Public Interest in New Medical Discoveries
Analyses of US and European Citizens' Interest in and Knowledge of Medical Discoveries and New Science and Technology Issues

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Abstract : The rapidly rising cost of health care has been an important policy concern in the United States, and the continuing explosion of medical research and increased utilization of medical technology are believed to be important factors driving up the costs. Several studies have implied that the US's continuous expansion of medical technology development and utilization might derive from Americans' strong commitment to medical innovation and a willingness to pay for expensive medical technologies. Using the data on the US and European citizens' attitudes toward other sciences and technologies and new medical discoveries, this study explores why Americans have such strong devotion to medical technologies. Specifically, this study examines whether the high level of interest that Americans have in new medical discoveries comes from their interest in new inventions or in new scientific discoveries. Exploratory factor analyses and logistic regressions of the public interest in medical discoveries and new science and technology issues show that the conceptual structures and determinants of the American public's interest in medical issues are different from those in science and technology issues. This pattern does not occur among European citizens. The US Government's decisions on public expenditures for medical science compared to those for science and technology issues seem to reflect the public's attitudes toward these issues.

INTRODUCTION

Controlling the expansion of public expenditure at a manageable rate is an important concern in many industrialized countries. The rapidly rising cost of health care has been an especially important policy concern in these countries, while the continuing explosion of medical research and increased utilization of medical technology are believed to be important factors driving up the costs. In an effort to control the continued rise in health care costs, many countries including the United States, have tried various policy options to limit spending on new medical technologies. For example, Health maps in France and Article 18 in the Netherlands are relatively effective regulations of medical technology (Office of Technology Assessment, 1995). The United Kingdom and Canada have been successful in taking a tough stance on introducing of major technology by controlling the level of funding for hospital services. On the other hand, the United States' measures that were intended to control expansion of medical technology have largely failed, and the nation's overall commitment to medical research and development (R&D) and new medical technologies has remained quite strong (Berk and Monheit, 2001).

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The US's Certificate-of-Need (CON) program, which was created to contain health care costs by regulating the supply of expensive services and facilities and guide health service development to avoid undue duplication or fragmentation, is often cited as the most prominent example of unsuccessful government regulation of excessive expansion of medical technology. While findings on the state CON programs' impact are inconsistent, a general conclusion is that they have little or no effect on the rational introduction of new technologies and restraining overall health care spending (Halm and Gelijns, 1989; Conover and Sloan, 1998). After Congress repealed the legislation that required states to implement the law in 1986, 11 states discontinued their CON programs. In addition, many other states are considering either repeal or revision of their programs (Conover and Sloan, 1998; State of Washington Joint Legislative Audit and Review Committee, 1999).

While the regulation of US Food and Drug Administration (FDA), the government agency that has responsibility for ensuring the safety and efficacy of new drugs and biologics as well as medical devices, is often considered onerous, the strictures apply to the initial adoption process rather than to controlling the drug use and pricing after a drug's initial adoption. Similarly, the regulation of medical devices is limited. The standard of evidence required for new medical device approval is legally set at a lower level than that required for new drugs, and controlled clinical trials may not always be required as they are for drugs (Kessler, Pape and Sundwall, 1987). Moreover, the FDA is under constant pressure from Congress, disease-specific interest groups and the drug industry to ease its regulations and expedite approval of new drugs and medical devices. As a result, the recent increase in FDA drug approvals and FDA reforms aimed at reducing approval times for medical devices provide a more favorable climate for new drug development. The Food and Drug Administration Modernization Act (FDAMA) of 1997 also includes several reforms to expedite the fast-track study and approval of drugs.

In the US, traditional systems of physician fee-for-service and hospital reimbursement insulate providers and patients from the immediate financial consequences of their decisions and have encouraged the acquisition of large, expensive devices as well as routine clinical choices to order a test, prescribe a drug, or perform a procedure (Weisbrod, 1994; McClellan and Kessler, 1999). It was therefore expected that several recent policy changes in the US, such as PPS (Prospective Payment System), DRGs (Diagnosis Related Groups), managed care, and RBRVS (Resource-Based Relative Value Scale) for physician services, may have created a different environment for providers in adopting new medical technology. Nevertheless, evaluation has shown that the changes in payment scheme have had little impact. For example, Sloan and colleagues found that mandatory rate-setting programs tended to retard diffusion of technology in some cases, but the degree of impact tended to be small (Sloan, 1986). Similarly, despite predictions that managed care plans' recent drive for efficiency would affect financial incentives for expensive drugs and other medical technologies, there is little evidence of a reduction in the supply and demand for high-technology in the US (Neumann and Sandberg, 1998; Baker and Wheeler, 1998).

Why don't regulatory efforts and economic incentives to control medical technology expansion work as well in the United States as in European countries? Among many reasons suggested, several studies implied that US's continuous expansion of medical technology development and utilization may derive from Americans' strong commitment to medical innovation and willingness to pay for expensive medical technologies (Rettig, 1994; Newhouse, 1993). An international comparative study on people's views on medical technology has confirmed that Americans' attitudes toward new medical technologies differ from Europeans (Kim, Blendon and Benson, 2001). Compared to Europeans, Americans were much more interested in new medical technologies and believed that they are more knowledgeable about those issues. The study also showed that Americans had significantly higher expectations than Germans do for medicine's capability regarding human health. Considerably higher proportion of Americans compared to Germans believed that with medical advancement modern medicine can cure almost all diseases. In addition, most Americans said that having access to the most advanced medical technology was absolutely essential or very important and showed a higher resistance to the idea of cost constraints on medical technology than did people in most other industrialized countries.

Then, how can we explain Americans' uniquely strong commitment with medical technologies? The US has been a world leader in many areas of science and technology, such as space, computer and military technology. This makes us expect that the high level of interest Americans have in new medical discoveries may come from their high interest in new inventions or in new scientific discoveries. This study tested the hypothesis by using the data on the US and European citizens' attitudes toward other sciences and technologies along with attitudes toward new medical discoveries. More specifically, this study examined the conceptual structure of the US public's attitudes by analyzing their interest in medical discoveries, new science and technology issues and the determinants of these interests. At the same time, Americans' attitudes towards these issues were compared with those of Europeans' to see if conceptual structure was similar between the populations.

The first section of this paper describes the data, methodology and variables used in the analysis of public attitudes toward medical technology and other sciences across countries. Following the description of statistical analyses used in this study, the next section presents the results of factor analyses and logistic regressions of public interest in these scientific issues. The final section provides the discussions and the implications of the findings.

RESEARCH DESIGN AND ANALYSIS

Data, Sample, and Survey Procedures

This study uses data from three main groups of public opinion surveys. The primary sources for European data are Eurobarometer surveys. Eurobarometer is a series of general population surveys of people in the European Community that routinely measures attitudes toward and awareness of the Common Market and other European Community institutions.

The 1995 Eurobarometer survey (Karlheinz and Melich, 1995), conducted between 3

November and 29 November 1992 with about 13,000 persons aged 15 and over residing in the 12 member nations of the European community (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom), focused on science issues. In the survey, respondents were asked various questions on their attitudes toward and awareness of science and technology issues.

The Eurobarometer survey used multi-stage probability sampling methods. All interviews were conducted face-to-face in the respondent's home. A standard questionnaire was used in each country and was administered in the appropriate national language or languages. The European Commission does not release response rates for the Eurobarometer polls. In this paper, I present the results for Europeans aged 18 and over in order to make the data comparable to the US and Canadian data.

The second data source for this study is a series of surveys of US adults (Miller, n.d.), conducted by the National Science Foundation to monitor public attitudes towards science and technology and their awareness and knowledge of scientific issues. The 1992 round of the series was closely coordinated with the Eurobarometer survey in order to facilitate international comparisons. The US survey used a random-digit-dialing (RDD) sampling of 2,001 people aged 18 and over who had working residential telephones. In addition, data from the 1995 and 1997 NSF surveys, conducted with 2,006 and 2,000 US adults, respectively, were also used.[1]

The year 2000 data for the US and Canadian public come from two surveys developed by the Harvard School of Public Health and was conducted over the telephone by ICR (International Communications Research) in Canada and the United States (Harvard School of Public Health/International Communications Research Poll, 2000). The US survey was conducted between 4 October and 8 October 2000, with 1,007 randomly selected American adults (age 18 and over). The Canadian survey was conducted between 5 October and 11 October 2000, with 1,500 randomly selected Canadian adults. To facilitate comparisons between people in the European countries and these North American countries, questions from Eurobarometer with identical wording were used. The questionnaires were administered in English in the US and in English and French in Canada.

Variables

As this study used data from existing international surveys, two variables that are available from the data were used to define the public's attitudes. Specifically, all respondents were asked to report on their level of interest in selected public policy issues -- how much they were interested in scientific issues such as new medical discoveries, new scientific discoveries, new inventions and technologies, and economic and social issues. In addition, a series of questions asked respondents how informed they considered themselves on these issues.

In past studies of public opinion, interest in policy issues has been frequently used as a measure of how salient the topic is to the public and policy makers. In a situation where

1) Interviews were conducted by telephone in the U.S. and Canada, where telephone penetration is high. In Europe, where telephone penetration is often relatively low, interviews were conducted in person.

the range of potential public policy issues is too broad for individuals to master, people choose which issue to follow based on the how salient the topic is (Almond , 1950; Rosenau, 1961; Miller, 1983; Popkin, 1994). Citizens interested in policy issues are more politically active regarding the policy decision making for that issue (Milbrath and Goel, 1977; Verba, Schlozman and Brady, 1995).

The political science literature also emphasized the role of knowledge in public attitude formation and political participation (Zaller, 1992; Delli Carpini and Keeter, 1989). As Zaller (1992) argues, "cognitive engagement" is a powerful predictor of political attitude formation and of the connectedness of an individual to the political process. While the variable used here is not a direct measure of the factual knowledge individuals have on these issues, it measures a person's self-assessed level of knowledge on an issue. Citizens are more likely to be active in political participation when they feel reasonably well informed and follow issues in the news as well as having a high interest level in an issue (Rosenau, 1961). Taken together, these two variables (interest and self-assessed level of information) captured the "attentive public", whose opinion will be more heeded by policy makers and reflected in the policy making process.

Analysis

First, descriptive statistics were calculated for each country on interest in and self-perceived level of awareness of new medical and other scientific discoveries.

To explore the underlying structure of interest in different issues, exploratory factor analyses of these issues using principal components analyses with Varimax (orthogonal) rotation were conducted. Among the available surveys of US citizens, data from the NSF were used in factor analyses because of the small number of policy items that were asked in the 2000 US and Canadian surveys. Individual scores were standardized to adjust for country effects (differences in average interest level across countries) by subtracting the mean interest score of each country from individual scores.

Several multiple logistic regression models were estimated to identify socio-demographic determinants of the public's interest in these scientific issues. The dependent variables were dichotomized into "very interested in the following issues (new medical discoveries, new scientific discoveries, and new technologies and inventions)" (1) and others (0). The independent variables included age (in three ordinal categories: 18-34, 35-64, and 65+), education (in three ordinal categories: high school or less, some college, and college graduate), gender, and income (in three ordinal categories: low, medium, and high).

A fixed-effect logistic regression model was used for the analyses of data from 12 European countries. This model included 11 country dummies to control for country specific effects. To make regressions comparable to European responses, HSPH 2000 survey data were used for analysis for American attitudes instead of the NSF surveys, as the NSF did not contain an income variable.

In mathematical forms, the regression models are as followings.

Fixed-effects logistic regression analysis for European countries

$$Y_{ij} = a + \beta X_{ij} + \gamma_j + \varepsilon_{ij}$$

Logistic regression analysis of US and Canada, separately

$$Y_{ij} = a + \beta X_{ij} + \varepsilon_{ij}$$

(i=individual, j=country, X= predictor variables, γ=country dummies, ε=error term)

RESULTS

Interest in new medical discoveries, scientific discoveries, and new technology and inventions. Americans were highly interested in medical technologies (66%), but in other science and technology issues, there were not such high levels of interest (Table 1). Only about a third of respondents (37% and 36% for new inventions and new scientific issues respectively) indicated that they were very interested in the other scientific issues. The substantial gap (about 30 percentage points) between Americans' interest in new medical discoveries and in other scientific issues does not appear in European responses. On average, about 44% of the Europeans said that they were very interested in medical discoveries, while about 35% said so regarding other science and technology issues. Overall, a considerably higher proportion of Americans and Canadians than Europeans expressed a high interest in new medical discoveries, but about the same proportion of Americans as people in the average European nation expressed interest in scientific discoveries and new inventions and technologies.

Dimensions of public's interest in various policy issues. Factor analyses of interest scores of European and US observations revealed an interesting underlying structure of public's interest in different scientific issues. Factor analyses of the US responses (Table

Table 1. International Comparison of Public Interest in News about Scientific Issues (% saying, "very interested in ...")

	New Medical Discoveries	New inventions & Technology	New Scientific Discoveries	N
US (1992)	66%	37%	36%	2,001
Europe Average	44	34	36	12,170
Belgium	37	27	30	951
Denmark	39	36	39	967
France	59	42	47	969
Germany	36	25	27	1,910
Greece	55	43	45	959
Ireland	38	30	28	921
Italy	46	39	45	924
Luxemburg	47	35	37	474
Netherlands	58	44	41	966
Portugal	28	21	22	960
Spain	38	31	36	942
United Kingdom	51	39	41	1,226
Canada (2000)	64	46	47	1,500
US average (1995, 1997, 2000)	67	45	47	

SOURCES: Eurobarometer 38.1 (1992); Science and Engineering Indicators Studies (National Science Foundation 1992, 1995, 1997); Harvard School of Public Health/ICR (2000).

Table 2. Factor Analysis (US: NSF Combined Data) (Factor Loadings: Final composite groupings indicated by boldface)

Issues/Factor number	1	2	3
International Issues	0.17	**0.78**	-0.03
Local School	-0.08	0.06	**0.79**
Scientific discoveries	**0.79**	0.08	0.16
Economics	0.15	**0.65**	0.19
Technologies/inventions	**0.77**	0.12	0.11
Nuclear	**0.48**	0.35	0.31
Medical discoveries	0.41	0.08	**0.58**
Space	**0.73**	0.19	-0.02
Environment	0.21	0.30	**0.58**
Military	0.08	0.74	0.19

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 3. Factor Analysis (Europe: Adjusted Data[a]) (Factor Loadings: Final composite groupings indicated by boldface)

Issues/Factor Number	1	2
Sports	-0.07	**0.90**
Politics	0.36	**0.58**
Environment	**0.72**	0.07
Medical discoveries	**0.78**	-0.03
Technology/inventions	**0.81**	0.21
Scientific discoveries	**0.85**	0.16

[a] controlled for country effect by subtracting the country mean from individual scores.
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

2) showed that the US public perceived medical discoveries as a separate dimension from science and technology issues. The first factor contained four scientific issues such as scientific discoveries, new technologies/invention, nuclear, and space issues. Three issues international, economic and military were most correlated to the second factor. Medical issues were grouped with the rest of the variables local school, medical discoveries and environment issues. These three issues are highly visible social issues in the American political agenda that are directly related to the public's everyday life. In combination, these three factors, with eigenvalues of the correlation matrix higher than 1.0 (3.3, 1.2, 1.0), explained 56% of the total variation.

On the other hand, European responses showed a somewhat different pattern. They categorized their interest in medical technologies in the same dimension as other science and technology issues. Table 3 shows results of factor analysis of Europeans' responses that revealed two factors with eigenvalues greater than 1.0 (2.8 and 1.07). Inspection of the item loadings for each factor defines the first factor with various scientific issue items such as the environment, medical discoveries, technology/inventions and scientific discoveries. The second factor was identified by political and sports issue items. These two factors accounted for 64% of the total variance in responses. When forced to use a three-factor solution (78% variance explained with eigenvalues as 2.89, 1.62, and

0.75), sports and politics were defined as two separate factors. Medical issues remained in the same group with science and technology issues. Grouping results were similar when principal factor analyses with oblique rotations were used as well as when unweighted data were used. The results were also similar when the data were not adjusted with country effects.

Self-assessment of knowledge about new medical discoveries. Table 4 presents similar gaps in the US public's self-assessed knowledge of medical technologies compared to their knowledge in other sciences. In 1992, about 22% of the US respondents said that they were very well informed about new medical discoveries. On the other hand, about 11% of the American respondents on scientific discoveries and 10% of the respondents on new inventions and technology said so. Europeans did not show as much difference. On average, 12% of Europeans said they were highly knowledgeable on the issue. About 9% of the Europeans said that they were very knowledgeable about other science issues and new inventions. In sum, while considerably higher proportion of Americans said that they were very informed about medical discoveries than Europeans, Americans were no more likely than are Europeans to consider themselves very knowledgeable about new technologies and scientific discoveries. Data on this item for Canada were unavailable.

Table 4. International Comparison of Self-assessment of Knowledge (% saying, "Very well informed in ...")

	New Medical Discoveries	New inventions & Technology	New Scientific Discoveries	N
Europe Average	12%	9%	9%	12,170
US	22	10	12	1,500
Belgium	14	10	9	951
Denmark	11	12	11	967
France	21	14	16	969
Germany	10	7	7	1,910
Greece	10	7	8	959
Ireland	8	8	7	921
Italy	12	8	10	924
Luxemburg	16	14	14	474
Netherlands	15	12	9	966
Portugal	6	4	4	960
Spain	7	6	6	942
United Kingdom	13	10	10	1,226

SOURCES: Eurobarometer 38.1 (1992); Science and Engineering Indicators Studies (1992)

Determinants of interest in new medical discoveries. Tables 5, 6, and 7 summarize the results from multiple logistic regression analyses of responses from European countries, the US and Canada on the likelihood of being very interested in new medical discoveries, new technologies and inventions, and new scientific discoveries. Determinants of US citizens' interest in medical sciences were different from those of other scientific issues. Among European responses, the difference between the issues was not shown.

In European countries, determinants of the public's interest were very similar across the three issues. In all three issues-medical discoveries, as well as in the other scientific

Table 5. Predictor of Interest in Scientific Issues among US Citizens (Parameter estimates for the probability of being "very interested in the following issues")

	Medical discoveries	New Technologies and Inventions	New Scientific Discoveries
College graduate	-0.230	**0.427**	0.020
Some college	-0.153	0.062	0.164
Female	**0.712**	-0.101	**-0.673**
Between 35 and 64	**0.541**	0.226	-0.070
Older than 65	**0.992**	0.408	0.044
Middle income	-0.181	0.033	0.092
High income	-0.050	0.058	0.228
Constant	-0.138	-0.654	-0.044
N	9620		

Source: HSPH/ICR (2000)

* Significant at p<=0.05.

Table 6. Predictor of Interest in Scientific Issues among European Citizens[a] (Parameter estimates for the probability of being "very interested in New Medical Discoveries.")

	Medical discoveries	New Technologies and Inventions	New Scientific Discoveries
College graduate	**0.466**	**0.620**	**0.843**
Some college	**0.225**	**0.316**	**0.428**
Female	**0.499**	**-0.629**	**-0.311**
Between 35 and 64	**0.066**	-0.073	-0.054
Older than 65	0.115	-0.266	-0.212
Middle income	**0.211**	**0.268**	**0.172**
High income	**0.372**	**0.484**	**0.417**
Constant	**-0.273**	**-0.397**	-0.369
N	9620	9620	9620

Source: Eurobarometer 38.1

* Significant at p<=0.05.

[a] The logistic regression controls for country effects.

Table 7. Predictor of Interest in Scientific Issues among Canadians (Parameter estimates for the probability of being "very interested in New Medical Discoveries.")

	Medical discoveries	New Technologies and Inventions	New Scientific Discoveries
College graduate	-0.221	-0.115	0.145
Some college	0.008	-0.091	0.042
Female	**0.458**	**-0.889**	**-0.385**
Between 35 and 64	**0.437**	-0.039	**0.257**
Older than 65	**0.576**	**-0.391**	-0.016
Middle income	0.032	-0.049	**-0.263**
High income	-0.159	-0.010	**-0.345**
Constant	0.137	**0.483**	0.065
N	1407		

Source: HSPH/ICR (2000)

* Significant at p<=0.05.

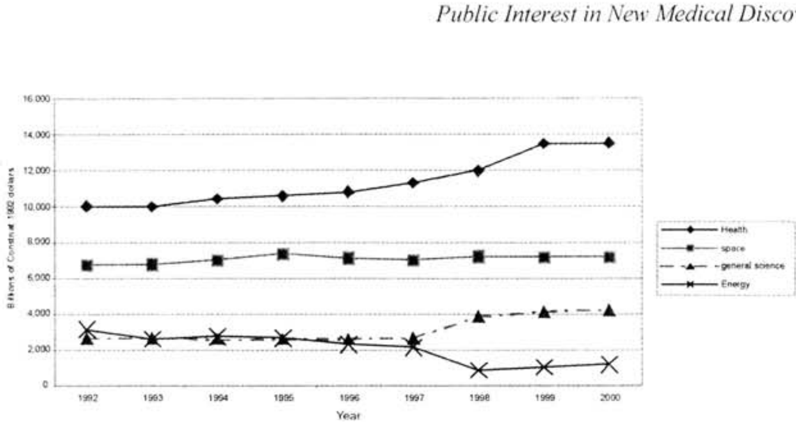
issues-people with a higher education and income were more likely to be interested than lower income and less educated people (Table 7). On the other hand, in the responses of citizens from the US or Canada, significant determinants of their interest in medical issues were different from those in other scientific issues. For example, while Americans with college education were more likely to be interested in the new technologies and inventions, education was not significantly related to the likelihood of being very interest in medical discoveries. Unlike most European countries, where people over age 65 differ little from those under 65 in their interest in medical discoveries, seniors in the US and Canada tend to express more interest in new medical discoveries than those under age 65. This trend was not shown with other scientific issues among US elderly respondents. In responses from European countries, elderly people did not show as much interested in medical discoveries or in other scientific issues. In sum, as shown in previous results from factor analyses, conceptual structures of American attitudes towards medical issues seemed to be different from attitudes towards other science and technology issues, and they were different from those of Europeans.

Implications and Limitations of the Study

By examining the conceptual structure of the public's attitudes toward scientific issues and medical discoveries, this study showed that the American public's unique interest in medical discoveries might not originate in their attitudes toward other science and technology issues. Americans were highly interested in medical issues and considered themselves very knowledgeable about the issues, but this pattern was not shown with other science and technologies issues. While European citizens grouped medical issues together with science and technology issues, Americans considered medical issues closer to social issues like environment and education.

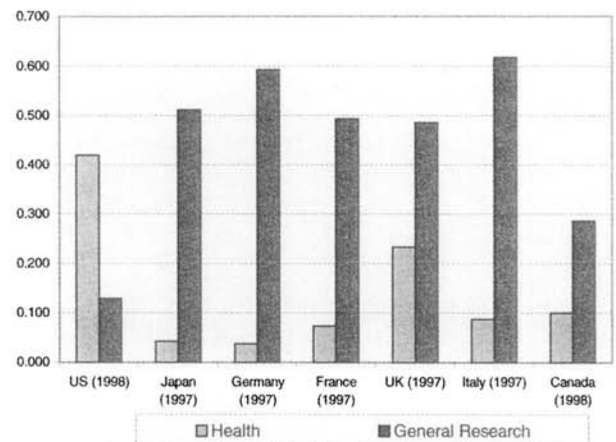
This finding seems to correspond well with the US government's decisions on its public expenditures. The United States develops and uses more medical technology than do other industrialized countries. Compared with most European countries, US hospitals perform a far greater number of catheterizations, angioplasties and bypass surgeries (Newhouse, 1992; Fuchs, 1993; Blumenthal, 1994; Fuchs, 1986). The United States also has more medical technologies and procedures available on an aggregate as well as a population-adjusted basis than most other countries (Organization for Economic Cooperation and Development, 2000).

On the other hand, the national emphasis on the medical technology and health sciences is not present in the case of other science and technologies. For example, in recent years, the proportion of the federal budget that supports mandatory programs has been expanding while the discretionary share has been decreasing. Discretionary programs now comprise less than a third of the total budget, and as a result, R&D and other discretionary programs are becoming increasingly likely candidates for reduction or curtailment to meet deficit-reduction targets. On the other hand, US government expenditures on health-related research have remained strong regardless of changes in political climate (Neumann and Sandberg, 1998; Blumenthal, 1994; National Science Board, 2000). As shown in the Figure 1, despite increasing vulnerability, the US health-related



Source: National Science Foundation (2000)
Notes: Data for 1980-98 are actual budget authority. Data for 1999 and 2000 are preliminary based on the FY 2000 Budget. Beginning in FY 1998, a number of Department of Energy programs were reclassified from energy to general Science.

Figure 1. Federal R&D Funding, BY Budget Function.



SOURCES: National Science Foundation, Division of Science Resources Studies (NSF/SRS), Federal R&D Funding by Budget Function: Fiscal Years 1998–2000, NSF 00-303 (Arlington, VA: 2000); Organisation for Economic Co-operation and Development, Basic Science and Technology Statistics (unpublished tabulations).
NOTE: General science is combined support for basic research and general university funds (GUF).

Figure 2. Distribution of Government Non-defense R&D Budget Appropriations, By Socioeconomic Objective (1997-8).

R&D budget has actually fared relatively well during the fiscal austerity of 1990s.

In comparison with six other industrialized countries for which data were available, the US spends a much higher proportion of its non-defense R&D budget on health research (Figure 2). In addition, among these seven industrialized countries, only the US spends more on health research than on general science research. This pattern is likely to continue (Neumann and Sandberg, 1998; National Science Board, 2000). An example is President Bush's announcement in early 2001 that he would seek a 14% ($2.8 billion) increase in funding for the National Institute of Health for the next fiscal year, in spite of his call for tax cuts and for slower growth in government spending (CNN.com, 2001).

Why have public expenditures on health sciences fared well while government budgets in other science and technologies have not? Studies on the relationship between the public's attitudes and public policy decision making suggest an answer to this question. A large body of empirical work in political science has shown that public preferences are often reflected in the process and outcomes of policy decision-making (Monroe, 1983; Page and Shapiro, 1983; Shapiro and Page, 1994; Westin, 1996; Erikson, Wright and McIver, 1993; Stimson, MacKuen and Erikson, 1995). For example, Monroe's study empirically showed that compared to majority support for proposed changes in policy with subsequent policy decisions, 64% of 222 policy decision cases were found to be congruent with the public's attitude toward the proposed policies (Monroe, 1998).

Another extensive study using different research methods looked at survey data about more than three hundred issues between 1935 and 1979 and found that 66% of *policy changes* were congruent with *changes in public attitude* (Page and Shapiro, 1983). Unlike Monroe's study where the direction of a cause-and-effect relationship was not clear, this study was able to show the direction of the responsiveness of policy to the degree of change in public opinion. In addition, using a time-trend analysis, Shapiro and Page were able to present better evidence of a causal relationship between opinion and policy (Shapiro and Page, 1994).

In terms of the impact of public opinion on the policy *decision-making process*, Miller and Stokes showed that roll-call votes cast by legislators were more supportive of a policy when a greater proportion of the public in their districts favored that policy (Miller and Stokes, 1963). More recently, Stimson, MacKuen and Erikson (1995) used time-series analysis to investigate the relationship of public mood data to a variety of summary indicators of policy decisions and also found evidence of a strong and resilient link between public opinion and policy.

Some factors may strengthen the relationship between public preferences and policy decisions. Public policy is, in general, more responsive to public preference when the issue is salient to the public. The public pays more attention to and forms more specific and stable preferences on an issue when the issue directly affects them, involves large costs or benefits for themselves, involves fundamental beliefs, receives a lot of media attention and is related to their real-life experience (Monroe, 1983; Glynn et al., 1999; Page and Shapiro, 1983; Miller and Stokes, 1963).

Most other policies regarding science and technologies are known to draw attention only from a small segment of the public because they are often perceived to be too technical and narrow for the general public to understand (Miller, Pardo and Niwa, 1997; Arnold, 1999). In contrast, medical technology has key characteristics that make it of interest to the public. While many technologies are almost exclusively the domain of professionals, medical technologies have been heavily exposed to the public through extensive media coverage. In addition, expanding medical technology is believed to be a politically attractive policy to legislators (Arnold, 1999), because its large perceptible benefits to many people allows legislators to claim credit.

Our data set did not allow us to determine whether the different policy emphasis between the medical sciences and other scientific issues is intrinsic to differences in cultures, are coming from differences in political systems, or are the results of political activities of physicians or pharmaceutical industry. While the findings in this study provide some insights on the relationship between the public attitudes and public policy decision-making, the data do not provide an explanation why the American attitude toward medical technology is different from those toward other scientific issues. Furthermore, the data does not explain why the Americans' unique interest in medical technologies is not found in other industrialized countries with similar levels of economic and scientific achievement. Frequent media coverage of the issues in the US may be one of the factors that shape this culture.

It is also possible that abundant high-tech equipment and surgical procedures leads the public to be interested in even more new interventions. Future content analyses of media coverage on new medical technology across countries, as well as a case study using archives and interviews with key decision makers or interest group players, will provide a better insight on how public preferences are formed and how policymakers learn about and respond to public opinion in different countries.

In other countries, especially those with very different cultures and political systems, similar patterns between public attitudes and public expenditure may not be replicated. For example, in Asian countries like South Korea, public attitudes have not been as frequently reflected in public policy decisions. Perhaps, the new emerging governance paradigm, where the role of public's participation is emphasized, may change this in the future. Further research is needed to examine how the impact of the public opinion on policy decisions differs in different cultures.

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