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The influence of popular media on perceptions of personal and population risk in possible disease outbreaks

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Infectious disease outbreaks are uncertain and potentially risky events that often attract significant media attention. Previous research has shown that, regardless of their objective severity, diseases receiving greater coverage in the media are considered to be more serious and more representative of a disease than those receiving less coverage. This study assesses the role of media coverage in estimations of population risk (measured as perceived incidence among a specific population within a 1-year time period) and personal risk (measured as perceived personal likelihood of infection). Diseases with higher media coverage were considered more serious and more representative of a disease, and estimated to have lower incidence, than diseases less frequently found in the media. No difference in estimates of personal risk was found. A significant correlation between estimates of population and personal risk was found for diseases infrequently reported in the media. A weaker correlation between estimates of population and personal risk was found for diseases frequently reported in the media. The correlation remained unchanged when participants were exposed to additional information, including symptoms, mortality and estimates of prevalence.

Keywords: risk; risk perception; uncertainty; media; print media

Introduction

In rich countries, individuals can generally expect to live longer, suffer fewer illnesses and receive better medical care than ever before. In particular, the infectious disease burden has declined in most rich countries. Among the top 10 causes of death in the United States, only lower respiratory tract infections, influenza and pneumonia are communicable diseases, and these are concentrated among the elderly (Mokdad \textit{et al.} 2004). Nevertheless, individuals often perceive themselves to be vulnerable to infectious disease, indicating a possible disjunction between perceived and actual risk. This is not surprising, as there is a general tendency to overestimate the probability of rare events and underestimate the probability of common ones (Coombs and Slovic 1979; Frost \textit{et al.} 1997; Slovic and Weber 2002).

One possible explanation for the disjunction between actual and perceived probabilities of infectious disease is the influence of the media. Scholars and
journalists have frequently criticised the media for ‘selective amplification’ of health risks (Murdock et al. 2003), overemphasising low-probability, high-consequence events such as bioterrorist attacks or outbreaks of rare diseases such as Ebola haemorrhagic fever, and underemphasising more common but less dramatic risks such as stroke, diabetes or stomach cancer (Singer and Endreny 1993). For example, in a New Republic cover story entitled ‘Paranoia Strikes Deep: Ebola, Outbreak, the Hot Zone and the New Panic about Plagues’, journalist Malcolm Gladwell argued that American culture was ‘in the grip of paranoia about viruses and diseases’, its populace pervaded by fear and ‘a sense of helplessness, a feeling of fatedness’ (Gladwell 1995, p. 38). Similarly, media scholar Susan Moeller (1999) devoted a quarter of her book, Compassion Fatigue: How the Media Sell Disease, Famine, War, and Death to the negative consequences of sensationalist coverage of infectious diseases such as Ebola and mad cow disease. Moeller argued that media coverage of disease is governed by the ‘Ebola Standard’ which disproportionately values highly contagious diseases with horrific symptoms, regardless of their actual prevalence.

These criticisms have been echoed more recently in popular books arguing that, because media coverage of diseases is driven by concerns other than the actual prevalence or probability of being affected, the public has an inaccurate understanding of the actual risk environment (Glassner 1999; Gardner 2008). As a result, they are influenced by ‘health scare’ reporting and thus ‘fear the wrong things’ – Ebola and anthrax, which are extremely rare, rather than far more frequent causes of death such as car accidents and heart disease (Gwyn 1999).

These critiques implicitly assume that frequency of representation in the media is directly proportional to individual risk perception – that is, the more media coverage a disease receives, the more likely individuals are to perceive it as a threat, regardless of the actual risk involved. This assumption is supported by research suggesting that, while there is little or no relationship between the frequency of media coverage and actual mortality statistics, public concern for a topic is related to frequency of media coverage (Coombs and Slovic 1979; Slovic and Weber 2002). This relationship has been demonstrated with respect to genetically modified foods (Frewer et al. 2002), genetic research (Bubela and Caulfield 2004), global warming (Mazur and Lee 1993), overall health (Wilson et al. 2004), health-related accidents (Cooper and Roter 2000), drug effects (Soumerai et al. 1992), domestic terrorism (Pfefferbaum et al. 1999, 2000, 2001, 2003; Pfefferbaum 2001; Vasterman et al. 2005), international terrorism (Schuster et al. 2001; Ahern et al. 2002, 2005; Schlenger et al. 2002; Silver et al. 2002; Kennedy et al. 2004; Galea and Resnick 2005) and bioterrorist attacks (Douglas et al. 2005). Media coverage often focuses on dramatic but rare events or risks, while more common risks receive little or no attention (Kaperson et al. 1988). In some cases, specific diseases can pass from high to low media frequency as they become more familiar. For example, the HIV/AIDS epidemic received considerable coverage in North America during its first decade, but by the mid-1990s it had become ‘routinised’, and displaced by coverage of more exotic diseases such as the Ebola and West Nile viruses (Brandel 1988; Kinsella 1989).

Given this context, it is worth investigating the potential association between frequency of media coverage of a disease and individuals’ perception of disease risk in the current media environment. Two issues are particularly worth noting. Firstly, perceptions of disease risk are usually investigated by comparing individual estimates of prevalence with actual infection or mortality rates (Klaidman 1990). For example, one might survey Canadians on their perceived risk of dying from pneumonia and
compare this to actual pneumonia mortality rates in Canada. This method assumes that risks exist independent of individuals’ perceptions, that the proper role of the media is to inform individuals about these objective risks and that deviation from correct assessment of objective risks may result from the media failing to accurately represent the true disease risk. This approach bypasses important debates over whether truly objective risks exist, and whether the proper role of the media is to transmit information sanctioned by ‘official’ state agencies or professional organisations (Lupton 1993; Heyman et al. 2010). In addition, the media often cover potential rather than present threats to health, such as possible future epidemics of a novel strain of influenza, the emergence of a new disease or risks arising from a new technology. The uncertainty inherent in future events precludes comparison of estimates of prevalence or incidence to actual infection or mortality statistics. In order to address the impact of coverage of potential future events, we propose an approach that differs from the traditional comparison between estimated and actual prevalence.

Secondly, frequent media coverage of a disease may have a more complex relationship to perceptions of disease risk than simply increasing estimates of prevalence (Young et al. 2008a). In particular, it may influence the relationship between individuals’ perceptions of population-level and individual-level risk. Individuals often exhibit ‘unrealistic optimism’, a disjuncture between their estimations of the risk to the general population which they are a part of and their estimation of the same risk on a personal level. For example, one study of adolescents’ perceptions of risks associated with tanning found that they were more likely to believe that tanning posed a risk to others than to themselves (Sjöberg et al. 2004). It is worthwhile to ask whether individuals exhibit a similar unrealistic optimism with respect to potential outbreaks of infectious disease, and what if any role the media might play.

In this article, we present findings from a study that investigated the relationship between media coverage of infectious diseases and the perceived personal and population risks they pose. Previous research has suggested a causal relationship between frequency of media coverage of infectious disease and perception of severity – that is, it is not just that the media cover more serious diseases more frequently, but that frequent media coverage increases perceptions of disease severity (Young et al. 2008a). This research also demonstrates that increased media coverage is associated with the ‘representativeness’ of a disease. The more a condition is covered, the more likely individuals are to classify it as a ‘disease’. We attempted to replicate these findings and also investigated whether the relationship between estimates of personal and population risk reflects the ‘unrealistic optimism’ found in previous studies.

**Methods**

**Participants**

Undergraduate students from the psychology participant pool at McMaster University in Ontario, Canada (n = 23; age range approximately 17–23) participated in this study in exchange for partial course credit. This sample is similar in size and age distribution to that used in previous research, and similar effect sizes were predicted for the current study (Young et al. 2008a). Participants were required to speak English with near-native fluency. This study was approved by the McMaster University Research Ethics Board.
Study design

Upon arrival at the laboratory, participants were briefed regarding the purpose of the experiment, and written consent was obtained. Participants were asked to complete a paper-and-pencil survey containing questions regarding 34 medical conditions. Participants were asked to make four different estimates for each condition:

1. The **seriousness** of each condition (10-point scale): ‘How serious is “X”, where “1” is not at all serious and “10” is very serious’.
2. The **representativeness** of each condition (4-point scale): ‘Please rate how likely it is that “X” would be considered a disease, where “1” is “definitely not a disease” and “4” is “definitely a disease”’.
3. The **population incidence** of each condition (free response to a maximum of 1,000 individuals): ‘Out of an undergraduate population of 1,000 students, how many are likely to contract “X” in the next year?’
4. The **personal risk** of the condition (10-point scale): ‘How much of a risk is “X” to you, where “1” is “not a risk at all” and “10” is “I am guaranteed to get it very soon”’.

While estimates of prevalence or incidence are often used as a measure of perceived risk (Coombs and Slovic 1979; Slovic and Weber 2002), these four questions were asked in order to evaluate the possibility of a more complex influence of media exposure on how individuals conceptualise infectious disease risks. While the questions regarding seriousness, representativeness and population incidence have been used in previous studies investigating the effect of media on perceptions of disease (Young et al. 2008a), this represents the first integration of these ratings with perceptions of personal risk.

While our measure of population risk in terms of incidence (how many individuals are likely to contract ‘X’) does not reflect the population prevalence (the proportion of a given population with a disease at a specific time), we believe that it is a reasonable way to incorporate the uncertainty of a future outbreak into a previously validated item (Young et al. 2008a), in a way that is relatively straightforward for a non-expert population to conceptualise. Similarly, the item chosen to assess personal risk includes estimates of risk and time (rated from ‘not at all’ to ‘I am guaranteed to get it soon’). While again non-traditional, we believe that this question allows us to capture components of personal risk that are relevant in the context of infectious disease. In general, we believe that these measures represent a reasonable attempt to understand perceptions of seriousness, disease representativeness and population and personal risk with regard to possible outbreaks of infectious disease.

Participants were randomly assigned to either a low or high information group, a design used previously in a similar study (Young et al. 2008a), to determine whether the immediate availability of pertinent information about the medical conditions could mediate the effect of media coverage on perceptions of disease risk. In the low information group, participants were asked to answer the questions listed above and were given only the name of the disease. In the high information group, participants were asked to answer the same four questions and were given information regarding symptoms, means of transmission, incidence, mortality and the name of the disease. An example of the information available to the high and low information groups is presented in Table 1.
This study focuses on 10 of the 34 conditions covered in the survey, grouped into five pairs, each containing one condition that frequently appeared in the media and one condition that did not frequently appear in the media. A list of these conditions is provided in Table 2.

Paired illnesses were defined as those which, according to the US Centers for Disease Control and Prevention database (www.cdc.gov/datastatistics/), shared similar vectors of transmission, symptoms, mortality and prevalence. Media frequency was determined by a Lexis Nexus database search within major North American print media sources for the 12 months preceding the completion of testing. The mean print media frequency for high media frequency conditions for the 12 months prior to testing was 1135 (range = 105–3010), and, for low media conditions, the mean print media frequency was 22.2 (range = 0–69). Similar diseases have been used in a previous related study (Young et al. 2008a); however these were updated to reflect recent media reporting trends.

**Data analysis**

*High and low media frequency diseases*

A mixed design analysis of variance was conducted, where the within-subjects comparison of interest was between high and low media frequency diseases. Amount of information provided (high or low information group) was also included as a between-subjects variable of interest.

**Coordination between personal and population risk**

A series of correlations relating estimates of personal and population risk were calculated. Correlations were assessed separately for high and low media frequency conditions and calculated using individual mean responses (i.e. mean response to all

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<th>Lyme disease</th>
<th>High information condition</th>
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<td>Low information condition</td>
<td>Lyme disease: Lyme disease is transmitted by a bite from an infected tick. Symptoms include fatigue, chills, fever, headaches, rash, muscle and joint aches. In the last 10 years, 310 cases have been reported in Ontario.</td>
<td>High information condition</td>
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<th>Table 2. High and low media frequency disease pairs.</th>
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high media illnesses for estimates of personal prevalence and population risk) and independent pairs of ratings (i.e. individual estimates of personal and population risk for disease ‘X’).

Findings

High and low media frequency diseases

Participants considered high media frequency diseases to be more serious (mean = 7.15, SE = 0.31) than the paired low media frequency diseases (mean = 6.00, SE = 0.31; on a 10-point scale) \[F(1,21) = 23.06, p < .001\]. Participants considered high media frequency diseases to be more representative of a disease (mean = 3.12, SE = 0.14) than the paired low media frequency diseases (mean = 2.74, SE = 0.14; on a 4-point scale) \[F(1,21) = 26.41, p < .001\]. Participants predicted that the high media frequency diseases would have lower population incidence (mean = 28.9/1000, SE = 14.0) than the paired low media frequency diseases (mean = 105.4/1000, SE = 19.5) \[F(1,21) = 70.29, p < .001\]. No difference was found for participant ratings of personal risk between the high and low frequency media conditions \(F < 1.5, p = .2; 10\)-point scale).

Role of information group

In general, providing more information about the diseases reduced the effect of media frequency on subjects’ estimations (that is, it reduced the difference in ratings between high and low media frequency diseases). Providing additional information minimised the difference between high and low frequency media diseases in estimates of seriousness \(F(1,21) = 7.5, p < .05\) – see Figure 1, upper panel); estimates of disease representativeness \(F(1,21) = 7.2, p < .05\) – see Figure 1, middle panel) and estimates of population incidence \(F(1,21) = 8.1, p < .05\) – see Figure 1, lower panel). Providing additional information had no impact on ratings of personal risk \(F < 0.5, p = .7\). Though the exact mechanism is unknown, the presence of immediately available information may reduce an individual’s likelihood of relying on their memory of what has been presented in the media (Kasperson et al. 1988), and thereby mitigate the more extreme ratings seen when no additional information is present.

Coordination between personal and population risk

We also examined the correlation between ratings of population incidence and ratings of personal risk, by comparing average ratings of personal and population risk across all diseases separately for high and low media frequency diseases. Using this method, we found a strong correlation \(r(23) = .63, p < .001\) between average judgements of personal risk and population incidence for low media frequency diseases. For high media frequency diseases, we found a moderate and significant correlation \(r(23) = .42, p < .05\). Thus, on average, diseases thought to have a higher population incidence were also thought to pose higher personal risk. This relationship appeared to be weaker for high media frequency diseases than low media frequency ones, but this difference did not reach statistical significance (Fisher’s \(r\)-to-\(z\) transformation, \(z = 0.9, p = .1\)).
Figure 1. Mean participant responses for ratings of seriousness (upper panel), disease representativeness (middle panel) and population risk (lower panel). Data is split by information condition (low information or high information condition), and error bars represent standard error of the mean.
We also examined the correlation between personal and population risk for individual pairings of responses. We found a strong correlation between ratings of personal and population risk for low media frequency diseases \((r(114) = .71, p < .0001)\), and a weaker correlation for high media frequency diseases \((r(114) = .32, p < .01)\). The difference between these correlations was statistically significant (Fisher’s \(r\)-to-\(z\) transformation, \(z = 4.1, p < .0001\)). Providing additional information did not affect the strength of these associations. For low media frequency diseases, the correlation between personal and population risk was: high information condition \((r(64) = .75, p < .0001)\) and low information condition \((r(49) = .73, p < .0001)\); and for high media frequency diseases: high information condition \((r(64) = .40, p < .01)\) and low information condition \((r(49) = .36, p < .01)\).

The correlation statistics employed measure the strength of linear relationships – that is, as estimates of population incidence increase, estimates of personal probability are expected to increase as well. However, previous research has suggested that there may be a ‘dissociation’ between estimates of personal and population risk (Sjöberg et al. 2004), which would imply either no relationship or perhaps a non-linear relationship between these two estimates.

We therefore fit our data using three possible regression models (linear, logarithmic and exponential), for both high and low media frequency diseases. If participants were ‘consistent’ in their estimations, the data would best-fit a linear model, as increases in perceived population risk would have a linear relationship to increases in perceived personal risk. If, on the other hand, individuals overestimate their personal risk at low levels of population incidence but to a lesser degree at higher levels of incidence, this might suggest a more logarithmic model. Finally, if estimates of personal risk are weakly related to population incidence at low levels but more strongly related at higher levels, this would be more consistent with an exponential model.

For the low media frequency conditions, a linear model accounted for the most variance \((r = .71, F(1, 113) = 110.5, p < .001)\) – for example, participants’ ratings of personal risk appeared to increase linearly with estimates of population risk. For the high media frequency conditions, the logarithmic model explained the most variance \((r = .59, F(1, 113) = 72.3, p < .001)\) and performed better than the linear model \((r = .33, F(1, 114) = 16.5, p < .001)\). The logarithmic and linear models are shown in Figure 2. A logarithmic function suggests that ratings of personal risk increase strongly with population incidence at low levels of incidence, but less strongly at higher levels of incidence. This implies that participants may overestimate relative personal risk compared to population risk for diseases thought to be less common. Even when individuals consider population risk (incidence) to be quite low, they still report high levels of personal risk (as can be seen by the cluster of responses near the vertical axis). However, great caution should be taken when interpreting the best model fit, as neither model explains much of the individual variation.

Discussion
This study replicates previous findings suggesting that individuals consider infectious diseases that receive frequent media exposure to be more serious, more representative of a disease, and less likely to pose population risk than comparable low media frequency diseases (Norman et al. 2003; Young et al. 2008a, 2008b). While the precise mechanism is unknown, these results may indicate that individuals
perceive disease severity and representativeness to be inversely related to population risk.

The differences in ratings between diseases frequently and infrequently covered in the media were reduced but persisted when individuals were given additional disease-specific information. Mean ratings of population risk correlated strongly with mean ratings of personal risk for low media frequency illnesses, but this correlation was weaker for the high media frequency diseases.

We found some evidence that, for high media frequency diseases, participants overestimated relative personal risk compared to population risk for diseases thought to be less common. This pattern of findings suggests that high media coverage increases the likelihood that individuals exhibit ‘unrealistic pessimism’, in contrast to the unrealistic optimism typically found in the literature.

Traditionally, unrealistic optimism is examined by comparing perceived personal risk and actual prevalence of a disease in a population (Sjöberg et al. 2004). This methodology may be sound for diseases whose actual prevalence is known, and as a means of assessing how well the media communicate objective facts about disease prevalence. It also reflects what has been called ‘a preoccupation in studies of both old and new media with quality and accuracy and, from the perspective of health professionals, the capacity of inadequate information to mislead an unknowing public’ (Heyman et al. 2010, p. 143). However, this approach does not take into account the likelihood that communication of expert-sanctioned facts may not be the ultimate goal of media. Moreover, it may not be applicable to uncertain future
events, such as the likelihood of a bioterrorist attack, an outbreak of novel influenza or the appearance of an entirely new disease. In these cases, there are no objective ‘facts’ about prevalence or actual population risk to which we can compare individual estimates or media coverage.

We focused our study on the calibration of the relationship between perceived population incidence and personal risk, rather than the relationship between perceived and actual risk. Interestingly, we found a weaker relationship between estimates of personal and population risk for the diseases frequently reported in the media than for those less often mentioned, indicating that a ‘disjuncture’ between perceptions of personal and population risk may have resulted from high media exposure. This lower correlation was not ameliorated by the presence of additional information about symptoms, mortality and prevalence, indicating that the disjuncture may have more to do with the media framing of risk than simply the presence or absence of accurate information about the disease. It appears that this lower correlation between population and personal risk is driven by an over-estimation of personal risk compared to overall population estimates. It is thus possible that frequent media coverage may lead to exaggerated perceptions of personal vulnerability (Kasperson et al. 1988).

Frequent media coverage may introduce a disjuncture between perceptions of personal risk and estimates of population incidence, rather than simply increasing perceptions of risk per se. It is also possible that frequent media coverage reduces individuals’ estimates of the likelihood that a disease will strike the population at large, but increases their estimate of the diseases severity, thus resulting in a relatively constant perception of personal risk. However, this hypothesis remains speculative and our study was not designed to capture the above distinction.

This study has several limitations. Firstly, it relies on responses to a set of 10 diseases selected from the Centre for Disease Control (CDC) database. Use of different diseases may have generated different responses. Secondly, this study represents a small sample, consisting primarily of young, well-educated, healthy college or university students, so results are unlikely to be generalisable. While members of our current study population are typically at low risk for most adverse health events, they are nevertheless a population that could be influenced by outbreaks of infectious disease. Further, we attempted to address these limitations by grounding participant estimates in populations with which they have experience, for example, estimating the prevalence of a disease in a group of their peers. While our population is primarily young and healthy, we have little reason to believe that the same effects would not be present in older populations (Frewer et al. 2002).

An additional limitation concerns the comparison between population and personal risk. Subjects were asked to estimate population incidence for a specific period of time (the next year) and personal risk for a less definite period of time (‘very soon’). Since the timeframes in the two questions differ, comparison between the two may be imprecise – for example, subjects might be less likely to indicate that they were at risk to contract a disease ‘very soon’ than ‘in the next year’. Moreover, estimates of personal risk were strictly relative, whereas the estimates of population incidence were absolute. Further research is necessary in order to more fully understand the relationship between media coverage, and perceptions of personal risk and population risk.

Another possible limitation of this study is that media exposure frequency was evaluated only through assessment of print media, neglecting other pathways
through which individuals may obtain information, including radio, television and the Internet. If some specific diseases systematically receive significantly more coverage in non-print forms of media, our results might have been different.

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