Efficacy of Print Media Risk Communication About Antibiotic Resistance

Author: Malini DeSilva

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Thesis Advisor:
John P. Roche, Ph.D.
Biology Department
ABSTRACT

The growing threat of antibiotic resistance makes it extremely important that citizens be informed about the risks posed by antibiotic-resistant bacteria, and measures with which they can reduce these risks. The print media are major sources of such information for members of the public. In the present study, articles from major newspapers in the United States and Canada appearing between 1998 and 2002 were surveyed to determine the extent to which mention was made of antibiotic resistance and the risks associated with antibiotic resistance, the contextual precision with which this information was communicated, and the extent to which information was presented about causes, and risk-reduction measures, associated with antibiotic resistance. The majority of articles surveyed mentioned antibiotic resistance, but most failed to mention associated risks (i.e., the risk of illness and/or the risk of mortality). Articles that did report risks, did so only at a low level of contextual precision. A relatively low percentage of articles mentioned causes of antibiotic resistance, and even fewer mentioned risk reduction measures. These findings suggest that the print media could improve the efficacy with which they inform the public about issues associated with antibiotic resistance.

INTRODUCTION
The rising level of antibiotic resistant bacteria is a significant threat to public health in the United States (Levy 1992; Lewis 1995; Smith et al. 1999; Maskalyk 2002; Normark and Normark 2002). Antibiotic resistant bacteria pose a wide range of health risks from an increase in infection to death. Infections caused by resistant bacteria are associated with higher rates of hospitalization, longer hospital stays, and higher illness and death rates throughout the world (Holmberg, Solomon, & Blake 1987; Linden 1998; Nordenberg 1998). Antibiotic resistant bacteria are introduced to the environment through random mutations of a bacterium’s genome, which reduce an antibiotic's effectiveness against the bacteria. The development of antibiotic resistance is increased by the exposure of bacteria to antimicrobial agents, such as antibiotics. Antimicrobial agents selectively favor the growth of resistant bacteria by killing all other bacteria, thus allowing the resistant bacteria to flourish (Lewis 1995 and Scheld 2003). Over-prescription of antibiotics, patient non-compliance in taking the full course of antibiotic prescriptions, the use of antibiotics in the agricultural industry, and the use of antimicrobial cleaning products, have all contributed to the increasing incidence of antibiotic resistance (Bren 2001; Levy 2001; Russell 2002; Smith et al. 2002; Trap and Hansen 2002; Vastag 2002). Members of the public have a right to be educated about antibiotic resistance because of the serious personal and societal risks associated with this problem (Simpson et al. 1991).

Risk communication is the science of communicating information about risks to members of the public. Risk communicators face challenges associated with how people perceive risks, and a large body of literature addresses how to increase the public’s understanding of risk (see, e.g., Thompson 1999; Slovik 2000; Covello et al. 2001;
Edwards et al. 2002; Glanz 1996; Mullin 2002). The print media are important vehicles for risk information because people often form much of their impressions of risk magnitudes from media reports (Fischhoff 1985; Kitzinger and Reilly 1997; Quarantelli 1989), and because the media are the most economical vehicle for risk education (Baker 1995). Therefore, on a societal level, it is the responsibility of the media to relay key risks and statistics from health experts to the public so that citizens can make informed judgements about their personal health (Wilkins and Patterson 1987). Two key goals of the media in risk communication are as follows: (1) to inform the public about a particular risk and (2) to inform the public about ways they can help reduce that risk (Mileti and Fitzpatrick 1991).

In relation to the threat of antibiotic resistant bacteria, the public would benefit by being informed by the media that antibiotic resistance is an emerging threat, that antibiotic resistance poses risks of a particular magnitude, and that there are measures that can reduce individual risk. Key risk-reduction measures that could be communicated include the following: (1) antibiotics should only be prescribed for bacterial infections, not those that are viral (Collignon 2002); (2) antibiotics should only be used for serious bacterial infections; (3) once a course of antibiotics is begun, it needs to be taken until all of the prescribed medicine is taken (e.g., not just for a day or two); and (4) when antibiotics are prescribed, they should be chosen to specifically target a particular bacteria as much as possible (Lewis 1995; Levy 1998). In addition, the public could be informed of simple infection-reduction practices such as hand-washing (Pelupessy et al. 2002; Weinstein 2001; Larson 2001).
The misinterpretation of risks by the public is a major problem associated with risk communication. One of the main factors playing into this misunderstanding is faulty personal perceptions of danger by the public (Covello et al. 1989). Personal perceptions are formed by a variety of factors including familiarity, controllability, and understanding of risks, as well as by the context in which a risk is presented (Bogardus et al. 1999; Edwards and Elwyn 2001; Edwards et al. 2002; Gordon-Lubitz 2003). The language used to address risks is troublesome in that it adds to public misinterpretation of risk (Edwards et al. 1998).

Risk information is relayed to the public with varying levels of contextual precision. It is important for the public to be informed about the risks of antibiotic resistance at a high level of precision. Information on risk magnitude can be categorized as being on the qualitative level, numerical level, or numerator/denominator level (Roche 2002; Roche and Muskavitch 2003). Words such as “high”, “low”, “minimal”, or “moderate” are qualitative statements of risk communication. These verbal descriptions are problematic because of the range of meanings associated with each word—individual definitions of a word differ from person to person (Bogardus et al. 1999; Calman 1996a; Calman 1996b; Edwards et al. 2002; Misselbrook and Armstrong 2002). Therefore, qualitative statements communicate risks at a low level of contextual precision, and are of limited usefulness. Simple numerical information (e.g., “ten people became infected”) offers more precision, but lacks the context of a population value (e.g., a denominator) with which to put the risks in perspective. Risks presented in a numerator/denominator fashion—e.g., “three out of 10,000 people became ill”—communicate risks at a high level of contextual precision, and thus assists people in forming a useful understanding of
a particular risk’s magnitude (Griffin 1999; Lynn and Bond 1992; Roche 2002; Roche and Muskavitch 2003; Slovic 1991). The current study focused on analyzing the efficacy with which the print media has informed the public about the problem of antibiotic resistance, the illness and mortality risks associated with antibiotic resistance, the causes of antibiotic resistance, and potential risk-reduction measures associated with antibiotic resistance. Articles from major newspapers in the United States and Canada published between 1998 and 2002 were surveyed to conduct this analysis.

METHODS

We ran a Lexis-Nexis database search for articles using the following guided search criteria: News Category = “general news”; News source = “major papers”; search term in headline = “antibiotics”; and date range = “January 1, 1998 through December 31, 2002.” Articles were selected from the search results if they contained over 250 words, were found in major newspapers in the United States or Canada, and were focused primarily on the topic of antibiotics. Editorials and advice columns were not included. If the same article was published more than once, it was only analyzed once for this study. “Antibiotics,” was chosen as the key word rather than “antibiotic resistance” because the goal of this study was to determine the efficacy of the print media’s communication about antibiotic resistance in all articles about antibiotics, not just those articles focusing exclusively on the issue of antibiotic resistance. Three hundred and sixty-four articles met these search criteria and were surveyed.

Before data collection began, we designed a code sheet and tested it in a pilot study. After the study, the code sheet was refined to simplify the code sheet’s
categorization scheme that. Two more pilot studies were conducted, followed by code sheet adjustments, to ensure the check sheet was as comprehensive and easy to understand as possible.

The check sheet was organized by mention of antibiotic resistance, mention of the risks of antibiotic resistance, mention of risk reduction prevention measures against antibiotic resistance, and mention of additional problems associated with antibiotic resistance. Mention of antibiotic resistance was subdivided into mention of antibiotic resistance on qualitative, numerical, and numerator/denominator levels. This same qualification scheme was used to code the risks associated with antibiotic resistance. There were qualitative, numerical, and numerator/denominator categories for unspecific risks, the risk of human illness, and the risk of human mortality.

Six risk-reduction measures were listed on the code sheet: (1) mention of the risks involved with using antibiotics for infections and illnesses that are not bacterial in nature; (2) mention of the fact that antibiotics should only be used for serious bacterial infections; (3) mention that the antibiotic chosen to fight a certain bacteria should be the most appropriate medicine for the infection; (4) mention that it is important to take the full course of an antibiotic; (5) mention of hand washing as an infection-reducing tactic; and (6) mention of the fact that keeping sick children home can decrease the need for antibiotics in other children.

Six problems associated with the growth of antibiotic resistance were listed: (1) mention of over-prescription of antibiotics by physicians; (2) mention of self-prescription and the sharing of antibiotics; (3) simple mention of the use of antibiotics in agriculture industry; (4) mention that the use of antibiotics in the agriculture industry is a
contributing factor to antibiotic resistance; (5) simple mention of the presence of antibacterial compounds in some soaps/cleaning products; and (6) mention that the presence of antibacterial compounds in some soaps/cleaning products is a contributing factor to antibiotic resistance.

The qualitative, numerical, and numerator/denominator divisions for the mention of antibiotic resistance, the unspecific risks of antibiotic resistance, risks of antibiotic resistance with regards to human illness, and risks of antibiotic resistance with regards to human mortality were chosen to provide an uncomplicated classification system of the print media’s contextual precision. Qualitative information was defined as any non-numerical mention of the topic. Numerical information was defined as information on the number of instances of antibiotic resistant bacteria, cases of human illness, or incidences of human mortality. Numerator/denominator information was defined as information on the above measures that provided both numerator and denominator values (e.g., 25 out of 100 Streptococcus pneumoniae strains were resistant to vancomycin).

After articles had been selected for use in the study, each article was read and mention of specific categories of information found on the code sheet were highlighted. Then, the highlighted areas were matched against the code sheet and marks were placed in the code sheet fields. Finally, the data from each code sheet were entered into a spreadsheet. Each code sheet field was represented on the horizontal axis of the spreadsheet. Articles were identified by the number assigned to them in the Lexis-Nexis search. These numbers, along with the date the article was published, were entered for article identification on the vertical axis. After all code sheet data had been entered into the spreadsheet, each article was reread to ensure all fields that were represented in the
article had been checked on the code sheet, and then all code sheet checks were cross-referenced with the spreadsheet data to confirm complete accuracy of the data set.

**RESULTS**

Seventy-four percent of newspaper articles mentioned the problem of antibiotic resistance at the qualitative level, 6% mentioned antibiotic resistance at the numerical level, and 20% mentioned antibiotic resistance at the numerator/denominator level (Figure 1). Thirty eight percent of articles provided a qualitative mention of the risks of human illness associated with antibiotic resistance, but only 7% mentioned human illness with a numerical level of precision, and only 11% mentioned human illness at the numerator/denominator level (Figure 2). The percentages of articles mentioning the risk of human mortality from antibiotic resistant bacteria were 16%, 7%, and 1%, respectively, at the qualitative, numerical, and numerator/denominator levels of precision (Figure 2).

Figure three shows the percentage of articles that mentioned the presence of antibiotic resistance at varying precision levels and also mentioned the risks of antibiotic resistant-associated human illness at different precision levels. The highest percentage of articles mentioning both variables (38%,) was found for articles that provided qualitative information on both the presence of antibiotic resistance and the risk of human illness. Twelve percent of the articles mentioned the presence of antibiotic resistance at the numerator/denominator level while mentioning the risk of human illness at the qualitative level. Eleven percent of the articles mentioned antibiotic resistance qualitatively and the risk of human illness at the numerator/denominator level. Less than 10% of the articles
mentioned both antibiotic resistance and the associated risks in other precision combinations. Articles that mentioned antibiotic resistance qualitatively seemed to mention risks associated with antibiotic resistance more often than articles that mentioned antibiotic resistance either at the numerical level or the numerator/denominator level. Articles that mentioned antibiotic resistance at the numerical level had the lowest concurrent mention of associated risks.

Figure 4 shows the percentage of articles that mention both the presence of antibiotic resistance at varying levels of precision and the risks of human mortality associated with antibiotic resistance at different precision levels. The highest percentage of articles mentioning both the presence of antibiotic resistance and the risk of human mortality associated with antibiotic resistance occurred when both factors were mentioned qualitatively (16%). Numerical mention of antibiotic resistance along with the mention of associated risks was very low at all precision levels. Numerator/denominator mention of antibiotic resistance associated risks of human mortality along with the mention of the presence of antibiotic resistance was negligible.

In terms of factors that contribute to the problem of antibiotic resistance, 30% of articles mentioned that antibiotics are sometimes over-prescribed by physicians and 6% mentioned self-prescription or the sharing of antibiotics by individuals. Twenty four percent of articles mentioned that antibiotics in livestock and agriculture contribute to antibiotic resistant bacteria, but only 2% of articles mentioned that antibiotic soaps could contribute to antibiotic resistance (Figure 5).

Figure 6 illustrates the percentage of articles mentioning measures people can take to reduce the spread of antibiotic resistant bacteria. The percentage of articles
mentioning that antibiotics are only effective against bacteria (e.g., not viruses) was 22%. The percentage of articles mentioning that it is important to take the full course of an antibiotic prescription was 10%. Only 3% of articles surveyed mentioned that antibiotics should be taken for serious illnesses only, and only 8% mentioned that specific antibiotics should be chosen to combat specific bacterial infections. Five percent of the articles mentioned hand washing.

Figure 7 depicts the overlap of risk reduction measures mentioned in the articles surveyed. Forty three percent of articles surveyed mentioned at least one of the four risk reduction measures listed in figure 6, 12% of articles mentioned any combination of two measures, and only 2% mentioned three measures. No articles mentioned all four measures.

**DISCUSSION**

The general population will not feel compelled to reduce the threat of antibiotic resistance in their lives unless they are informed about the risks and prevention strategies related to this danger. The present study has shown that the print media were effective in communicating the emergence of antibiotic resistance to the public between 1998 and 2002. However, the print media presented antibiotic resistant bacteria-associated risks at a low level of contextual precision. The fact that the majority of articles that gave any mention of antibiotic resistance associated risks did so qualitatively rather than at the numerical or numerator/denominator levels indicates that the print media in failed to communicate a precise perspective on antibiotic resistance risks to the public from 1998
to 2002. In addition, fewer than half of the articles mentioned risk-reduction measures and fewer than 15% of articles included two or more risk-reduction measures.

The majority of articles surveyed did not mention the risks associated with antibiotic resistance concurrently with mentioning the presence of antibiotic resistant bacteria. The failure of journalists to tie the presence of antibiotic resistance to the risks associated with antibiotic resistance shows a flaw in the risk-communication chain. Without knowledge of related risks, the mention of antibiotic resistance will not convince the public that the problem of antibiotic resistance is a real threat.

Mirroring the general mention of antibiotic resistance, a majority of the articles that mentioned the risks associated with antibiotic resistance did so qualitatively rather than quantitatively. Numerical mention of the risk of antibiotic-resistance induced illness, and numerical mention of antibiotic-resistance induced mortality, were both found in under 10% of articles surveyed. As was noted in the introduction, risks stated in a numerator/denominator fashion, in which the numerator represents the number of individuals affected and the denominator denotes the size of the population at risk, are more helpful than risks given either qualitatively or numerically. Less than 15% of the surveyed articles presented risks at the numerator/denominator level, and so most articles did not present risk information in the most useful possible format.

The data from this study show that the print media displayed mixed success in their attempt to inform the public about the causes of antibiotic resistance. Thirty percent of articles mentioned over-prescription of antibiotics and 24% of articles mentioned the use of antibiotics in the agricultural industry as factors contributing to antibiotic resistance. This is encouraging because it shows that the print media were focusing on
two factors that experts have identified as major contributors to antibiotic resistance (Levy 1992; Schmidt 2002; U.S. Senate 1999). The other key contributing factors, however, self-prescribing antibiotics and the use of antimicrobial cleansing products, were mentioned in only 6% and 2% of the articles, respectively.

In addition to the low percentage of articles that mentioned factors contributing to antibiotic resistance, Figures six and seven show that the majority of articles did not inform the public about the most important personal risk-reduction methods. The only risk reduction method mentioned in more than 10% of the articles was that antibiotics should only be used when treating a bacterial infection (22% of articles). Probably the easiest personal risk reduction method to put into practice, hand washing, was mentioned in only 5% of the articles. This is of particular concern because by reducing bacterial infections, hand washing could reduce the number of antibiotic prescriptions, and would offer the added benefit of reducing non-bacterial infections as well.

Whereas it is important to note that nearly half of the articles mentioned one risk-reduction method, less than 15% mentioned more than one measure. This shows a commendable attempt by the media to inform the public about things people can do to slow the spread of antibiotic resistance. However, because multiple risk-reduction strategies are found in few articles, the public received only a subset of important information. The small number of articles that provided insight into the factors that promote growth of antibiotic resistance, or steps individuals can take to slow the rise of antibiotic resistance, is disturbing because the media is the most efficient tool with which to inform the public learns about health issues and antibiotic resistance is a severe and expanding health threat.
This study investigated only the prevalence and precision with newspapers reported on antibiotic resistance and its risks, and the extent to which they reported on associated causes and risk-reduction measures; it did not assess the separate issue of the accuracy of information provided by newspaper articles. In addition, the distribution of newspapers surveyed was not taken into account. Therefore, the number of readers who might have potentially been influenced by a certain article is unknown. For example, if newspapers with wide distributions, such as the New York Times, carried more articles containing a greater amount of information about antibiotic resistance than less widely circulated periodicals, a larger percent of the population would in theory have access to that information. Investigations of these factors would be excellent subjects for further risk communication studies.

Framing effects are another aspect of risk communication upon which this study did not focus. The frame through which a risk is viewed can skew the way a risk is perceived. Framing manipulations are created by presenting logically equivalent risks in different ways, (e.g., saying either “the risk of dying is 1 in 100” or, “the survival rate is 99%,”). Whereas the information in these two statements is equivalent, by altering the frame used, the statements create different perceptions of risk. Studies of framing manipulations have shown that loss and negative framing, giving the possible losses or chance of death associated with a certain action, has a greater deterring effect on people than gain or positive framing, which illustrates the gains or chance of survival of a risk. An investigation of the framing effects used in the media when addressing antibiotic resistance risks combined with public perceptions of the risks of antibiotic resistance would be another interesting topic for future study.
Many experts on risk communication acknowledge the need for a common language for risk assessment. The most often cited model for this common language is the Calman Scale in which already prevalent risk related terms such as “high,” “moderate,” and “minimal” are explicitly linked to pre-determined risk ranges such as “high” = risk of 1:100, “moderate” = risk of 1:100 – 1:1000, and “minimal” = 1:100,000 – 1:1,000,000. Agreement on very specific bounds for risk terms by health officials and the media would simplify the now complicated and ambiguous language of risk. The definitions provided by such a system would also allow for graphical and other visual displays of risk, which would help reduce undue anxiety about very small risks, while alerting the public to real, menacing threats. Another commonly mentioned tool for risk communication that would aid in the general public’s assessment of risk is comparing a given risk with well-known, everyday risks (Covello et al. 2001). Comparisons with familiar risks help contextualize the magnitude of less familiar risks. Perhaps, the combination of words, numerator/denominator values, and examples from everyday life would provide the greatest understanding of risks by the public (Bogardus et al. 1999).

In conclusion, from 1998 to 2002, major newspapers did a commendable job of informing the public about the emergence of antibiotic resistance. They could improve, however, by presenting more contextually precise information about the incidence of antibiotic resistance and the risks associated with antibiotic resistance, and could be more thorough in reporting ways in which people can reduce the risks of antibiotic-resistant bacteria. They could be aided in this goal by close interaction and assistance from scientists and public health experts, who share in the responsibility of informing the public about public-health issues (Greenwood and Riordan 2001).
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REFERENCES:


**FIGURE LEGENDS:**

**Figure 1:** Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that mention the presence of antibiotic resistance at different levels of precision.

**Figure 2:** Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that mention the risks of human illness and the risks of human mortality associated with antibiotic resistance at different levels of precision.

**Figure 3:** Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that concurrently mention the presence of antibiotic resistance at different levels of precision with the risks of human illness associated with antibiotic resistance at different levels of precision.

**Figure 4:** Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that concurrently mention the presence of antibiotic resistance at different levels of precision with the risks of human mortality associated with antibiotic resistance at different levels of precision.

**Figure 5:** Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that mention factors contributing to antibiotic resistance.
Figure 6: Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that mention key personal risk reduction measures.

Figure 7: Percentage of articles from major newspapers in the United States and Canada between 1998 and 2002 (N = 364) that mention at least one, two, or three key personal risk reduction measures.
Figure 1: Mention of Antibiotic Resistance
Figure 2: Mention of Risks of Antibiotic Resistance

- Risk of Human Illness
- Risk of Human Mortality

Percentage of Articles

- Qualitative
- Numerical
- Numerator/Denominator
Figure 3: Concurrent Mention of the Presence of Antibiotic Resistance and the Associated Risk of Human Illness
Figure 4: Concurrent Mention of the Presence of Antibiotic Resistance and the Associated Risks of Human Mortality
Figure 5: Mention of Factors Contributing to Antibiotic Resistance
Figure 6: Mention of Personal Reduction Measures
Figure 7: Overlap of Personal Reduction Measures