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Impact of Media Messages on Public Opinion: A Case Study of Severe Acute Respiratory Syndrome

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Abstract

Objective: To determine the effects of agenda-setting and framing on the public's evaluation of different frames relevant to Severe Acute Respiratory Syndrome (SARS). The volume and issues mentioned in the media messages were examined to understand the public's perception and awareness of the disease.

Methods: A content analysis of newspaper reports on SARS was performed. Analyses of public opinion data collected by the Harvard School of Public Health, the Robert Wood Johnson Foundation and the Pew Research Foundation were also performed. We then performed a correlation analysis of media coverage about SARS with the survey data.

Results: The results of the analysis substantiate the hypothesis that frames represented predominantly in the media will influence public opinion. The correlation analysis revealed a correlation between the economic frame and the percentage of positive responses expressing worry about being exposed to SARS. A very small negative correlation was found between the biomedical frame and overall worry about the disease.

Conclusion: Framing and agenda-setting are essential in bringing the public's attention to issues and in creating an initial awareness of the issue. However, it was observed that perceptions of relevance mediated the public's response. Thus, successful efforts to limit the spread of SARS in the United States may have reduced Americans' perceptions that the biomedical frame was relevant, compared with the economic frame.

Keywords: Severe acute respiratory syndrome; Media; Frame; Economic; Biomedical; Human rights; Security

Introduction

On March 15, 2003, the World Health Organization (WHO) issued a global alert and emergency guidelines for airlines and travelers about a new atypical pneumonia of unknown etiology affecting people in China, Hong Kong, and Vietnam. It was considered a deadly respiratory disease with the potential of developing rapidly into a global pandemic. By March 24, 2003, the Centers for Disease Control and Prevention (CDC) confirmed that Severe Acute Respiratory Syndrome (SARS) was caused by a new strain of virus (the coronavirus) most frequently associated with upper respiratory infections. Both the local and international media reported extensively on the disease. According to the WHO, 8,098 people worldwide became sick with SARS during the 2003 outbreak, and 774 of those affected died. In the United States, only eight people had laboratory evidence of SARS-corona virus infection. All of these people had traveled to other parts of the world where SARS was present. By the end of June 2003, no new cases were reported, and the WHO declared the global outbreak to be over. "With the last known chain of transmission interrupted in Taiwan, the whole world can breathe an initial sigh of relief," said Dr. David Heymann, the WHO executive director for the Communicable Diseases Cluster. The number of newspaper stories about SARS decreased when the WHO withdrew its travel alerts towards the end of June.

Throughout the outbreak, the media reported on the biomedical aspects, economic consequences, security concerns, and human rights issues related to the disease. SARS was recognized by the WHO as the first severe infectious disease to emerge in the twenty-first century. In an age of travel and increased global trade, it spread at an alarming rate from Asia to other parts of the world. It was seen as a mysterious disease that spread very efficiently from person to person, and there was no known vaccine or cure for the disease. As leading laboratories and public health practitioners devoted themselves to understanding the cause of SARS and to researching the genetic sequence of the coronavirus that was thought to cause it, newspapers reported overwhelmingly on the biomedical aspects of the disease and the prospects for a cure. Medical news was notably dominant throughout the outbreak. Certain events, such as the WHO's global health alert and advisories against traveling to many countries, led to increased news reporting. The following news story, which appeared on April 7, 2003, in The New York Times, discusses the medical aspects of the disease:

Public anxiety about SARS appears to be increasing, with a hotline at the federal Centers for Disease Control and Prevention in Atlanta

receiving more than 1,000 calls a day late last week. People of all ages have caught SARS. The illness typically starts like any other acute respiratory infection: with a fever, chills, headache, malaise, and dry cough. Chest X-rays tend to show what doctors call "atypical pneumonia" in a lower lobe of a lung. In the following days, a victim may develop difficulty breathing as the pneumonia spreads to another lobe. About five to seven days after onset, the symptoms improve in about 80 to 90 percent of patients and worsen in the remainder. Many of the sickest patients require intensive care, even to the point of being connected to a respirator. Why some people improved, and others die is not known. So far, it appears that people most susceptible to severe symptoms are 40 or older, and those who have had a chronic disease in the past. Aside from regular nursing care and help in breathing, there is no effective treatment, and recovery seems to depend on a patient's immune system. No one is certain what causes SARS, but a microbe known as a coronavirus is the chief suspect, most likely a new strain that originated in Guangdong province [1].

At that time, there was no vaccine or treatment for SARS, and the disease was extremely contagious. There were reports in the newspapers of people stigmatizing and discriminating against people infected by SARS. Such stories were reported mainly from countries such as Hong Kong, China, and Canada, where SARS was more widespread. In the United States, debates about the linkage between human rights and SARS centered on the issue of isolation and quarantine. In the absence of a vaccine and a definite cure for SARS, the media in the United States widely endorsed the views of the CDC and the WHO that the best way to stop the spread of this contagious disease was to practice isolation and quarantine. On April 4, 2003, United States President George W. Bush issued an executive order that added SARS to the CDC's list of quarantinable diseases. This order gave the CDC the authority to isolate persons who might have been exposed to the disease. This drew protests from civil rights activists, who argued that such laws might curtail peoples' civil liberties. The following news story that appeared in The New York Times is illustrative of the debate that ensued:

A lesson of the SARS outbreak is that we in the United States need to compromise on civil liberties to confront health risks more effectively. After 9/11, the Bush administration wisely pushed a Model Emergency Health Powers Act as a template for legislation by the states. Such legislation would permit governors to respond to health crises with a state of emergency in which they could impose quarantines, order vaccinations and the destruction of dangerous property, limit people's movements and ration medicine, and seize anything from dead bodies to private hospitals. The steps are tough and sobering but would apply only in desperate circumstances and within safeguards. So far, only 22 states have passed this kind of law, and California, New York, and Texas have all spurned it. One main obstacle has been shrieks of protest by civil libertarians, whom I am usually sympathetic to but not this time. Aside from terrorism, 30 new diseases have popped up in the last quarter-century, from avian flu to AIDS. This is an age of global disease when viruses flit across continents. If you disagree, how about if I visit your neighborhood the next time, I'm back from an Ebola outbreak in Congo and feeling feverish?

According to the CDC website, because there was limited transmission of the SARS virus, neither individual- nor population-based quarantine was recommended. Therefore, the issue of SARS as a threat to human rights was not as prominent as the biomedical and economic news about SARS. As SARS hit Asia and Canada in June 2003, there was tremendous economic fallout, as these countries had extensive commercial links with the rest of the world. The spread of SARS disrupted retail, manufacturing, trade, tourism, and travel. The media reported extensively on the economic consequences of the disease both during the outbreak and in the period following the outbreak: SARS is not just a health problem. As fear and shutdowns curtail travel, it is devastating the Asian economy. It may seem heartless to look at a terrifying disease, for which there is neither a vaccine nor a cure, through the lens of cash. But as widespread suffering has failed to persuade leaders in both poor and rich countries to finance public health, perhaps an economic argument will carry more weight.

In fact, in the two months after the SARS outbreak, the economic frame became the dominant frame. Newspapers reported extensively on losses suffered by airlines and the retail and manufacturing sectors. In October, there was a renewed interest in SARS in the media because it was anticipated that SARS might reemerge during the influenza season. News stories that gave information on preparedness efforts of the CDC, the WHO, virologists, and laboratories around the world were published in newspapers. At this point in time, there was a renewed emphasis on the discussion on SARS with a focus on scientific and medical issues. SARS emerged in the aftermath of the events of September 11, 2011, the anthrax scare, and growing concern among policymakers in the United States about the malicious use of microbes by rogue states and terrorist groups. The security frame, however, was not one of the dominant frames during or after the SARS outbreak. Newspapers published a few news stories that called SARS a threat to regional and national security in Asia, and in the United States some public health officials and scientists raised fears about bioterrorism [2].

Some news reports called for greater surveillance "to protect against the growing danger of potentially devastating pandemics, either occurring naturally or because of bioterrorism." According to the Washington-based Jamestown Foundation, at least one Russian scientist has suggested a link between SARS and bio-war, but the mainstream media did not pick up this story. In other words, the mainstream media in the United States did not link SARS with bioterrorism. In fact, there were only a few stories that framed SARS as a security threat. For example: SARS, a respiratory infection with an overall death rate of 11 percent and one 50 percent or higher among people 60 and older, is of paramount concern. The longstanding threat of bioterrorism turned real with the deliberate release of anthrax spores in 2001. When SARS suddenly appeared, there was speculation that it was bioterrorism. Experts dismissed that. No one was "smart enough to invent a SARS from scratch," said Dr. Joshua Lederberg, a Nobel Prize-winning microbiologist. Now, he said, "SARS may end up being a biological weapon. No one knows when or where the next plague may be from a newly discovered infectious agent or a natural mutation that produces a new version of an old microbe. It may even escape from a laboratory."

The examples from news reports cited above show that the media not only extensively covered the SARS outbreak, but it also framed SARS in different ways. The volume and nature of media messages, therefore, need to be examined to understand its impact on public perception and awareness of SARS. The remainder of this paper is divided into four parts: The first part presents the results of the content analysis of newspaper reports on SARS. The second presents an analysis of public opinion data collected by the Harvard School of Public Health (project on the Public and Biological Security) and the

Robert Wood Johnson Foundation. These data were retrieved from the Kaiser Family Foundation's Health Poll Search database. Additional data were collected from surveys conducted by the Pew Research Center. The third section reports a correlation analysis of media coverage about SARS with survey data. Finally, the fourth section discusses the effects of agenda-setting and framing on the public's evaluation of different frames relevant to SARS.

Content Analysis of Newspaper Reports

To investigate in detail the prominence and content of news coverage of SARS, We conducted a content analysis of news stories about SARS published in The New York Times and The Washington Post. Using the Lexis-Nexis academic database, we collected news articles between March 1, 2003, and December 30, 2004. The search stipulated that the term "SARS" must be present in the "headline or lead paragraph" with "at least three occurrences" in the article to ensure that SARS was the focus of the article. Obituaries were excluded from the search process. The New York Times returned 550 stories in the time period March 16, 2003, and June 26, 2004, and The Washington Post returned 370 stories between March 20, 2003, and May 5, 2004. Because the stories returned by Lexis-Nexis were not ordered in any way other than by date, every fourth story was included in the pool. A total of 224 news stories were coded. The stories were identified, sampled, and coded for different frames (biomedical, economic, human rights, and security) included in the stories. Table 1 shows the total number of articles (coded) for each newspaper and for the two newspapers combined. In further analysis, news data from both newspapers were combined.

Each news article was coded at the sentence level. Each frame was considered to be a variable and was assigned a numerical value based on the number of times the frame was mentioned in a given news article. For example, if the biomedical frame was mentioned twice, it was given a score of 2. This numerical score was then converted into a weighted measure for each frame, which is defined as the ratio of the number of times a given frame is mentioned in the news article and the total number of sentences in the news article. The weighted measure was used primarily for two reasons: 1) to normalize the measure so that it is comparable across news articles of varying lengths, and 2) to allow comparison of the relative scores across frames in a given news article.

Newspaper	Number of articles	Start date	End date
The New York times	136	3/16/03	6/26/04
The Washington post	88	3/20/03	5/1/04
Overall	224	3/16/03	6/26/04

Table1: Data sources and overall coverage.

The stories also were coded as follows for the region or country that was the focus of the story: USA, countries other than the USA, global impact, or geographic region not mentioned. As SARS spread to different geographic regions of the world, local and international media covered the epidemic. Table 2 shows the frequency of the analyzed articles that were related to each geographic location. Both newspapers published more stories about the impact of SARS on Asia and countries other than the United States to which SARS had spread than about its impact on the United States. This fact is important in understanding the public reaction to SARS in the United States. More than half the stories in both newspapers discussed the impact of the spread of SARS in Asia and Canada. Only 26% of the total coverage discussed the impact of SARS on the United States. Seventeen percent of the total news coverage, however, discussed the global impact of SARS in an increasingly interconnected world [3].

Newspaper	Geographic location					
	United States	Other countries	Global impact	Not mentioned	Start date	End date
The New York Times	36 (25.2%)	83 (58.0%)	22 (15.4%)	2 (1.4%)	3/16/03	6/26/04
The Washington post	24 (28.9%)	41 (49.4%)	18 (21.7%)	0 (0.0%)	3/20/03	5/1/04
Overall	60 (26.5%)	124 (54.9%)	40 (17.7%)	2 (0.9%)	3/16/03	6/26/04

Table 2: Frequency of news content by geographic location.

Data Analysis

The mean ratios of four coverage types/newspapers: The data were analyzed using descriptive statistics as well as comparative statistics such as Analysis of Variance (ANOVA). All analyses were conducted using Excel and SPSS. The data were analyzed in great detail to evaluate the pattern of coverage and to understand changes in media coverage over time. News data overall (The New York Times + The Washington Post) were analyzed for type of coverage (Table 3), mean ratios of coverage type for regions coded (Table 4), and comparison of coverage during and after the outbreak (Table 5). To investigate the monthly and weekly trends in newspaper coverage of SARS, the data were further analyzed using monthly (Figure 1) and weekly intervals (Figure 2; Table 6). Because the news articles were coded for content or type of coverage and weighted for length, the news data were further analyzed with a focus on different types of coverage. Table 3 displays the mean ratios for all four types of coverage. The biomedical and economic frames were the most prominent in news reports about SARS.

Number of articles	Frame					
	Biomedical	Economic	Security	Human rights	Start date	End date
224	0.366	0.154	0.04	0.026	3/16/03	6/26/04

Table 3: Mean ratios for each coverage type in both newspapers combined.

Mean ratios of the four coverage types also were computed for each region for the overall sampled period (Table 4). The biomedical frame was the dominant frame in news reports that discussed the impact of SARS on the United States and on other countries. The economic frame was the second most prominent frame. The security and human rights frames were less important.

Region	Biomedical	Economic	Security	Human rights	Time interval

USA	0.27	0.17	0.05	0.06	3/16/03-6/26/04
Other countries	0.36	0.19	0.04	0.02	3/20/03-5/1/04
Global impact	0.46	0.09	0.04	0	3/16/03-6/26/04
Not mentioned	0.67	0	0	0	3/16/03-6/26/04

Table 4: Mean ratios for coverage type by region.

Further analysis of the media data on SARS included comparing the four frames over the entire time period to determine whether the media coverage focused primarily on one of the four frames or on a few or all of the four frames and determining if there was a difference in the relative weight of these four frames during the SARS outbreak and after it was over. The analysis was performed by breaking the total sampling period into two phases: the period of the outbreak (March 16-June 30, 2003) and the period after the outbreak (July 1, 2003-June 26, 2004).

A one-way ANOVA was used to test for differences in the ratios among the four frames over the entire sampling period, during the outbreak, and after the outbreak (Table 5). During the entire sampling period, the least-squares mean values were 0.37, 0.15, 0.04, and 0.03 for the biomedical, economic, security, and human rights ratios, respectively. The least-squares mean is the best linear unbiased estimate of the subpopulation means. It thus represents the relative weight of each frame in media coverage. Comparison among the least square means values of the four frames revealed that the biomedical ratio was the most prominent frame ($p<0.0001$). The economic ratio was the second highest, and it was significantly higher than the security and human rights ratios ($p<0.0001$). Thus, all pairwise comparisons are significant at the $p<0001$ levels except for the comparison of the amount of human rights and security coverage (which did not differ significantly) and the medical and economic coverage (which differed with a significance level of $p<0.002$). The human rights ratio and security ratios did not significantly differ, and both were minimal compared to the economic and biomedical ratios.

Least square mean of the four frames				
Sampled period	**Economic**	**Human right**	**Medical**	**Security**
Entire sampled period 3/16/03-6/26/04	0.15	0.03	0.37	0.04
During outbreak (3/16/03-6/30/03)	0.15	0.03	0.38	0.05
Post outbreak (7/1/03-6/26/04)	0.18	0	0.32	0.02

Table 5: Comparison of the four frames over the entire sampling period.

To determine whether the relative weight of these four frames in media coverage showed similar patterns during the SARS outbreak and after it, the analysis was performed separately for these two periods. During the SARS outbreak (March 16, 2003-June 6, 2003), the least squares mean values of the biomedical, economic, security, and human rights ratios were 0.38, 0.15, 0.05, and 0.03, respectively. The biomedical frame again was the dominant frame, and its ratio was significantly higher than those of the other three frames ($p<0.0001$). The economic ratio was the second highest, and it was significantly higher than the security and human rights ratios. The security and human rights ratios were both minimal and did not differ significantly. During the post-outbreak period (July 1, 2003-June 24, 2004), the same relative ranks were maintained. The only difference in the post-outbreak period was that the least squares mean value for the biomedical frame decreased slightly (from 0.38 to 0.32), and the value for the economic ratio increased slightly (from 0.15 to 0.18). These changes in value occurred because media coverage shifted from the biomedical issues to the economic fallout of the disease as estimates of losses were made after the outbreak. Overall, for both phases, the biomedical frame was the predominant frame, followed by the economic frame. Both security and human rights frames were less significant in the news coverage of SARS, with the human rights ratio being the smallest among the four frames.

Changes in media coverage over time

The changes in media coverage in terms of the number of articles published (including ratios of the four frames) were summarized using monthly and weekly intervals over the course of the outbreak period to examine the trends at a much more detailed level. During the entire sampling period, there were, on average, five articles about SARS per week. The period from April 13 to May 24, 2003, was one of "saturation coverage." During this period, the level of coverage jumped to four times the average level, with each newspaper publishing as many as 25 articles about the spread of SARS. Figure 1 shows the monthly trend of changes in frames. The SARS timeline of key events is also plotted in the graph to show the key events that triggered a change in the nature of media coverage. The figure illustrates that the biomedical and economic frames were the two dominant frames in media coverage. In contrast, the security and human rights frames were much less prominent in the media coverage. On March 12, 2003, the WHO issued its first global alert about SARS. At the same time, the biomedical frame dominated about half of the media coverage (ratio=0.48) over the entire month. When news about the biomedical aspects of the disease declined, the economic impact and the losses incurred by countries due to SARS began to be widely reported [4].

By the beginning of June, the economic frame exceeded the biomedical frame and became the prominent frame for about two months. After the beginning of August 2003, the biomedical frame again exceeded the economic frame and remained the dominant frame throughout the remainder of the study period. The monthly average of the biomedical, economic, security, and human rights ratios were 0.11-0.52, 0.00-0.43, 0.00-0.08, and 0.00-0.04, respectively. Notably, the biomedical ratio was at its lowest levels when the economic ratio climbed to its highest levels for one month beginning on July 16, 2003. The decline in SARS-related biomedical news could have been triggered by the WHO's announcement in July that SARS had officially been contained worldwide and that no new cases were being reported. As SARS was no longer a health emergency, the media coverage shifted its focus from biomedical coverage to the economic impact of the disease.

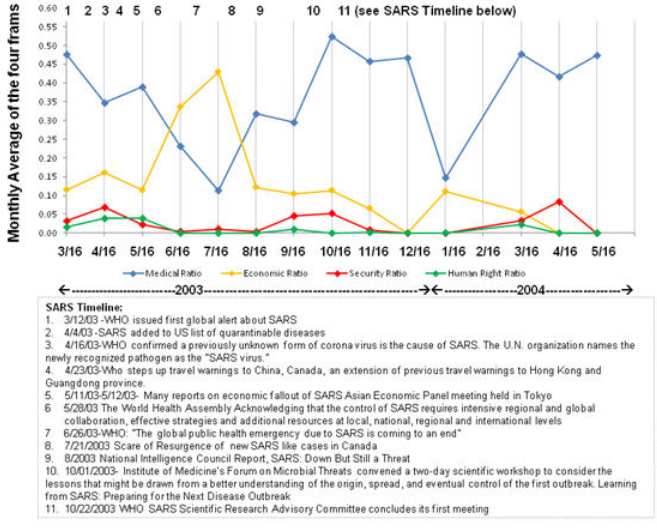

Figure 1: Changes in media coverage over time at monthly intervals.

The same analysis was conducted at weekly intervals, and the change over time plot (Figure 2) clearly shows three sub-periods. The first phase encompassed the period of the intense outbreak and rapid spread of the disease from Asia to other parts of the world. The biomedical frame was the dominant frame during this entire period. The second phase took place from the second week of June to the end of August. During this time period, both the CDC and the WHO began to lift their travel advisories against countries in Asia, as no new SARS cases were reported. Despite the lack of new cases, the media continued to actively report on SARS, particularly the economic and political impact of the disease. During this phase, there was a shift in media framing, and the economic frame became the dominant one. In this phase, the mean ratio for the economic frame was the highest, and it exceeded the biomedical frame. In both the first and second phases, few stories reinforced the human rights and disease linkage or framed SARS as a security issue. The third phase in this analysis began around the end of August 2003 and ended in June 2004. During this period, biomedical issues once again dominated the media stories about SARS. This is because most media stories discussed the efforts of the WHO, the CDC, and scientific committees around the world to be prepared in case SARS returned in the winter to coincide with influenza.

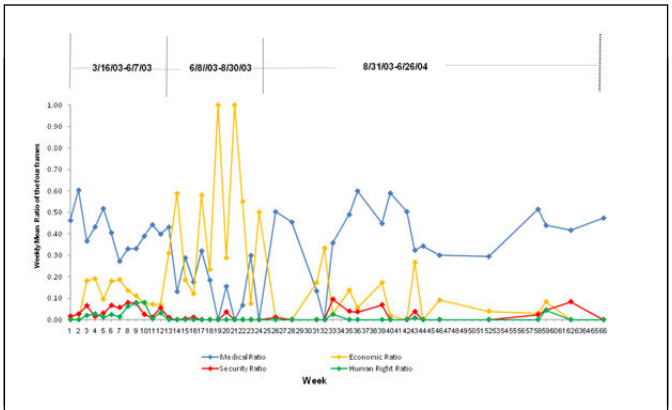

Figure 2: Changes in media coverage over time at weekly intervals.

The media coverage over time (weekly trend) was further analyzed using ANOVA followed by Tukey's test. The test indicated that the biomedical frame was the dominant frame during the first phase (Table 6). The economic and biomedical frames were equally prominent during the second sub-period, as no significant differences were found between them (p=0.7194); the least squares mean value for the economic frame, however, was higher than that for the biomedical frame (0.32 vs. 0.25). Significant differences existed between each pairwise comparison, except for security versus human rights.

Least square mean of the four frames				
Sampled period	**Economic**	**Human right**	**Biomedical**	**Security**
Sub-period 1 (3/16-6/7/03)	0.13	0.04	0.38	0.05
Sub-period 2 (6/8/03-8/30/03)	0.32	0	0.25	0.01
Sub-period 3 (8/30/03-6/26/04)	0.13	0	0.36	0.02

Table 6: Comparison of four frames during the three phases (weekly trend).

Public opinion analysis

The public opinion surveys were drawn from a secondary database corresponding to the time period in which these news stories were published. Public opinion data were collected mainly from the I Poll data bank, Polling the Nation, and the Health Poll Search of the Kaiser Family Foundation. All three are databases contain polling data on health-related issues from major polling organizations such as Gallup, The Pew Research Center, and the Harvard School of Public Health. All survey results are based on representative national samples of adults aged 18 or older. With very few exceptions, the sample sizes of these surveys were at least 1,000 respondents. Shifts in public opinion towards infectious diseases were assessed by considering exact and similarly worded questions about issues related to SARS. Specifically, these questions measured the following: a) willingness to support harsh public health measures such as quarantine to curb the spread of disease; b) precautionary steps taken and behavioral changes made in personal lives due to fear of the disease; and c) concerns about the spread and likelihood of contracting the disease. Positive responses to these questions would indicate a higher level of awareness and concern about the disease in response to media coverage of SARS.

The data were analyzed using descriptive statistics. A z-test was used to compare the proportion of subjects who responded positively or negatively in each survey. Survey responses were grouped together to form positive or negative responses. For example, survey responses such as "very worried" and "somewhat worried" or "extremely likely" and "very likely" were grouped together. All analyses were carried out using Excel and SPSS. Z-test scores > the absolute value of 1.96 at the 95% confidence interval were considered to be statistically significant. Four sets of questions were examined in the category of willingness to change behavior and support quarantine. All four surveys were conducted in April 2003 and repeated in May 2003. Three sets of questions were about the public's willingness to support quarantine.

More than 90% of the surveyed population supported quarantine, and over 80% of the sampled population did not see it as a threat to their rights. Moreover, the percentage of responses (positive or negative) did not vary much when the surveys were repeated in May (± 2%). In the fourth survey, respondents were explicitly asked if they were more likely to seek medical help if they or their families experienced flu-like symptoms. Sixty-nine percent of the surveyed population gave a positive response. According to z-test results, a significant number of people supported quarantine. This likely is related to the increased news coverage presenting SARS as a highly infectious disease both prior to and at the time the surveys were conducted.

Nine survey questions related to actual behavioral changes made also were examined. The respondents were surveyed between April 11 and 13, 2003. The same sets of questions were repeated in another survey conducted between May 2 and 6, 2003. The average percentage of positive responses dropped from 12% to 8%, and the average percentage of negative responses increased from 87% to 91% between surveys in April and May. A significantly higher percentage of people did not change their behavior. Thus, news of the spread of SARS did not bring about changes in the daily behavior of people. This may be partly attributed to the fact that news of the SARS outbreak was reported mainly in China, Southeast Asia, and Canada. In the United States, only eight people were confirmed to have SARS based on laboratory tests, and no one died from it. Thus, very few people in the United States contracted SARS. This was in sharp contrast to the large number of reported cases in other countries.

Three sets of questions were examined to evaluate the concern among Americans about the spread of SARS. The first set of questions asked respondents if they were worried that they or someone in their family would be exposed to SARS. The first survey was conducted between April 5 and 6, 2003, and it was repeated every subsequent week in the months of April and May. The surveys conducted in April and May showed that on average 32% of the population was worried about being exposed to SARS. This indicates a reasonably high level of concern. Another survey with very similar wording was repeated in November 2003, and it indicated that 40% of people were worried. By this time media reporting about SARS had dropped considerably. However, this survey coincided with the influenza season and people were concerned about the return of SARS or a related illness. The second set of survey responses analyzed came from surveys conducted in December 2003 and repeated in November 2004. The surveys asked people if they were concerned that they or members of their family would be exposed to SARS. 28% of respondents feared SARS in December 2003. However, the numbers declined to 14% in the December 2004 survey. Both of these surveys were conducted when the coverage of SARS had declined considerably.

A third set of questions was studied to assess changes in perception about the threat posed by the new disease from Asia. Respondents were questioned about the likelihood that they or their families might be exposed to SARS. The first set of surveys was conducted between April 11 and 15, 2003. In this survey, 25% of the people felt that SARS was likely to spread. The percentage of positive responses declined steadily to 14% (April 25-30, 2003), 16% (May 2-3, 2003), 8% (June 18-to July2, 2003), 8% (January 7-11, 2004), and 7% (August 25-29, 2004). The high level of initial concern can be attributed to the media reports of people dying from SARS in Asia and that there was no cure or vaccine to protect people from SARS. The numbers would have been significantly higher had the disease spread to the United States and infected many people.

Relationship between Media Coverage and Public Opinion

To understand the relationship between changes in media coverage of SARS and changes in public opinion, further correlation analyses were conducted. The three public opinion measures studied were willingness to support harsh public health measures, actual behavioral changes made, and recognition of SARS as a threat. Public opinion polls that asked people whether they were willing to support harsh public health measures such as quarantine were first conducted in April 2003 and repeated in May 2003. To examine the correlation between media frames and public opinion, news coverage data from the corresponding time period (March 16, 2003, to June 5, 2003) were included in the analysis. A 5-day interval was chosen to examine the changes over time in the two sets of data. The percentage of positive responses within the four frames of media coverage is shown in Figure 3. There was no change in public opinion when the survey was repeated in May. As far as the media coverage is concerned, the biomedical ratio decreased from 0.53 to 0.37. The economic ratio showed a modest increase between April and May but then dropped to its original level of 0.11. The human rights and security ratios were very small and changed very little. These results show that changes in frames did not correlate with changes in public opinion. The overall support, however, for harsh measures such as quarantine and isolation were very high and stable at 95% during the sampled period. Thus, the total ratio of coverage with a focus on biomedical aspects and economic implications of the disease seems to have influenced public opinion.

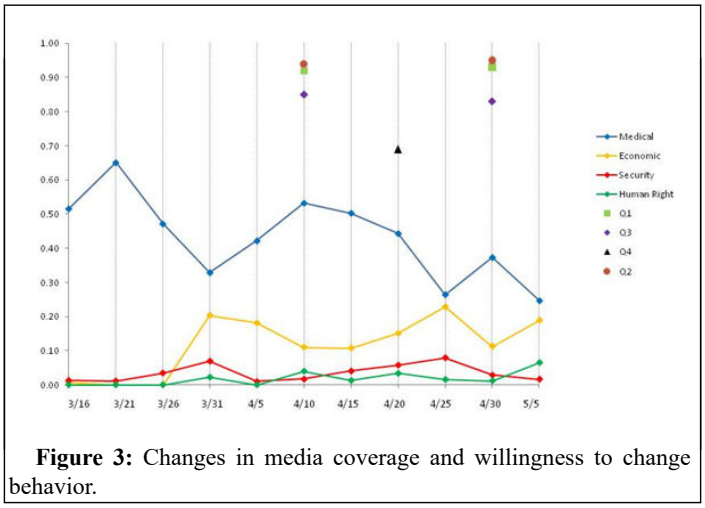

Figure 3: Changes in media coverage and willingness to change behavior.

To examine the relationship between media coverage and public opinion data about actual behavioral changes made in response to SARS, a total of nine survey questions were analyzed. A table was constructed displaying mean ratios from media coverage and the mean percentage of positive/negative responses in 5-day intervals (Figure 4). The questions asked respondents if they had taken any precautionary measures or made changes in their behavior to prevent SARS. For seven out of nine questions, the mean percentage of "yes" answers dropped from 12% to 8% between April and May when the surveys were administered. During the same time period, the biomedical ratio decreased from 0.53 to 0.37. The economic ratio first increased and then dropped to the original level of 0.11. The human rights and security ratios were very small and showed very little change. Changes in public opinion seemed to correspond to a decrease in biomedical news, as it was the dominant frame when the first round of survey questions was administered. Moreover, all nine questions

were largely related to health and biomedical issues. It is reasonable to conclude, therefore, that the public response to these questions reflected the change in the biomedical ratio.

To examine the relationship between media coverage and public perception of SARS as a threat, a table of mean ratios from media coverage and mean percentage of positive responses in the threat category at weekly intervals was constructed. The Pearson correlation coefficient was computed for the first question in the "threat" category for the period between March 30 and May 24, 2003, because many surveys were administered during this period. None of the correlations was significant. The percentage of positive responses regarding worry over being exposed to SARS, however, had the highest correlation with the economic ratio. The level of worry showed a very small negative correlation with the biomedical frame (Table 7 and Figure 5).

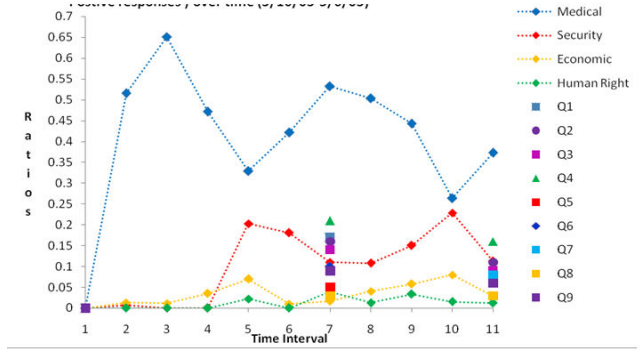

Figure 4: Changes in media coverage and behavioral changes made.

Frame	Pearson correlation coefficients (p-value)
Biomedical	-0.2087 (p=0.6534)
Economic	0.6542 (p=0.1109)
Security	0.40198 (p=0.3714)
Human Rights	-0.21427 (p=0.6445)

Table 7: Correlation between worry about exposure to SARS and media coverage.

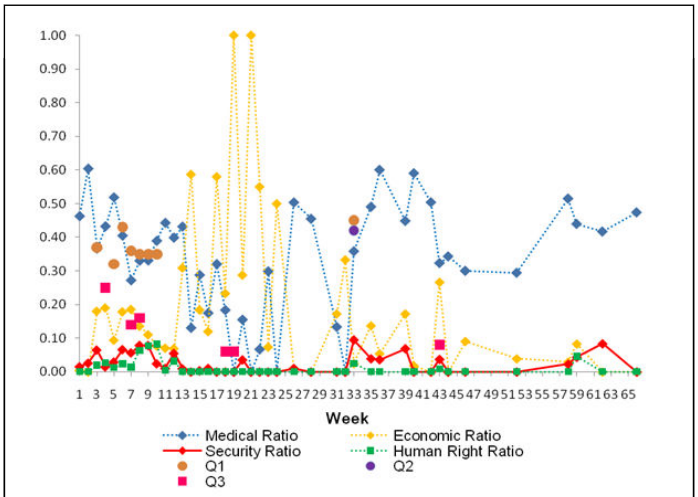

Figure 5: Changes in media coverage and perception of SARS as threat.

Relationship between media coverage and public opinion

The above analysis did not reveal any significant correlation between changes in media coverage and public response to SARS. To determine if news coverage about SARS that focused on its impact on the United States had a higher correlation with the survey question assessing perception of the threat from SARS, Pearson correlation coefficients were computed. None of the correlations were significant. The percentage of positive responses indicating the level of worry about being exposed to SARS, however, showed a small positive correlation with the biomedical frame (r = 0.2456) and the economic frame (r=0.2267) and a small negative correlation with the human rights frame (Table 8).

Frame	Pearson correlation coefficients (p-value)
Biomedical	0.2456 (p=0.5956)
Economic	0.2267 (p=0.6250)
Security	0.0793 (p=0.8658)
Human rights	-0.2317 (p=0.6172)

Table 8: Correlation between worry about exposure to SARS and media reports of the impact of SARS on the United States.

Discussion

In this study, we assessed whether news coverage during and after the outbreak of SARS increased the anxiety of Americans about the disease and led to support for measures such as quarantine. In March and the beginning of April 2003, the story was developing and being brought to the attention of the public. Extensive reporting about how SARS had affected various parts of the world evoked public concern about the disease, and this concern was evident in many surveys administered in April 2003. One-third of the respondents were gravely concerned about the disease. The responses (willingness to support quarantine and perception of threat) did not change much between when the surveys were first administered in April 2003, and when they were repeated in May 2003. While high percentages of people were

worried in May, the number of positive responses did not increase in May. The time period from April to May was one of "saturation coverage." There was a steady decline both in news coverage and in public perception of the threat of the disease after that time. In this study, we also sought to understand if certain ways of representing or framing the disease evoked greater concern among the public, which in turn would lead them to make behavioral changes in their personal lives and support harsher public health measures such as quarantine [5].

The results of the analysis substantiate the hypothesis that frames represented predominantly in the media will influence public opinion. The correlation analysis revealed a correlation between the economic frame and the percentage of positive responses expressing worry about being exposed to SARS. SARS caused significant economic losses in Asia and in countries linked commercially to Asia and Canada. The economic frame was the second most prevalent frame throughout the sampled period (Tables 5 and 6). A very small negative correlation was found between the biomedical frame (predominant frame) and overall worry about the disease. This can be attributed to the fact that the actual number of people infected with SARS was very low in the United States. According to the CDC website, from November 2002 through July 2003 a total of 8,098 people worldwide became sick with SARS that was accompanied by either pneumonia or respiratory distress syndrome (probable cases). Through July 2003, 192 cases had been reported in the United States, including 159 suspected and 33 probable cases. Of the 33 probable cases, only 8 were confirmed in the laboratory as SARS infections. There were no reported cases of SARS-related deaths in the United States. Another explanation for why the biomedical frame did not increase worry about the disease could be that while the media reported a lot on the biomedical aspects of the disease, it also described how the United States public health system was equipped and well prepared to control the disease following the distribution of anthrax-tainted mail in 2001. Table 2 clearly shows that close to 50% of total stories focused on the impact of SARS on countries outside the United States; only 26% of the total coverage discussed the possible and actual impact on the United States.

A separate correlation analysis was conducted for stories that discussed the impact of SARS in the United States and levels of worry about the disease (Table 8). In this analysis, both the biomedical and economic frames showed a small positive correlation with people's worry that they or their families might be exposed to SARS. This finding further confirms the second hypothesis that biomedical and economic frames, when predominant, will influence people to support inconvenient measures such as quarantine and isolation. This is because these issues are of personal relevance to them. Peoples' worry about being exposed to the disease will make them support quarantine. Public opinion polls indicated strong public support for the use of quarantine when required. The overall support for harsh biomedical intervention strategies such as quarantine and isolation were very high and stable at 95% during the sampling period. The news media emphasized the severity of the highly infectious disease and its consequences to human health. When respondents were asked if they had made changes in their behavior or taken precautionary steps to prevent SARS, the responses were mixed. Few Americans purchased face masks or consulted a doctor. However, many consulted a website, used disinfectant at home, and avoided international travel and contact with people who they thought had traveled to Asia. These responses appeared to follow changes in the biomedical frame. Although SARS did not become a public health crisis in the United States, the country experienced an economic impact of the outbreak. Not only were the direct costs of quarantine and screening at airports significant, but many airlines, tour operators, and companies that had offshore offices and manufacturing units in Asia suffered considerable economic losses. The economic coverage became more prominent as these losses mounted, and in turn, a corresponding worry and increased concern over the disease occurred. The security and human rights frames were not prominent, and people did not see them as relevant.

Conclusion

Thus, we conclude that framing and agenda-setting are important in bringing the public's attention to issues and in creating an initial awareness of the issue. However, it seems likely that the public's response is mediated by perceptions of relevance. In this case, successful efforts to limit the spread of SARS in the United States may have reduced Americans' perceptions that the biomedical frame was relevant, compared with the economic frame.

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