

# Nanotechnology: Risks and the Media



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An unusual protest occurred at a Chicago, IL, Eddie Bauer store in May 2005 when members of Topless Humans Organized for Natural Genetics (Thong) stripped naked to protest the company's sale of stain-resistant "nanopants" [17]. Eddie Bauer is one of many companies that sell products made with nanotechnology. Nanomaterials can be found in sunscreens, cosmetics, tennis balls, computers, and a number of other products. On the horizon, promise nanotech boosters, are exciting developments including smaller but more powerful computers, internal medical monitoring, new foods, lighter and stronger materials, and new methods of cleaning up environmental pollution. Nanotechnology is supposed to drive a "new industrial revolution," according to U.S. government officials, who are investing heavily in it.

Such promises of extensive commercial, health, and socio-economic progress have been made before for other developing technologies including nuclear power, recombinant DNA, the Internet, and biotechnology. But past experience with these technologies has shown the public that along with the good comes the bad — for example, adverse health and environmental effects [4], [12], [16], [23].

A few environmental organizations and a significantly large number of business, academic, and government interests have expressed concerns about nanotechnology — although their members have not painted "expose the truth about nanotech" on their bodies like members of Thong did. Voiced most often are concerns about the technology's potential long-term health and environmental effects. For example, the United Kingdom's Royal Society and Royal Academy of Engineering issued a report in July 2004 that, while supporting nanotechnology in general, expressed



concerns about its use in sunscreens and other cosmetic products and recommended stopping this use until further research is done. Business Week Online also worried about health effects: "Could the same properties that make the tiny particles so effective also turn them into efficient troublemakers inside the human body?" [11]. And David Rejeski of the Woodrow Wilson International Center for Scholars pondered what the environmental effects will be when nanoproducts wear out. "Who knows what happens when you grind this stuff up, incinerate it or it goes into a landfill?" he asked [25].

Even a report by the President's Council of Advisors on Science and Technology [19] acknowledged that not much is known about nanotechnology's potential long-term health and environmental effects. According to the report, "The state of knowledge with respect to the actual risks of nanotechnology is incomplete" [19, p. 35].

In addition to health and environmental risks, other societal issues are worrisome. Possible military, legal, privacy, economic, and globalization impacts of nanotechnology have concerned scholars, government, and industry officials [1]-[3], [10]. For example, one of the world's leading insurance firms, Swiss Reinsurance, is worried about how nanotechnology could affect the insurance industry, particularly if it becomes a "technological fiasco" like asbestos [26, p. 7].

Another major concern almost from the birth of nanotechnology among U.S. scientists and government officials has been fear that some members of the public would react to nanotechnology in the same way many reacted to genetically modified organisms (GMOs) [20], [24]. Anti-GMO sentiments are particularly strong in Europe, affecting sales of GMO products and blackening reputations of companies associated with the technology [8], [15]. Indeed, some environmental groups active in the GMO debate, particularly the Action Group on Erosion, Technology and Concentration (ETC Group), have turned their scrutiny to nanotech. Concerned about the nanotech's potential societal and health impacts, the ETC Group called for a moratorium on the use of synthetic nanoparticles in the lab and in any new commercial products until governments adopt "best practices" for research [6].

### **Public Knowledge and Mass Media Coverage**

Given all this concern about potential nanotech risks from government, industry, and activist groups, one wonders how public stakeholders are responding. It appears that they aren't. Recent studies have shown that members of the public in the United States and United Kingdom have not heard much about nanotechnology [21]. In the United States, a representative national telephone survey in 2004 of 1536 individuals found that more than 80 percent said they had heard lit-

tle or nothing about nanotechnology [5]. Asked in surveys in both the United States and Europe if nanotechnology would improve their way of life or make it worse, 35 percent of the Americans and 53 percent of the Europeans said they did not know [8].

These studies indicate that public knowledge about and opinions on nanotechnology are still in an early stage. Whether members of the public ever become more informed will depend primarily on their own interests and on articles about nanotech appearing in the mass media or on the World Wide Web. The mass media are the prime source of science information for U.S. adults [18], and by the amount of attention they pay to a subject, they can call the public's attention to it as well. In addition, whether the media portray a subject in a generally favorable or unfavorable light can be a factor in public acceptance or rejection. Therefore, how much attention the media pay to nanotechnology risk issues and how they report about them could have a significant impact on public knowledge and perceptions [8] as it has on other risk topics such as dioxin [7].

In the past few years, the media do seem to be paying more attention to nanotechnology, therefore giving readers an opportunity to gain information and form opinions. Stephens [22] found that the yearly number of articles published ranged from 1 in 1988 to 305 in 2003 in a study of 749 articles in "94 mostly U.S. newspapers and popular periodicals with the keywords 'nanoscience' or 'nanotechnology' in the headlines." In another study, Gorss and Lewenstein [9] found that coverage had risen quickly from just a few articles a year to more than 150 in 2003 using sampled nanotech coverage from 1986 to mid-2004 in the New York Times, Wall Street Journal, Washington Post and Associated Press wire service. They also found that the majority of this coverage was "overwhelmingly positive, focusing on progress and potential economic benefits, and with little discussion of attendant risks" [9, p. 1].

The positive elements of current nanotechnology media coverage identified in the Gorss-Lewenstein study are reflected in any sampling of headlines found on Today's NNI News Update, a listserve that provides links to various articles about nanotechnology regularly but does not archive these links. For example, among headlines listed for October 21, 2005, were: "Carbon nanoparticles stimulate blood clotting, researchers report"; "Stronger than steel, harder than diamonds: researcher developing numerous uses for extraordinary 'Buckypaper'"; and "Nanoparticles boost solar cells" (<http://www.nano.gov/html/news/current.html>).

### **Media Coverage of Nanotech Health and Environmental Risks**

Because it is important to let the public "in on the perils as well as the promises of new research frontiers"



[13, p. 99], we wanted to go beyond the positive aspects of what the media were communicating on nanotechnology and look at "the perils" of health and environmental risks. In a baseline study of selected U.S. and U.K. newspapers and wire services from 2000 to 2004, we investigated how much coverage there was of nanotechnology health and environmental risks, and what specific risks were featured in the articles. As part of this assessment, we tried to evaluate whether the main focus of these risk articles was positive or negative.

Besides health and environmental risks, we investigated whether other societal risks were discussed and whether the media were comparing potential nanotech risks to risks of GMOs or other problematic technologies. Another question was whether the articles called for more government regulation.

To find answers to these questions, we systemically analyzed the content of selected U.S. and U.K. newspaper articles obtained from a search of the Major Newspaper section of Lexis-Nexis Academic database between January 1, 2000, and December 31, 2004. Additional articles came from a search in Lexis-Nexis Academic for the Associated Press and United Press International during the same period. (Terms used for the full-text searches in Lexis were: Nanotechnology or nano \* AND Risk! or concern or issue or problem or toxicity or safety AND environment! or health!)

One person reviewed the almost 400 articles that resulted from the database searches to cull those that did not discuss nanotechnology health and environmental risks in some manner. To quantitatively analyze the information, a coding instrument was developed and tested. After a number of training sessions, three people coded information from the selected articles. Reliability tests were run to ensure that the three people were coding the same type of information in each category on the coding instrument. The reliability scores averaged 86 percent.

U.S. newspapers were selected for the study because of the national scientific, industrial, and governmental interest in nanotechnology and because of the newspapers' potential impact on policy makers, businesses, and citizens. U.K. newspapers were used to see whether differing points of view were developing concerning nanotechnology risks. Given the substantial differences in U.S. and U.K. media coverage and public perceptions concerning GMOs [12], comparing coverage from

these two countries was important. U.S. wire services were selected to allow for broader coverage that could have been used by smaller-circulation newspapers and by television.

## Number of Articles

The number of articles found about nanotechnology health and environmental risks was low for both U.S. and U.K. coverage. Only 71 U.S. and 50 U.K. articles were found between 2000 and 2004 (see Table I). Of the U.S. newspapers, the New York Times ran the most articles (13), followed by the Washington Post (9), the Houston Chronicle (5), San Francisco Chronicle (4) and Christian Science Monitor (4). If newspapers had fewer than four articles they were grouped together in an "other" category (11). The Associated Press and United Press International wire services carried 8 and 17 articles respectively. The large number of UPI articles reflects a weekly nanotechnology column it produces.

In the U.K., the Guardian published the most articles (14), followed by the Financial Times (11) and the Independent (6). Irish/Scottish newspapers were grouped (6) as were other U.K. newspapers (13) because of their small number of articles.

Compared to the large number of articles found by Gorss and Lewenstein and Stephens, a total of 121 articles dealing with nanotech health and environmental risks over four years is a rather small number. However, as shown in Table I, the number of articles about these risks increased in both countries' publications in 2003 and 2004, so this topic may be gaining importance as the technology becomes better known and funded.

**Table I**  
Number of Nanotechnology Risk Articles

U.S. Newspapers & Wires	2000	2001	2002	2003	2004	Total
United Press International (UPI) Wire Service	0	1	3	3	10	17
New York Times	2	1	1	6	3	13
Other U.S. Newspapers	4	1	1	3	2	11
Washington Post	2	0	0	0	7	9
Associated Press (AP) Wire Service	0	0	1	1	6	8
Houston Chronicle	0	1	0	1	3	5
San Francisco Chronicle	0	0	0	2	2	4
Christian Science Monitor	2	0	0	2	0	4
<b>Total</b>	<b>10</b>	<b>4</b>	<b>6</b>	<b>18</b>	<b>33</b>	<b>71</b>
U.K. Newspapers	2000	2001	2002	2003	2004	Total
Guardian	1	0	0	7	6	14
Financial Times	0	1	1	4	5	11
Independent	0	0	0	1	5	6
Irish or Scottish Newspapers	0	0	0	2	4	6
Other U.K. Newspapers	2	0	0	4	7	13
<b>Total</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>16</b>	<b>27</b>	<b>50</b>



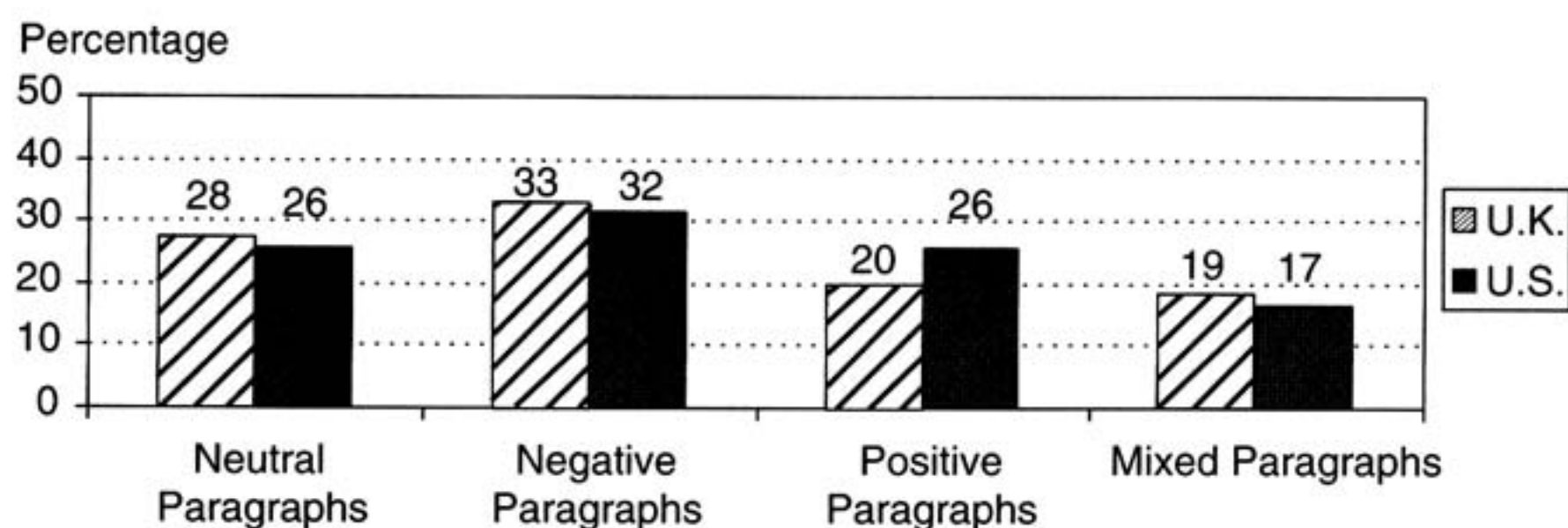


Fig. 1. Percentage of positive, negative, mixed and neutral paragraphs about nanotechnology in U.S. and U.K. articles.

### Focus of the Risk Articles and Headlines

Considering that all of the articles selected for this study were found in the Lexis database because they included words such as risk, problem, concern, issue, toxicity, and safety, one would expect them to have a substantial negative focus. That was not the case. While the majority of paragraphs in these articles about health and environmental risk were indeed negative, a surprising number of positive and neutral paragraphs also appeared. Overall, this indicates a fairly balanced outlook in these stories.

To evaluate this measure, paragraphs in each article were categorized into one of four different foci — positive, negative, mixed (including both positive and negative points), or neutral (statement of facts that had no specific orientation). While an overall average of 32

and 33 percent of the paragraphs in the U.S. and U.K. articles were negative, close to 26 and 20 percent of the paragraphs in the articles, respectively, were positive (see Fig. 1). In addition, a large percentage of the U.S. and U.K. paragraphs were neutral, about 26 and 28 percent, respectively, with the rest being mixed. The U.K. articles had the fewest positive paragraphs.

While the paragraphs provided an overall balanced focus, article headlines did not. Close to half of them were negative: 48 percent of the U.S. and 44 percent of the U.K. articles. Only about 23 percent of the U.S. and 14 percent of the U.K. headlines were positive, with the rest either neutral or mixed. Interesting, the U.S. publications had both the most negative and positive headlines, with twice as many negative as positive ones. The U.K. negative headlines were more than three times the number of positive headlines, but U.K. newspapers included more neutral and mixed headlines (20 and 22 percent) compared to U.S. headlines (15.5 and 14 percent).

Negative headlines partially reflect the need of headline writers (not reporters) to attract readers and sometimes do not reflect the focus of the articles themselves. Coders in this study often found that negative

headlines did not reflect the articles they topped. Unfortunately, readers often glance at headlines but do not read the accompanying articles, so people could have taken away a more negative impression about nanotech's health and environmental risks than the articles described.

### Health and Environmental Risk Coverage

After finding only a small but growing number of articles about health and environmental risks, interest shifted to the specific types of risks being described in the media. For the most part, these were general non-specific risks, although some specific ones were

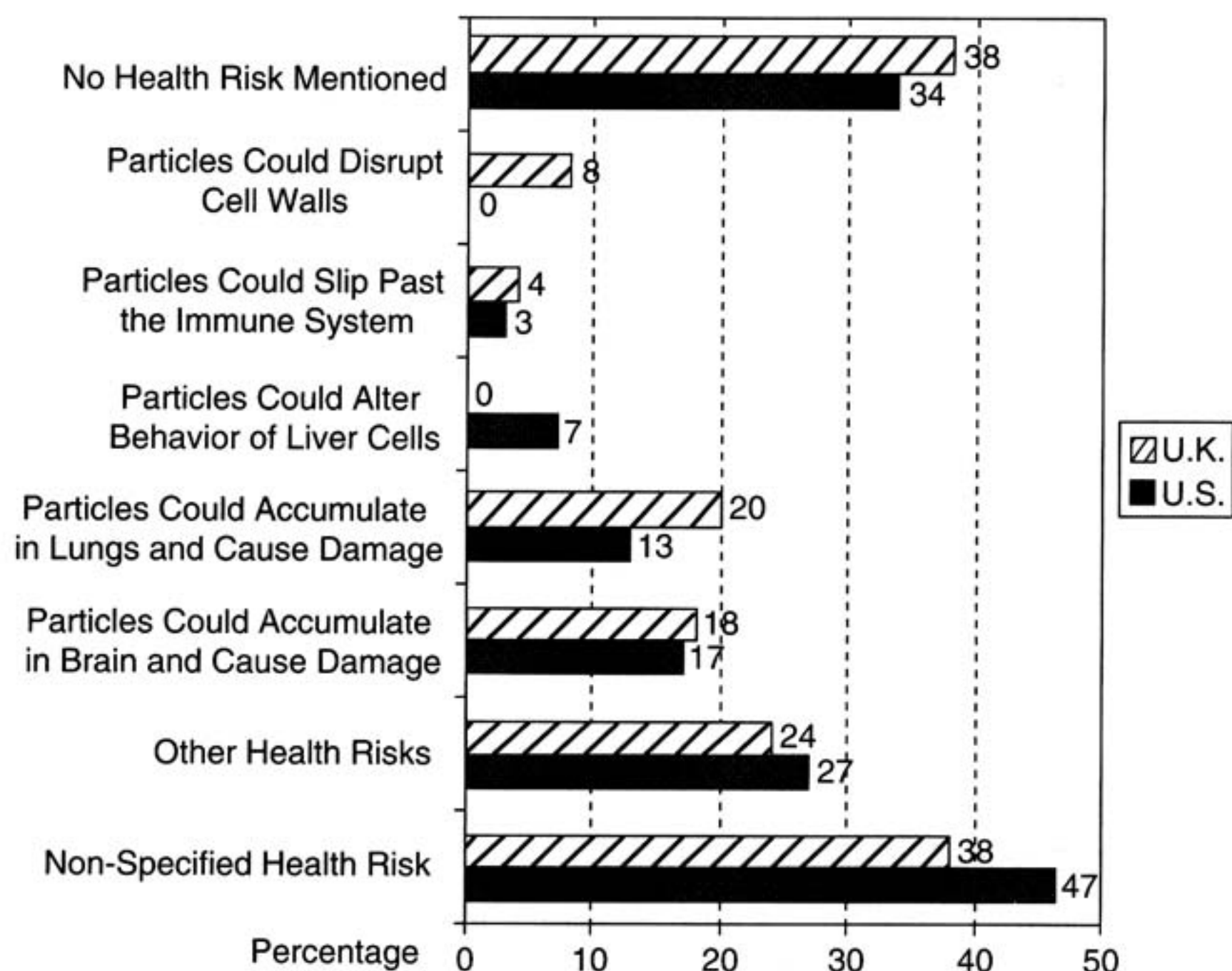


Fig. 2. Percentage of types of health risks related to nanotechnology discussed in U.S. and U.K. articles.



noted with health risks, thanks to toxicology studies published mostly in 2003 and 2004 (see Fig. 2). Such studies included work by Günter Oberdörster on inhalation of nanoparticles by rodents; lung granulomas found by NASA researcher Chiu-Wing Lam in mice; clumps of immune cells surrounding nanoparticles in rats' lungs by David Warheit; and buckyballs causing possible brain damage in largemouth bass by Eva Oberdörster, among others. In addition, there was the U.K.'s Royal Society and Royal Academy of Engineering "go slow" report in June 2004. All these studies, particularly those by Eva Oberdörster and the Royal Society, appeared in media articles in both countries. However, most articles — about 47 percent of the U.S. and 38 percent of the U.K. articles — focused on non-specified health risks.

About 60 percent of the environmental risk articles in each country discussed non-specified general environmental risks, while less than 15 percent discussed any specific type of environmental risk such as nanoparticles wiping out native species (see Fig. 3). This result is probably because most nanotech toxicology and environmental studies are still in their early stages and had not announced results by the end of 2004.

### Coverage of Other Societal Risks

Health and environmental risks were not the only ones mentioned in the articles studied. Societal issues also were discussed. Side effects of runaway technology was the most prominent, mentioned in 60 percent of the U.K. and about 47 percent of the U.S. articles (see Fig. 4). Concerns about safety issues were discussed in 48 percent of the U.K. articles and in 35 percent of the U.S. articles. These two categories, side effects and safety, show interesting differences between the U.S. and U.K. articles, but

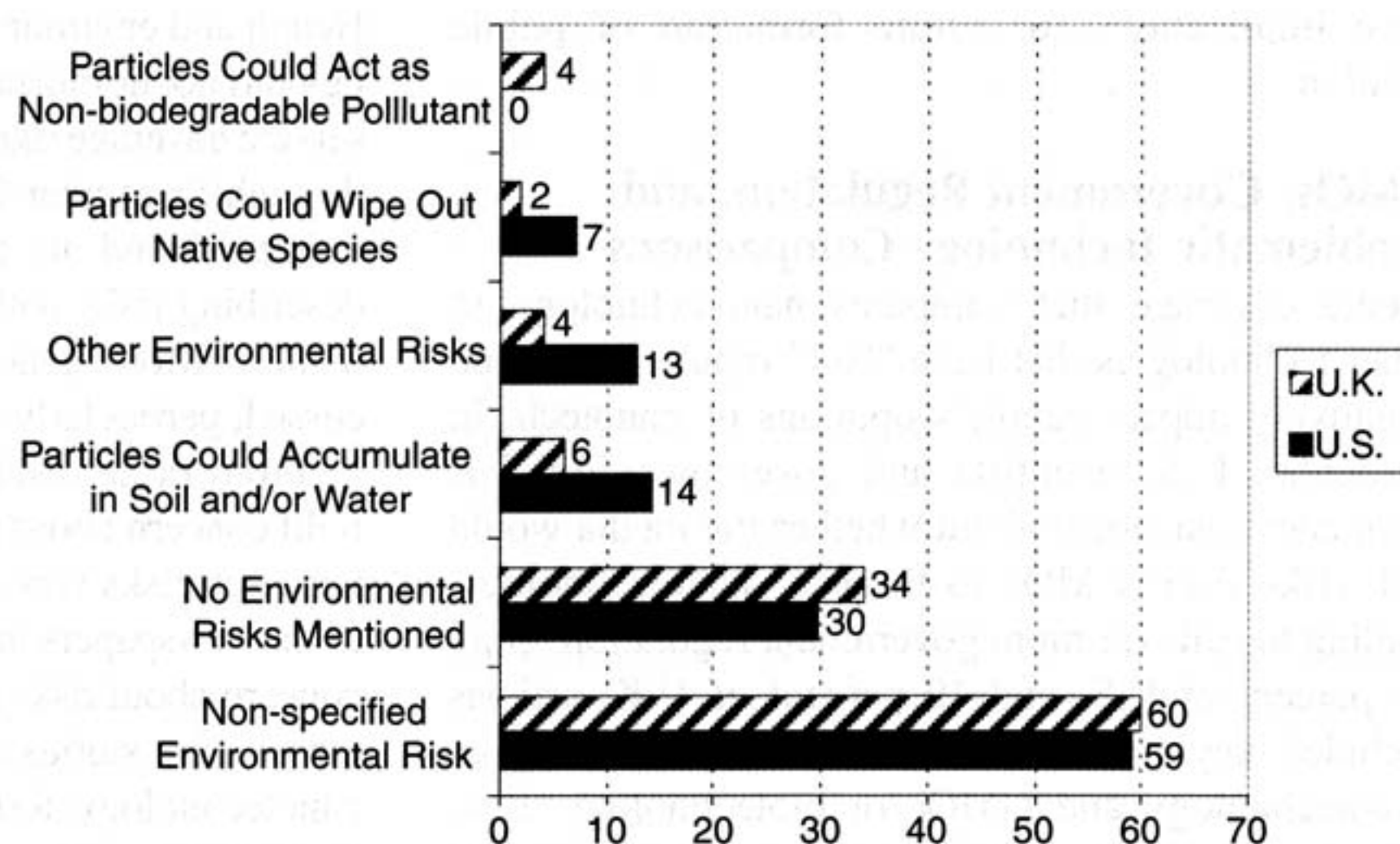


Fig. 3. Percentage of types of environmental risks related to nanotechnology discussed in U.S. and U.K. articles.

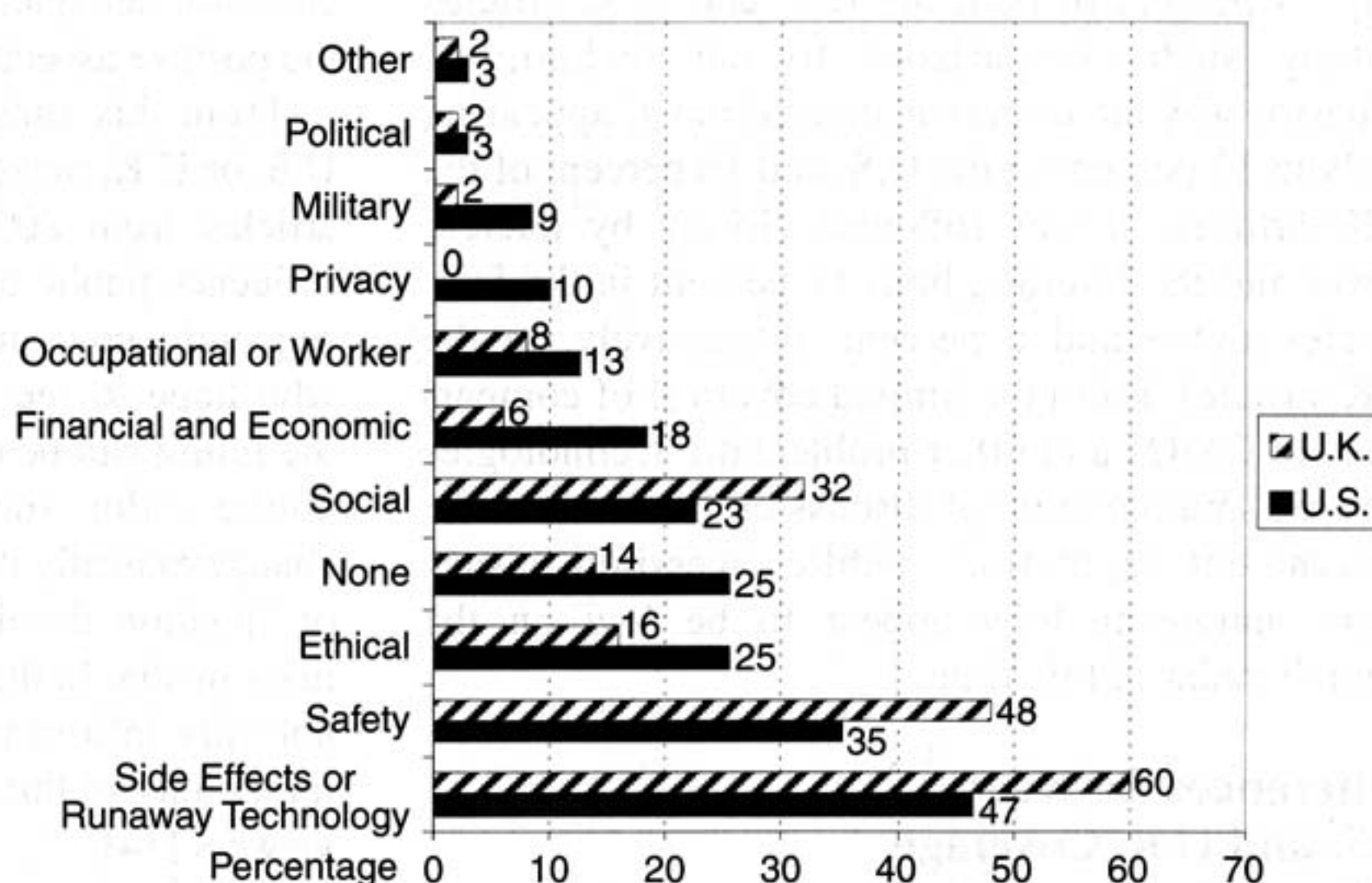


Fig. 4. Percentage of other risks from nanotechnology discussed in U.S. and U.K. articles.

there were other differences as well. More U.K. articles included discussion of social risks, while more U.S. articles included information on ethical, financial and economic, privacy, occupational or worker, and military issues. (The differences between articles from the two countries for financial/economic and privacy issues were statistically significant.) While these results do not reflect an accurate portrayal of media coverage of these societal issues in their own contexts since they were found in articles connected to healthcare and environmental risks, they indicate that reporters often group nanorisks in their coverage and specify which ones are of most interest in their countries. Both of these factors —



grouping and societal risk specification — could have implications for future formation of public opinion.

### **GMOs, Government Regulation, and Problematic Technology Comparisons**

Media coverage that compares nanotechnology to other technologies that have “bad” reputations could negatively impact people’s opinions of nanotech. In particular, U.S. scientists and government officials have been concerned about whether the media would link risks from GMOs to those of nanotechnology, leading to calls for more government regulation. Only 31 percent of U.S. and 40 percent of U.K. articles included any mention of risk similarities between nanotechnology and GMOs or biotechnology. Less than 40 percent of the U.S. and U.K. articles discussed a need for new or tightened regulations about nanotechnology.

Not much media attention focused on earlier mistakes or side effects of other technologies, with only 38 percent of both the U.S. and U.K. articles making such comparisons to nanotechnology. Asbestos was the comparison used most, appearing in about 13 percent of the U.S. and 16 percent of the U.K. articles. It was followed closely by nuclear power and the Internet, both 11 percent in the U.S. articles and 8 and 6 percent, respectively, in the U.K. articles. From the limited coverage of comparisons to GMOs and other problematic technologies plus the small amount of discussion on the need for government regulation, public oversight issues about nanotechnology appear to be low on the media’s radar at this time.

### **Differences Between U.S. and U.K. Coverage**

Differences and similarities in coverage of nanotech health and environmental risks between the U.S. and U.K. newspapers and wire services have been pointed out throughout this article. Most differences were not substantial, and the overall coverage was similar. However, two subtle differences should be noted. First, U.K. articles were slightly more negative on most measures. Second, U.K. articles included some higher levels of concerns about nanotechnology’s effects on society. These findings support those of Gaskell et al. [8], who noted in their content analysis of nanotech risks and benefits in the New York Times and the Independent that the Times included “considerably more” references to benefits than the Independent. They felt the media coverage was “more slanted towards a supportive culture of science and technology in the United States” and a less favorable view about technology in general in the United Kingdom [8, p. 86].

### **Risks Did Not Dominate Coverage**

Health and environmental risks related to nanotechnology did not dominate U.S. or U.K. newspaper and wire service coverage of nanotechnology from January 2000 through December 2004. Of the 71 U.S. and 50 U.K. articles found in this study, most were balanced, describing risks with both positive and negative information. More general than specific risks were discussed, particularly for the environment.

From these results, we conclude that overall only mild concern about potential health and environmental nanotech risks was expressed between 2000 and 2004 in the newspapers and wire services studied. This mild concern about risks clearly does not counterbalance all the positive stories about the benefits and promises of nanotechnology found by Gorss and Lewenstein [9] and Stephens [22].

Potential societal risks from nanotechnology were presented in the articles in a generally balanced fashion. Concerns about the side effects of a runaway technology and safety issues dominated these media discussions, but again did not overshadow discussions of the positive aspects of nanotechnology.

From this analysis, it does not appear that these U.S. or U.K. newspapers and wire services published articles from 2000 to 2004 that would negatively influence public opinion about nanotechnology. Consequently, government officials, scientists, and others who hope to see nanotechnology efforts succeed in the future can be cautiously optimistic. However, the public calm surrounding nanotechnology could change radically if a threatening negative study, event, or situation develop that would be covered by the mass media. In that case, the media’s coverage would not only inform people, but also would amplify the importance of this negative information to readers and viewers [14].

Because this was a baseline study, its findings start close to the beginning of an issue where there is often much generalization. So far, only a few specific health or environmental effects have caught the media’s attention. As more studies are completed, one hopes that a better picture of specific risks, particularly to workers in both labs and manufacturing facilities, will emerge in media coverage. Even more important for media reporting is discussion of any potential health risks to consumers who are currently unknowingly exposed to nanoparticles in their sunscreens, cosmetics and “nanopants” without the benefit of any scientific knowledge about long-term effects.

As specific nanotechnology risk coverage increases, it will be important to place various risks discovered into context and not cover them simply as “the study of the week.” Without contextual information, individual research reports can become either diminished or overblown by their authors as well as reporters, leaving



the public confused because the relative importance of a study is not explained.

Continued study of mass media coverage of nanotechnology's health and environmental risks should prove fruitful for both communication researchers and those interested in public understanding and the safe development of this new technology.

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