newspapers published in Hindi and other vernacular languages. Since English-language newspapers such as *TOI* cater primarily to the middle and upper-middle classes of society (De Souza, 2007), their readers tend to be more educated and affluent than readers of Hindi and vernacular newspapers (Kumar & Sarma, 2015). Hence, English-language newspapers might have a more significant influence on the elite than the average Indians. Future analysis using both English-language and the vernacular press would provide a more comprehensive assessment of the framing effects on a broader Indian audience (Lee & Maslog, 2005). Furthermore, this study was also limited by the period of the evaluation. The researchers believe that new studies could also examine similar risk scenarios longitudinally and measure changes overtime. This could be particularly helpful for future research to reveal the changes of coverage in different developmental stages of public health issues.

Notes

1. These countries were chosen due to the different development stages of NDM-1 in each country. NDM-1 was initially discovered in India, first reported by UK scientists, and has received plenty of attention in India and the UK, and is emerging in the USA. By September 2011, there were 143 NDM-1 cases in India, 88 cases in the UK (Health Protection Agency, 2011), and 13 cases in the USA (Hardy et al., 2012).
2. Fung et al. (2011) investigated an additional risk characteristic in their study of news coverage of avian flu: catastrophic potential. However, catastrophic potential as part of risk communication does not apply to the case of NDM-1, as the latter does not have a death toll that can be labeled as 'catastrophic'. Thus, the risk dimension of catastrophic potential information could not be examined in this study.
3. This rate is measured in terms of DDS/1000 inhabitants/day. A standardized measure of antibiotic consumption is DDD (defined daily doses), which is recommended by the WHO Collaborating Centre for Drug Statistics Methodology (2009). DDD is defined as 'the assumed average maintenance dose per day for a drug used for its main indication in adults' (WHO

Collaborating Centre for Drug Statistics Methodology, 2009, para. 2). A popular DDD index is DDDs per 1000 inhabitants per day, which can 'provide a rough estimate of the proportion of the study population treated daily with a particular drug or group of drugs' (The concept of the defined daily dose, para. 8). For example, when the antibiotic consumption in a certain population is 10 DDDs per 1000 inhabitants per day, this indicates that 1% of the population on average might receive antibiotics (The concept of the defined daily dose).

4. The loaded words we identified from this study included: Alarm, alarming, alert, danger, dangerous, deadly, deadliest, fatal, fear, frightening, horror, impossible to treat, kill, killer, lethal, life-threatening (life threatening), panic, scare, scary, serious, severe, threat, threatening, trouble, troublesome, unmanageable, unprecedented, unstoppable, untreatable, warn, warning, worry, worrying(ly), worrisome, worst.

5. The uncertain words we identified from this study included: Do not know, further studies seem necessary, impossible to say, 'It has to be seen … ', little data, need to be confirmed, no consensus on, no conclusions, no evidence, no records, not sure, there can't be any assumptions made, too early to judge, uncertain, uncertainty, unclear, unknown, unpredictable.

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