Citizens, Knowledge, and the Information Environment

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Abstract

In a democracy, knowledge is power. Research explaining the determinants of knowledge focuses on unchanging demographic and socioeconomic characteristics. This study combines data about the public’s knowledge of nearly 50 political issues with media coverage of those topics. In a two-part analysis, we demonstrate how education, the strongest and most consistent predictor of political knowledge, has a more nuanced connection to learning than is commonly recognized. Sometimes education is positively related to knowledge. In other instances its effect is negligible. A substantial part of the variation in the education-knowledge relationship is due to the amount of information available through the mass media. This study is among the first to distinguish the short-term, environmental-level influences on political knowledge from the largely static individual-level predictors, and to empirically demonstrate the importance of the information environment.
Is there a permanent information underclass in the United States? Decades of research would seem to suggest so. A voluminous literature shows that socioeconomic factors, such as being rich or educated, are positively associated with political knowledge (e.g., Bennett 1988; Delli Carpini and Keeter 1996, Luskin 1990; Neuman 1986). So well developed is this literature that the characteristics commonly associated with political knowledge are referred to as the “usual suspects” (e.g., Delli Carpini and Keeter 1996, 179). However, the resulting image is one of a static relationship between socioeconomic factors and political awareness. Not only is this a normatively unsatisfying position, but it also strikes us as inaccurate. Citizens experience politics in an environment that changes over time as domestic and foreign developments unfold. Yet, we know little about how variations in naturally occurring information environments affect what citizens know about politics.

Determining the nature of this effect has important implications for representative democracy. The uneven distribution of political knowledge biases the shape of collective opinion (Althaus 2003). Not only does political knowledge help citizens form stable, consistent opinions, but it also enables them to translate their opinions into meaningful forms of political participation (Delli Carpini and Keeter 1996). If variations in media coverage do little to offset the information advantage associated with high socioeconomic status, then large segments of the population will remain on the periphery of the American political system. If, on the other hand, the information environment can reduce the differences in political knowledge that exist between certain elements of society, there is hope that traditionally disadvantaged groups, such as the uneducated or the poor, can make their voices heard.

Our study investigates this issue by analyzing over three dozen public opinion surveys for a period of more than 10 years. In a two-part analysis, we examine whether differences in the
quantity of media coverage alter the relationship between individual-level predictors, such as education, and political knowledge. We find that higher levels of information in the environment elevate knowledge for everyone, but the educated learn disproportionately more from newspaper coverage. Increases in television coverage, by contrast, benefit the least educated almost as much as the most educated. Thus, the environment has a nuanced effect: certain news formats reinforce existing differences in political knowledge; others can weaken those differences.

The Information Environment and Political Knowledge

Our use of the term “environment” is distinct from scholars who study the influence of contextual factors, such as neighborhoods or workplaces (e.g., Huckfeldt 2001; Krassa 1990; Mondak and Mutz 2002). We also distinguish ourselves from those who study the broader political environment, such as district competitiveness or particular institutional arrangements (e.g., Gordon and Segura 1997; Hutchings 2001; 2003). Instead, we focus our attention on the information to which people are exposed in the news media. This includes statements made by public officials, interest groups, journalists, and other relevant actors regarding political developments and policy issues. Of course, in making this distinction, we do not deny the role that neighborhoods, workplaces, and other contexts play in filtering information citizens receive from the mass media. ¹

¹ We also distinguish ourselves from the literature on campaign effects. While there is evidence that learning takes place throughout the course of an election campaign (Alvarez 1997; Freedman, Franz, and Goldstein 2004), few studies directly examine the information environment as we do below (e.g., Alvarez 1997; Brians and Wattenberg 1996; Zhao and
Our argument is that the individual-level factors commonly associated with political knowledge have a variable impact—one that depends on features of the information environment. The ground one might cover in testing this claim is enormous. At the individual level, the determinants of knowledge include demographics (e.g., age, gender), socioeconomic factors (e.g., education, income), and behavioral characteristics such as interest (Delli Carpini and Keeter 1996). Indirect references to the influence of the information environment abound even if explicit tests are rare.² Amid this vast terrain, we focus on education, the most important predictor of political knowledge (Delli Carpini and Keeter 1996) and one of the most commonly used measures of socioeconomic status (e.g., Holbrook 2002). When it comes to environment-level influences, we focus on a simple but fundamental characteristic of the information environment: variation in the amount of media coverage of recent political developments.

**Volume of Media Coverage**

Scholars have recognized the role that opportunity plays in the acquisition of political knowledge (e.g., Gordon and Segura 1997; Delli Carpini, Keeter, and Kennamer 1994). For example, studies have shown an association between the availability of information, such as front page coverage of a topic in the media, and aggregate levels of political awareness (Chaffee 1995). Those that do have a peripheral interest in knowledge, focusing instead on voter perceptions or vote choice (e.g., Just et al. 1996).

² For example, Delli Carpini and Keeter (1996) state: “the information environment…varies with great consequence for how well the public is able to comprehend the political world” (p. 209). They also acknowledge that their model “is a closed system based entirely on factors specific to the individual and does not take account of external factors critical to political learning” (p. 209).
(Nicholson 2003). However, it would be premature to conclude that widespread political ignorance can be cured merely by increasing media coverage of political developments.\footnote{Indeed, some scholars maintain there already is an abundance of political information in the contemporary United States (e.g., Bimber 2003; Graber 2004; Lupia and McCubbins 1998).} Too often, the presentation of news does not match the processing skills of the audience. Graber (2004) writes, “[stories] are routinely written or narrated at an eighth-grade, or even twelfth-grade, comprehension level that ignores the fact that most American adults do not function comfortably above a sixth-grade level” (p. 558). Thus, opportunity is not the only factor that conditions whether someone will learn about a subject; ability, or having sufficient cognitive capacity, also matters. Some people simply are better at learning, retaining, and extrapolating from information they encounter in the media (Luskin 1990).

On this point, scholars have observed that infusions of information into society have an uneven effect on citizen knowledge (Tichenor, Donohue, and Olien 1970; see Zaller 1992 for a more recent treatment). Those who have attained a higher level of formal education are better able to process information in news stories. Not only is their reading ability likely to be greater, but they also are better at sorting and storing key points of information (Eveland and Scheufele 2000).\footnote{A similar dynamic has been observed in studies of priming, where well-informed individuals are more likely to manifest priming effects than their least informed counterparts (Krosnick and Brannon 1993). The difference arises from the ability of the well-informed to understand news content, store the information or its implications in memory, and retrieve it at a later date.} Following Tichenor et al. (1970), we expect that as the volume of information about a topic increases, every one will gain knowledge but at different rates. More formally, we hypothesize that increases in the overall amount of media attention to an issue will increase the
average amount of knowledge in the population (Hypothesis 1a), but that the gap in knowledge between individuals with low and high levels of education also will increase (Hypothesis 1b).\textsuperscript{5} Rather than allowing the less educated to “catch up,” increasing the amount of media coverage reinforces the relationship between education and political knowledge.

The best test of these hypotheses occurs when media coverage of issues varies. Despite the long tradition of studying knowledge gaps, however, very few studies meet this requirement (Gaziano 1997, 242).\textsuperscript{6} The present study contributes to the literature on political knowledge by content analyzing media coverage across a wide array of domestic and foreign policy issues, and then directly linking variations in media content to political knowledge. In particular, we are interested in whether the relationship between education and political knowledge varies across issues receiving differing amounts of media attention.

\textsuperscript{5} The two effects are related but distinct. Hypothesis 1a implies a positive intercept shift in environments with abundant political information. Hypothesis 1b entails a strengthening of the relationship between education and knowledge (represented by an increase in the size of the coefficient on education).

\textsuperscript{6} Recent studies have examined how the relationship between education and knowledge changes throughout a foreign policy crisis (Rhine, Bennett, and Flickinger 1999) and election campaigns (Holbrook 2002). The analytical approach in these studies is to interact a respondent’s education with some measure of time—on the assumption that time is a proxy for increasing media coverage—and to examine the relationship between this interaction and knowledge. This approach is an improvement over past studies, but it still represents an indirect method of measuring the information environment.
Differences in Medium

If knowledge gaps appear because of cognitive differences across individuals with low and high levels of education, more cognitively taxing news formats should reinforce those gaps, while less cognitively taxing formats ought to weaken them (Eveland and Scheufele 2000; Kwak 1999). Indeed, Neuman, Just, and Crigler (1992) show that differences in the format of print and broadcast coverage influence the extent to which people learn from the news. They find that the first few paragraphs of newspaper stories are dominated by facts as opposed to explanatory devices such as framing or analysis. Other scholars have noted that the complex and compactly written stories of print news outlets require a certain level of literacy (Graber 1994). Television, by contrast, is better able to exploit the dramatic and emotional components of a news story through visuals (Prior 2004; also see Graber 2004). Often, the visual component of a news story is consistent with or complementary to the verbal content (Neuman et al. 1992), making information more accessible to those with weaker cognitive skills.

Based upon these studies, we can refine our expectations regarding the influence of the information environment to include the following hypotheses. All else held constant, increasing the amount of newspaper coverage will raise the average level of knowledge in the population, but it should primarily benefit those with high levels of education (Hypothesis 2a). Restated, we expect increases in print coverage to boost the intercept (i.e., the average level of knowledge in a given survey) and to strengthen the relationship between education and knowledge. The effect of television is more subtle. Those with low levels of education likely learn more from television than their more educated peers, but it is doubtful that they learn enough to eliminate completely the information advantage of the most educated (e.g., Freedman et al. 2004, 733-34). Therefore, Hypothesis 2b states that an increase in television coverage will raise the average
level of knowledge in the population, but it will not alter the relationship between education and knowledge (i.e., no statistically meaningful effect in either direction). We test both of these hypotheses in the second part of our study.

**Data and Methods**

To test our hypotheses regarding the information environment, we combined more than three dozen public opinion surveys and collected data on the availability of information prior to each one of these surveys. Our first study examines a series of knowledge questions on two issues that gained prominence in the late-1990s (the tobacco settlement with the states and congressional proposals on Medicare). Our second study examines 41 issues over a period of 10 years. The magnitude of this data collection effort required that a number of decisions be made regarding the measurement of knowledge and the information environment. We summarize the most important of these decisions here and provide additional details in Appendix A.

**Measuring Knowledge**

Traditionally, political knowledge has been categorized as either chronic or domain-specific (Zaller 1992; Delli Carpini and Keeter 1996; Gilens 2001). Chronic, or general, knowledge consists of civics-style facts one might learn from a textbook, such as the branch of the federal government which can declare laws unconstitutional or the vote margin needed in Congress to overturn a presidential veto. By contrast, policy- or domain-specific knowledge represents facts about particular programs, policies, or problems, such as the percent of the budget devoted to foreign aid or recent trends in the crime rate.

Chronic measures are widely available and therefore tend to be used more frequently (Gilens 2001, 380), but they suffer from an important limitation. Once chronic knowledge is
obtained, the typical citizen might go years, decades, or even a lifetime without the need to update their knowledge of who occupies the vice presidency, which party controls the House of Representatives, or the protections guaranteed by the First Amendment (Graber 2004, 561). For this reason, several scholars have argued that domain-specific measures are preferable when trying to examine the impact of the information environment (Iyengar 1990; Zaller 1992, 336-7). Following the preference for policy-specific information, we focus on news events (Price and Zaller 1993) or what Delli Carpini and Keeter (1996) call “surveillance” issues. Survey questions about these issues have one important quality: knowing the correct answer depends almost exclusively on recent exposure to information in the media rather than learning that occurred years ago.

Focusing on surveillance knowledge is appropriate for another reason. In recent years, scholars have questioned the notion that citizens need a large store of general knowledge in order to function in a democratic society (see Kuklinski and Quirk 2001 for a review). According to this perspective, citizens should be knowledgeable about acute problems and pressing issues that appear in the headlines, but little else (Schudson 1998). As more scholars reject the ideal of the fully informed citizen in favor of Schudson’s “monitorial citizen,” understanding how people acquire surveillance knowledge will be of great normative interest.

Our study employs 41 cross-sectional public opinion surveys administered by Princeton Survey Research Associates (PSRA) from 1992 to 2003. These surveys asked respondents about recent political developments (e.g., “Does the Clinton health care reform plan guarantee that workers do not lose their health insurance coverage, if they lose or quit their jobs, or doesn't the plan go that far?”), and hence they are more specific and topical than general knowledge questions. However, it was precisely because the questions asked respondents about specific,
recent political developments that we expected to observe a relationship between features of the information environment and performance on the knowledge questions. The dependent variable in our analysis is a dichotomous measure coded “1” if the respondent answered the knowledge question correctly and “0” otherwise.7

Individual-Level Predictors

Following in the tradition of researchers who have examined the individual-level predictors of political knowledge (e.g., Bennett 1988; Delli Carpini and Keeter 1996, Luskin 1990; Neuman 1986), we included measures of education, income, age, race, and gender in our models.8 In addition, several studies have documented that following politics in the news is associated with higher levels of political knowledge (Delli Carpini and Keeter 1996; Luskin 1990). Like previous scholars, we view the “follows” measure as conveying important information about exposure to the information environment (Dalton, Beck, and Huckfeldt 1998; Hetherington 1996). The follows measure used below improves upon past research because it is

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7 Following Luskin and Bullock (2004), we combine incorrect and “don’t know” responses. Randomly reassigning “don’t know” responses (Mondak 2001) or including a dummy variable when respondents were reminded of the option to say “don’t know” did not alter our conclusions.

8 The range and coding for the variables are as follows: education (1-7; 7=post-graduate), income (1-6; 6=$100,000+), age (18-97; 97=97 years old), black (0-1; 1=African-American), female (0-1; 1=female). Missing demographic responses were imputed (King et al. 2001).
specific to the particular surveillance issue mentioned in the knowledge question (e.g., “How closely have you been following the debate over health care reform?”). 9

The Information Environment

We conducted a content analysis of the full text transcripts of three national media outlets during the six weeks prior to the first day of each PSRA survey. The choice of a six week coding period was deliberate. The sponsors of the PSRA surveys designed knowledge questions in response to political developments that had been in the news during this period of time (Brodie, Hamel, Altman, Blendon, and Benson 2003).

We use the Associated Press (AP) to represent the total amount of media attention devoted to an issue. This decision can be justified on a number of grounds. As the major newswire service in the United States, the AP serves 1,700 newspapers and 5,000 radio and television stations (www.ap.org). Moreover, the AP has long been viewed as an agenda setter for other news outlets around the nation (e.g., Jacobs and Shapiro 2000, 160). While few people actually read the AP newswire, it influences news coverage widely, and serves as a good proxy for the overall volume of information in the environment at any given time.

9 Coding categories are: 1=not at all closely; 2=not too closely; 3=fairly closely; 4=very closely.

It is possible that the causal relationship may run in the opposite direction—i.e., knowledge about a particular issue stimulates one to follow that topic in the news. In separate analyses we explored the possibility of endogeneity (Reviewers: see Supplemental Reviewer Addendum). Our key substantive findings remain intact regardless of whether we employ alternate specifications that account for endogeneity or exclude follows from the analysis altogether.
In Study 2, we concentrate on differences between print and television coverage. For our broadcast source, we randomly selected one television station from the three major networks and content analyzed its evening news program (*CBS Evening News*). We selected *USA Today* as our print source because of its wide distribution. The daily audience for this paper is 5.4 million people (www.usatoday.com), earning it the nickname “the nation's most read daily newspaper.”¹⁰ Like our use of the *AP*, we view *CBS* and *USA Today* as providing a representative picture of the information that was appearing on television and in newspapers around the county.¹¹

Once we identified the relevant sample of media reports in each media outlet, we coded each source for the total number of stories during the content analysis period.¹² A simple story count captured the essence of what we sought to measure; namely, the degree to which information about a particular issue was plentiful.¹³ We coded stories for other characteristics,

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¹⁰ Among major national newspapers (*USA Today*, *Wall Street Journal*, and the *New York Times*) the market share of *USA Today* is 43% (www.usatoday.com).

¹¹ Media reports for all three sources were obtained from Lexis-Nexis and evaluated by multiple coders. Intercoder reliability analyses on a randomly selected sample of news reports (15 percent) show high levels agreement among coders for all the content analyses we report here.

¹² A story was considered relevant as long as it discussed the issue underlying the knowledge question. For example, if PSRA asked respondents about recent congressional action regarding prescription drug discount cards, we included stories that discussed prescription drugs, not just those that mentioned drug cards.

¹³ The results we report later are robust to related measures, such as the duration of news coverage (e.g., in terms of days) and the intensity of that coverage (e.g., stories per day).
such as the inclusion of expert commentary and background-oriented contextual coverage, which we return to in our discussion of the empirical findings at the conclusion of Study 2.

**Study 1: Variation in Media Coverage within an Issue**

Two of the 41 surveys in our sample asked respondents multiple questions about the same surveillance issue. Importantly, media coverage of the issue varied in a way that allows us to test Hypotheses 1a and 1b. The first surveillance issue we examine is the 1998 tobacco settlement with the states. There were multiple components of the deal (e.g., payments to the states, a ban on tobacco advertisements such as Joe Camel) each of which received differing amounts of coverage in the media. Our second surveillance issue, congressional proposals on Medicare during 1997, is similar in the sense that Congress was considering several different ideas (e.g., increasing the eligibility age, means testing for benefits), each of which received more or less coverage in the news. Thus, in both surveys, the same individual is asked multiple questions about the same issue. For any given respondent, variation in knowledge across the questions can be attributed to differences in the amount of media coverage to particular aspects of the tobacco settlement or Medicare.

And differences in media coverage there were. When it came to the tobacco settlement, the media focused almost exclusively on one feature of the deal: the billions of dollars that the tobacco industry was to pay to the states. In the six weeks leading up to the PSRA survey, this aspect of the deal was covered in 28 *Associated Press* stories (approximately one story every other day). Other parts of the settlement, such as the ban on advertisements, received a moderate amount of attention (11 stories), while still others, such as the right of individuals to sue the tobacco industry, received little media attention (4 stories). Coverage of Medicare was similarly uneven. The media paid the most attention to proposals that required means testing for
premiums and that raised the eligibility age (23 and 25 stories, respectively). Giving seniors more choice under Medicare and cutting provider payments received some coverage (11 and 17 stories, respectively). Means testing for benefits received no attention (0 stories). We expect these differences in media coverage to be related to variations in political knowledge within each survey.\textsuperscript{14}

Hypothesis 1a leads us to expect that the average level of knowledge among survey respondents will be highest for those topics receiving the most media attention. Aggregate patterns of political knowledge follow precisely this pattern. Over 70 percent of respondents correctly answered questions regarding the billion dollar payment to the states and the ban on advertisements. Only 25 percent of respondents correctly answered the question regarding the right to sue, the topic that received the least attention in the news ($t$-tests for differences in knowledge significant at $p < .01$). On Medicare, approximately 60 percent of the sample correctly answered questions about the two most heavily covered topics (eligibility age, means testing for premiums); 46 percent correctly answered questions about cuts in provider payments and patient choice, and only 37 percent provided the right answer to the question about means testing for benefits ($t$-tests significant at $p < .01$). Again, these patterns follow the level of coverage devoted to each issue.

Due to the cognitive differences between individuals with low and high levels of education, the least educated are the least equipped to process increases in the amount of political information. Thus, Hypothesis 1b states that the relationship between education and knowledge

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\textsuperscript{14} The other factor that is varying is how the individual questions regarding tobacco and Medicare were worded. We deal more systematically with question difficulty in Study 2.
should become stronger as media coverage increases. This pattern is shown in Figure 1a, which displays the coefficient on education from a series of probit models predicting knowledge.\footnote{This model includes the usual array of individual-level predictors: education, income, age, gender, race, and whether the respondent was following news about the tobacco settlement (or Medicare). See Appendix B for the complete table of coefficients and question wording.}

Figure 1a about here.

The coefficients are arranged in order of increasing media coverage. For example, the left-most coefficient ($\hat{\beta} = 0.03$; standard error 0.027) represents the relationship between education and knowledge on that part of the settlement that received the least coverage (the right to sue). This relationship is statistically insignificant, as indicated by the 95% confidence interval that overlaps zero. Consistent with our expectations, this relationship is weaker than the relationship between education and knowledge on the two tobacco topics that received more coverage (ad ban, payments to the states).

To put the coefficients in perspective, consider the gap in knowledge between two typical respondents, one with an eighth grade education and the other with schooling after college.\footnote{The typical respondent is a white female who takes on the average value of all other variables.} When it comes to the right to sue, a high education respondent is only slightly more likely to provide the correct answer to the question than a low education respondent (24 versus 23 percent). The confidence intervals around these predictions are large and overlap considerably. As media coverage increases, both individuals are more likely to correctly answer questions about the settlement, but it is the highly educated who benefit the most from an increase in media coverage. For the most heavily covered topic (payments to the states), a person with low education has a 56 percent chance of correctly answering the question (95% C.I. from 47 to 65
percent). A respondent with high education has a 77 percent chance of getting the question correct (95% C.I. from 70 to 82 percent), translating into a 21 percentage point knowledge gap.

Figure 1b about here.

Figure 1b presents education coefficients for the five questions dealing with congressional proposals on Medicare. Once again, the two coefficients on the left correspond to topics with the least media coverage (means testing of benefits, patient choice), and the three coefficients on the right correspond to the topics with the most (cut provider payments, means testing for premiums, and eligibility age). For the most part, Figure 1b reproduces the pattern seen in Figure 1a: an insignificant relationship between education and knowledge when media coverage is low and a positive and significant relationship when media coverage is high. Like the previous models, the gap between the least and most educated is largest for those aspects of the issue that received the most news coverage.

Looking at the same respondents across the same issue (either tobacco or Medicare), we have shown that variations in the level of knowledge correspond to differences in the amount of news coverage. We also have shown that the well-known relationship between education and knowledge is not fixed—not even within the same issue. How generalizable are these findings? We turn to that question in Study 2.

**Study 2: Variation in Media Coverage across Issues**

In this study, we combined 41 public opinion surveys and collected data on the availability of information prior to each one of the surveys. Although the subject of these questions varies over time, they are equivalent measures of knowledge in at least one respect: they have passed Zaller’s (2003) “burglar alarm” news standard, which is to say that they represent important issues journalists were covering in the weeks leading up to the survey (also
see Schudson 1998). Put somewhat differently, whereas Study 1 had a high degree of internal validity, Study 2 has a high degree of external validity.

To return to our central claim, we argue that in addition to the individual-level predictors of knowledge, variations in the information environment affect what citizens know about politics. Thus, the first step was to document that knowledge of recent political developments changes across the 41 surveys in our study. If it did not, there would be little reason to look beyond the stable individual-level factors we know to be associated with knowledge.

Figure 2 presents the percentage of respondents giving the correct response to a question tapping their knowledge of surveillance issues from 1992 to 2003.

As Figure 2 demonstrates, levels of political knowledge were anything but constant across the topics queried in the PSRA surveys, ranging from a low of 4% (President Bush’s drug plan) to a high of 91% (West Nile Virus). There also is no obvious pattern to citizen knowledge on this sample of issues. Citizens are no more—or less—knowledgeable about partisan issues (compare, for example, the varying levels of knowledge about Social Security, Medicare, and abortion). We remain hopeful, then, that at least some portion of political knowledge can be linked to different features of the information environment across these subjects.

Like the two issues we examined in Study 1, there was a great deal of variation in media coverage across the 41 issues. The mean level of stories in the \textit{AP} was 11 news stories. The variation around that mean was substantial, however, with some issues receiving no coverage and others as many as 40 stories. As for the volume of print coverage, the mean number of

\footnote{Because all of these issues represent important, not just recent, political developments, every one of the issues we examine in Study 2 was covered by at least one of our three media sources.}
stories in *USA Today* was 5.4 (min = 0; max = 21). The average number of stories on *CBS Evening News* was 2 (min = 0; max = 8).

Hypothesis 1a predicts that the average level of knowledge among a group of survey respondents will be positively related to the volume of information in the media. An explicit test of this proposition will come later, when we combine our surveys and examine whether the variation in the intercept is significantly greater than zero. In the meantime, we see support for Hypothesis 1a in the aggregate-level relationships. The bivariate correlation between our media measures and the knowledge series ranges from .54 to .58 ($p < .01$). The outline of this relationship can be seen in Figure 2. There were 3 stories in the *AP* about the Bush drug plan and Social Security solvency, 13 on the Supreme Court’s abortion decision, 18 about investing the Social Security trust fund, 23 on the subject of Medicare premiums, and 34 about West Nile Virus.

We also see some initial support for Hypothesis 2b which states that the knowledge gap between the least and the most educated will be largest on issues with the most media coverage. Figures 3a and 3b shows the percent correct across education groups for the 7 least and most covered issues (which corresponds roughly to the lower and upper quintiles of our sample).

For issues that receive relatively little coverage, there is no consistent pattern between a person’s level of education and what they know about recent political developments. On some issues the highly educated know more (e.g., Social Security), while on others the least educated appear to know more (e.g., medical errors) or there is no difference between the two groups (e.g., a proposal to extend Medicare for 55 to 65 year olds). The average knowledge gap across these seven issues is 0. Panel B, by contrast, shows that on issues with high levels of media coverage,
there is a consistent gap between education groups. The average size of this gap is 22 percentage points, and it ranges from 10 percentage points (Medicare) to 32 percentage points (Stem Cells).

Having shown that the relationship between education and knowledge varies (also see Figure 1, Study 1), we turn next to the role that media coverage plays in accounting for the variance in this relationship. Because we are combining 41 cross-sectional surveys, subtle differences in survey topics or administration might affect patterns of political knowledge. One obvious factor is the inherent difficulty of the question. When respondents are confronted with a question that is worded in a confusing manner or when they are queried about a complex subject, the mean of all respondents answering this item will be lower than we would otherwise expect.

In our next and final set of analyses, we used item response theory (Hambleton and Swaminathan 1985; Lord and Novick 1968), to create a measure of question difficulty. We use this variable to control for differences across surveys. In its original form, Item Difficulty represents the objective probability of correctly answering a knowledge question. We subtracted the variable from 1 so that higher values indicate a more difficult question.\footnote{We also operationalized question difficulty in terms of the number of response options and the number of words in the question. Neither variable was statistically significant in our models.}

**A Multilevel Model**

Our data combine survey respondents who are nested in different information environments, which is to say that we have data at two levels. The first is the level of the individual survey respondent; the second corresponds to the information environment preceding each survey. Because individuals in any given survey confront similar information environments, there is a significant amount of clustering in our data. In this situation, multilevel
models are an appropriate solution (Raudenbush and Bryk 2002; Goldstein 2003; see Peffley and Rohrschneider 2003 or Rohrschneider 2002 for applications).

Given our argument, a multilevel model entails the specification of three equations:

\[ \text{Knowledge}_{ij} = \beta_0 + \beta_1 \text{education}_{ij} + \ldots + \beta_k x_{kij} + \varepsilon_{ij} \]  

(1)

\[ \beta_0 = \gamma_{00} + \gamma_{01} \text{volume}_{ij} + \gamma_{02} \text{difficulty}_{2j} + \delta_{0j} \]  

(2)

\[ \beta_{1j} = \gamma_{10} + \gamma_{11} \text{volume}_{ij} + \gamma_{12} \text{difficulty}_{2j} + \delta_{1j} \]  

(3)

Equation (1) models the relationship between the usual suspects (education, age, income, etc.) and political knowledge. Where the multilevel model departs from the typical regression is that the parameters in the first equation are allowed to vary across the \( j \) level-2 units. Thus, equation (2) models the intercept (\( \beta_0 \)), the variation in the average level of knowledge among a group of survey respondents, as a function of the volume of information in the environment (measured in terms of the \( AP \), \( CBS \), or \( USA \) Today) and the inherent difficulty of the question. The third equation models the variation in the education parameter (\( \beta_{1j} \)) as a function of these same factors. The relationship posited by equation (3) commonly is referred to as a “cross-level interaction” because it involves the relationship between a level-1 and a level-2 predictor.\(^{19}\)

According to Hypothesis 1a, increases in the overall volume of the information environment will raise the average level of knowledge (i.e., \( \gamma_{01} \) will be positive and significant). Hypothesis 1b predicts that most of this increase will take place among the most educated, leading to a strengthening of the relationship education and knowledge in high volume

\(^{19}\) Equations (2) and (3) also include disturbance terms (\( \delta \)). One of the virtues of multilevel models is that researchers do not assume the level-2 variables account perfectly for the variation in level-1 parameters (Steenbergen and Jones 2002, 221).
environments (i.e., $\gamma_{1i}$ will be positive and significant). We expect that increases in the amount of *newspaper* coverage will strengthen the relationship between education and knowledge (Hypothesis 2a), which again implies a positive sign for the cross-level interaction between the volume of newspaper coverage and education. Increases in the amount of *television* coverage should have no effect on that relationship (Hypothesis 2b), leading to an insignificant cross-level interaction between the volume of television coverage and education.

A useful starting point in the analysis of multilevel data is the random effects ANOVA model (Raudenbush and Bryk 2002, 24). In this representation,

$$Y_{ij} = \gamma_{00} + \delta_{0j} + \epsilon_{ij}$$

the probability of correctly answering a question is modeled as a function of $\gamma_{00}$, the grand mean of $Y$. The model also includes two random parameters. The first, $\delta_{0j}$, represents a survey-level random effect while the second, $\epsilon_{ij}$, represents an individual-level random effect. What makes this model particularly useful is the fact that it decomposes the variance in the dependent variable across levels of analysis. Thus, we can determine how much between-survey variation ($\tau_{00}$) there is relative to within-survey variation ($\sigma^2$). For example, the ratio of $\tau_{00}$ to the total variance ($\tau_{00} + \sigma^2$) indicates how much of the variance in knowledge can be attributed to environmental-level factors. Given the importance of individual-level factors in predicting knowledge, it should come as little surprise that approximately 75 percent of the variance in knowledge can be attributed to the individual-level. Importantly, however, 25 percent of the variance is attributable to environmental-level factors. Scholars have long acknowledged that
the information environment has an important influence on knowledge; this study is the first to estimate the relative magnitude of that influence.\textsuperscript{20}

Table 1 reports the results of two multilevel models where the first corresponds to the overall information environment, using *Associated Press* coverage as a proxy, and the second compares the effect of newspaper (*USA Today*) and broadcast (*CBS Evening News*) coverage.\textsuperscript{21}

Table 1 about here.

We begin by presenting the coefficients for the level-1 fixed effects. These terms represent the average effect of each level-1 variable across our sample of issues. Focusing on the first column, the *Education* coefficient, $\hat{\beta}_1 = .070$ (.008 standard error), represents the estimated average slope for education across the 41 surveys. The fact that the coefficient is positive and

\textsuperscript{20} Another way of illustrating the importance of between-survey variation in our data is a Wald test, where the null hypothesis states that $\tau_{00} = 0$ (Rasbash et al. 2000; Goldstein 2003). We reject the null hypothesis ($\chi^2 = 17.085; p < .01$) and therefore conclude that the variation in $\tau_{00}$ is significantly greater than zero (i.e., the intercept should be specified as a random parameter).

As another preliminary step, we estimated a random coefficient model in which we treat the education parameter as a random variable (i.e., $\beta_{ij} = \gamma_{10} + \delta_{ij}$). We conducted a Wald test, where the null hypothesis states that the variance component for education is equal to zero. We can reject the null hypothesis ($\chi^2 = 11.552; p < .01$), and conclude that the variation in the education coefficient is significantly greater than zero.

\textsuperscript{21} Our dependent variable is dichotomous, so we use a probit link function. Statistical estimates were generated using MLwiN 2.0 (Rasbash et al. 2000) and R 1.9.1 (Pinheiro and Bates 2000). Continuous variables are grand mean centered (see Raudenbush and Bryk 2002 for discussion).
significant confirms decades of studies showing a positive relationship between education and political knowledge. Other level-1 predictors perform exactly as one would expect, given past research in this area. Higher levels of political knowledge are associated with having a high income, being older, male, white, and following a particular issue in the news. The results for the individual-level predictors are similar across both models, so we instead concentrate on variables that have the most relevance for our theoretical argument.

Turning to the coefficients for the level-2 fixed effects, we see support for Hypothesis 1a. The positive and significant coefficient on Newswire coverage indicates that even when we control for the difficulty of the question, an increase in the overall amount of media attention to an issue raises the average level of knowledge. Consistent with Hypothesis 1b, the coefficient on the cross-level interaction between Education and Newswire coverage is positive and significant. This implies that as the volume of information increases, the relationship between education and knowledge becomes stronger. Predicted probabilities put this last finding in perspective.22 In an environment devoid of information, the typical citizen with low education has a 19 percent chance of getting the correct answer on a knowledge question (95% C.I. from 16 to 23 percent). A more educated respondent has a 29 percent chance of providing the correct answer (95% C.I. from 25 to 32 percent), for an estimated knowledge gap of approximately 10 percentage points.

22 We computed predicted probabilities using means for continuous variables and modal values for dichotomous variables. “Low” education corresponds to a person with an eighth grade education or less; “high” education corresponds to a person with schooling after college.
The knowledge gap between these hypothetical citizens *triples* in an environment that is rich with information (the difference between 48 and 79 percent).²³

The second column of results compares the conditioning role of newspaper and television news coverage. Focusing first on the level-2 fixed effects, an increase in either news source is positively associated with knowledge. In other words, variation in aggregate political knowledge across surveys can be attributed to differences in the amount of newspaper and television coverage. Going from the minimum to the maximum on print and broadcast coverage results in 29 percent and 26 percent increases in aggregate political knowledge, respectively.

The coefficients on the cross-level interactions (*Education X newspaper* and *Education X television*) show support for our hypotheses. Higher amounts of print coverage strengthen the relationship between education and knowledge, while television has no effect on that relationship. The substantive effect of both terms is best displayed graphically.

Figure 4 about here.

Consistent with Hypothesis 2a, the first panel of Figure 4 shows that the highly educated benefit the most from an increase in print coverage. When newspaper coverage is at its lowest, the difference between low and high education respondents is modest (10 percentage points). The gap in knowledge between these groups grows threefold when print coverage is abundant. Underlying this growth are differential rates of learning. Low education respondents are only 14 percentage points more likely to get the correct answer when newspaper coverage is at its maximum (the difference between 23 and 37); high education respondents, by contrast, are

²³ We find similar results when we use alternate measures of the overall information environment, such as the sum of news stories across our print and broadcast sources and the sum of news stories across all three sources.
nearly 40 percentage points more likely to get the correct answer (the difference between 33 and 70).

Panel B displays the comparison between low and high education groups across different levels of television coverage. While it is true that the gap between low and high education respondents increases along with the volume of television coverage, the difference is small and statistically insignificant.\textsuperscript{24} The subtle effect of television can be seen by comparing the increase in percent correct across the two groups. Contrary to the preceding panel, low education respondents benefit nearly as much from an increase in television coverage as high education respondents. They are 22 percentage points more likely to get the correct answer when television coverage is at its maximum (the difference between 21 and 43); high education respondents are 27 percentage points more likely to get the correct answer (the difference between 36 and 63). Relative to the starting point for each group, this translates into more than a 100 percent gain for the least educated but only a 75 percent gain for the most educated.\textsuperscript{25} Finally, although it is not our central focus, the analysis shows that respondents do worse on more difficult items. The negative sign on \textit{Education X difficulty} suggests that the relationship between education and knowledge diminishes on more difficult questions.

The motivation for our multilevel model was the fact that we expected to observe, and indeed found evidence of, random variation in our parameters. As such, a common way of

\textsuperscript{24} The coefficient on \textit{Education X television} is indistinguishable from zero (Table 1).

\textsuperscript{25} Freedman et al. (2004, 733-34) come to similar conclusions regarding the impact of television ads on candidate knowledge. They find no evidence of differential effects (i.e., low information citizens do not learn significantly more from ads than high information respondents), but the \textit{relative} increase in knowledge for the least informed is large compared to the highly informed.
assessing the explanatory power of a multilevel model is to calculate the proportion variance explained in the parameters as one goes from a random coefficients model without any level-2 predictors to one that includes our measures of volume and difficulty. Accounting for the volume of print and television coverage reduces the variance in the intercept coefficient by over 50 percent; it reduces the variance in the education coefficient by 41 percent.\textsuperscript{26} Thus, not only were we able to account for significant variation in the average level of knowledge across our 41 surveys, but we also made significant headway in understanding how the effect of education varies with changes in the information environment. The fact that the variance components for the intercept and education parameter remain significant (Table 1) indicates that other environmental-level factors might further reduce the variance of the intercept and education parameters.

**Discussion**

Our analysis has shown that the relationship between education and knowledge varies along with changes in the information environment. Increases in newspaper coverage primarily benefit high education respondents, thereby strengthening the relationship between education and knowledge (Figure 4a). Increases in the volume of television coverage, by contrast, benefit the least educated almost as much as the most educated (Figure 4b). Additional content analyses highlight some of the differences between print and broadcast news and shed further light on our findings.

\textsuperscript{26} These figures were calculated by comparing the variance components from a random coefficients model with those for the fully specified models of Table 1. For example, the percent reduction in variance for the intercept was calculated as follows: \( \frac{\tau_{00}(RC) - \tau_{00}(Full)}{\tau_{00}(RC)} \).
For each of the issues in our sample, we tallied the number of experts that were quoted or paraphrased in media reports. We also coded each story according to its level of contextual coverage. As the name implies, contextual coverage refers to any kind of reporting that discusses the historical, political, or social background of an issue (Bennett 2003; Graber 2004). This includes articles that consider why a particular policy action has been taken, that discuss the consequences of a policy change, or that provide an in-depth discussion of a policy problem. Expert commentary and contextual coverage typically are considered indicators of quality in news reporting, however, citizens with low education are the least able to digest this type of information. It comes as little surprise, then, that our print source (USA Today) was significantly more likely to feature experts and to provide contextual coverage than our broadcast source (CBS Evening News). These differences in the composition of newspaper and television coverage, added to the differential rates of learning, contribute to the patterns found in Table 1.

Although our findings are robust to alternative specifications, several issues give us pause. First, there is the potential problem of selection in the newspaper versus television model (Table 1). Given the abstract writing style of many newspapers, individuals with low levels of education might be more likely to choose television as their main source of political information. If so, our estimates of the knowledge gap between education groups could be incorrect. Fortunately, in 11 of the 41 surveys we examined, respondents were asked where they got most of their information. The choices were television, newspapers, radio, magazines, the internet, friends, or other sources. We re-estimated the models in Table 1 on the smaller dataset and reproduced the same pattern of findings. We then included the media use variable in the model to control for the possibility that high and low education groups rely on different media sources.

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27 T-test (one-tailed) results are as follows: \( t_{\text{expert}} = -1.407; p < .10 \) and \( t_{\text{context}} = -2.02; p < .01 \).
This variable was not related to knowledge, nor did its inclusion alter any of our substantive conclusions.

Another concern is that there may be patterns in the types of issues which receive media attention (i.e., media coverage is not exogenous). Two types of issues stand out in this regard. First, we might expect to observe differences in coverage for partisan and nonpartisan issues. Partisan issues often are, or have a history of being, highly contested. The ease with which these issues can be presented in news stories, and the presence of two readily identifiable “sides,” might make them a favored topic among members of the media. If so, we would expect there to be a greater number of news stories on partisan issues. Second, a number of our cases have to do with presidential initiatives or major statements of administration policy (e.g., the State of Union Address). Given the role of the president as a central protagonist in news stories, we might expect that relative to the other issues in our dataset, the number of stories will be higher when the topic is a presidential initiative. Besides the slight tendency of the AP to provide more coverage of partisan issues (one-tailed \( t = 1.255; \ p = .11 \), \( t \)-tests show no significant differences in the volume of coverage across our three sources for either partisan issues or presidential initiatives. Thus, while media coverage may not be entirely exogenous—e.g., production values drive coverage to some extent—we did not uncover any relationship between the issues we examined here and the volume of news stories across any of our sources.

Finally, many of the surveillance issues in this study are public health topics. To the extent our sample of issues is biased, this threatens the external validity of our results (i.e. “health knowledge” as opposed to knowledge); it also could violate the assumption that the \( j \)-units are sampled randomly. In separate analyses, we sought to determine if issue type was significantly related to the variation in the parameters. In the aggregate, citizens are more
knowledgeable about health issues \( (p < .05) \). However, this variable did not moderate the impact of education nor did it alter the findings we report in Table 1.\(^{28}\)

**Conclusion**

Scholars have long recognized that the quality of public opinion depends in large part upon the information and ideas that are conveyed to it (e.g., Key 1961; Page 1996). Likewise, the ability of citizens to monitor the soundness of policies and the performance of politicians depends on a media that functions as their “eyes and ears” (Graber 2003, 146). Examining over three dozen issues for a period of more than 10 years, this study has shown that the information environment has a powerful effect on knowledge.

Far from being static, the well-documented relationship between education and knowledge varies as a function of the information environment. Differences in knowledge that have been attributed to education become even greater in environments in which information is plentiful. The increase in the knowledge gap between low and high education citizens is driven primarily by the format of print news, which tends to be more abstract and factual, with few visual aides. Increases in television coverage do not lead to a statistically significant increase in the knowledge gap between low and high education groups. Indeed, our results show that the least educated benefit nearly as much as the most educated (and in terms of relative gains, they do better). Thus, the environment has an important, although nuanced, effect: certain news formats reinforce existing differences in political knowledge; others can weaken those differences.

\(^{28}\) Indicators for presidential initiatives and partisan issues almost always are insignificant predictors of knowledge.
Our findings have important implications for scholars, journalists, and political leaders. Simply providing more information is likely to reinforce the knowledge gap that exists between people with low and high levels of education. Although scholars lament the tendency of the media to provide “simplistic, nonsubstantive, nonhistorical and noncontextual” coverage (Postman 1985, 141), our results suggest the importance of transmitting political information in a way that can be comprehended by the least educated. Our analyses also cast the media effects literature in a new light. In addition to the subtle role the mass media play in priming and agenda setting (e.g., Miller and Krosnick 2000), we have found that variations in the quantity of news coverage moderate the relationship between education and knowledge.

Our findings beg the question of exactly what citizens need to know in order to function effectively in a democratic society (Hutchings 2003; Lupia and McCubbins 1998). In recent years, scholars have recast citizenship as a “monitorial obligation” (Schudson 1998; also see Zaller 2003). According to this perspective, citizens pay attention to a wide variety of issues, although none too closely. They do not gather information actively; instead, they survey the environment just carefully enough to “detect threats.” But the problems confronting modern societies are complex, which means that the monitorial citizen must rely almost exclusively on professional communicators to evaluate policies and interpret political events (Page 1996). If anything, then, Schudson’s evolving notion of citizenship makes understanding the role of information environment more, not less, important.
Appendix A: The Political Knowledge Series

When constructing the political knowledge series, we looked for surveys conducted by a single organization which contained questions about political knowledge and news attention. A search of all available dates in the Roper Center for Public Opinion Research iPoll database turned up 41 surveys conducted by Princeton Survey Research Associates (PSRA) that had at least one close-ended political knowledge question as well as a measure of how closely the respondent was following that issue. Most of the 41 surveys we chose had more than one knowledge question, in which case we randomly selected a question. The items we examine cover a variety of domestic and international issues. Table A-1 lists the question topic and correct answer for each of the surveys we use in the analysis.

Table A-1 about here.

The data files for the surveys used here have been archived for public dissemination at the Roper Center for Public Opinion. Detailed information on the surveys, including question wording, order, and introductions, etc., is available at the Roper Center. The Kaiser Family Foundation and Harvard School of Public Health sponsored many of the surveys in our sample. For more information on survey methodology and response rates, see Brodie et al. (2003) or www.kff.org.

29 The follow question generally read like this: “As I read each item, tell me if you happened to follow this news story very closely, fairly closely, not too closely, or not at all closely. How closely did you follow news stories about …?”

30 Study 2 includes two randomly selected questions from Study 1 (right to sue, means test premiums).
Appendix B: Study 1 Probit Coefficients

Table B-1 presents the coefficients for the models described in Study 1 (Figure 1). Question wording appears below.

Table B-1 about here.

In the case of tobacco, respondents were asked: “Also in the news were reports about a legal settlement that was reached between the tobacco industry and the states that were suing tobacco companies for health costs related to cigarette smoking. As far as you know is each of the following part of the deal of not? First is, (INSERT ITEM, ROTATE LIST) part of the deal or not? (a) Individuals and groups can no longer sue the tobacco industry; (b) The tobacco industry would be banned from advertising on billboards and from using cartoon characters such as Joe Camel in their ads; (c) The tobacco industry would pay billions of dollars in damages to the states.” Correct answers were no, yes, and yes.

In the case of Medicare, respondents were asked: “Please tell me to the best of your knowledge if Congress considered proposals to (INSERT ITEM, ROTATE LIST), or not? (a) No longer provide Medicare to upper income seniors who can afford other health insurance; (b) Give seniors wider choice of health plans under Medicare; (c) Cut Medicare payments to doctors, hospitals, and HMOs; (d) Require upper income seniors to pay higher Medicare premiums; (e) Gradually raise the age at which someone is eligible for Medicare from 65 to 67.” The correct answers were no, yes, yes, yes, and yes.
References


Krassa, Michael A. 1990. “Political Information, Social Environments, and Deviants.”


*American Political Science Review* 87 (December): 963-75.


<table>
<thead>
<tr>
<th>Parameter</th>
<th>Overall Information Environment Estimates</th>
<th>Newspaper vs. Television Estimates</th>
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<tbody>
<tr>
<td><strong>Fixed Effects</strong></td>
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<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.289 **</td>
<td>-0.292 **</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.061)</td>
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<tr>
<td>Education</td>
<td>0.070 **</td>
<td>0.070 **</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Income</td>
<td>0.041 **</td>
<td>0.041 **</td>
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<tr>
<td></td>
<td>(0.008)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Age</td>
<td>0.003 **</td>
<td>0.003 **</td>
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<tr>
<td></td>
<td>(0.001)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.092 **</td>
<td>-0.092 **</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Black</td>
<td>-0.067 +</td>
<td>-0.067 **</td>
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<tr>
<td></td>
<td>(0.038)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Follows issue</td>
<td>0.270 **</td>
<td>0.270 **</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.006)</td>
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<tr>
<td>Item difficulty</td>
<td>-0.864 **</td>
<td>-0.844 **</td>
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<td></td>
<td>(0.285)</td>
<td>(0.243)</td>
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<tr>
<td>Newswire coverage</td>
<td>0.029 **</td>
<td>--</td>
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<tr>
<td></td>
<td>(0.009)</td>
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<td>Newspaper coverage</td>
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<td>0.036 **</td>
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<td></td>
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<td>Television coverage</td>
<td>--</td>
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<td>Education X newswire</td>
<td>0.002 **</td>
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<td>Education X newspaper</td>
<td>--</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Education X television</td>
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<tr>
<td></td>
<td></td>
<td>(0.005)</td>
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<td>Education X item difficulty</td>
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<td>(0.035)</td>
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<td><strong>Variance Components</strong></td>
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<td>(0.033)</td>
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<td>Education</td>
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<td>0.002 **</td>
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<td>(0.001)</td>
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<tr>
<td>$N_i / N_j$</td>
<td>45365 / 41</td>
<td>45365 / 41</td>
</tr>
</tbody>
</table>

*Note*: Table entries are maximum likelihood (IGLS/PQL) estimates with estimated standard errors in parentheses. The data have been weighted to reflect the U.S. population.

$+ = p < .10$, $* = p < .05$, $** p < .01$
Table A-1. Political Knowledge Questions and Answers

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Survey Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can states restrict abortion in the first trimester</td>
<td>They can after <em>Casey</em> decision</td>
<td>April 30-May 3, 1992</td>
</tr>
<tr>
<td>Clinton's policy on gays in the military</td>
<td>Don't ask, don't tell</td>
<td>July 29-August 1, 1993</td>
</tr>
<tr>
<td>Clinton administration health care plan</td>
<td>Workers guaranteed coverage</td>
<td>December 2-5, 1993</td>
</tr>
<tr>
<td>How many killed in Rawanda massacre</td>
<td>Approximately 250,000 killed</td>
<td>May 12-15, 1994</td>
</tr>
<tr>
<td>U.S. intervention in Haiti</td>
<td>American forces killed Haitians</td>
<td>October 6-10, 1994</td>
</tr>
<tr>
<td>California Proposition 215 on marijuana</td>
<td>Allowed use in medical situations</td>
<td>December 13-17, 1996</td>
</tr>
<tr>
<td>FDA action on allergy drug Seldane</td>
<td>Steps to remove Seldane from shelves</td>
<td>February 22-24, 1997</td>
</tr>
<tr>
<td>Balance budget agreement and Medicare</td>
<td>Proposal to increase Medicare premiums</td>
<td>June 18-22, 1997</td>
</tr>
<tr>
<td>Congressional proposals on Medicare</td>
<td>Require upper income seniors to pay more</td>
<td>August 7-10, 1997</td>
</tr>
<tr>
<td>Size of budget deficit relative to five years prior</td>
<td>Decreased</td>
<td>August 7-10, 1997</td>
</tr>
<tr>
<td>Why was Phen-Fen taken off the market</td>
<td>It caused heart valve problems</td>
<td>October 17-21, 1997</td>
</tr>
<tr>
<td>Bombing of abortion clinic in Alabama</td>
<td>Someone was killed</td>
<td>February 13-17, 1998</td>
</tr>
<tr>
<td>Main reason for reforms for Social Security</td>
<td>Projected funding problems in 30 yrs.</td>
<td>April 17-27, 1998</td>
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<tr>
<td>Insurance coverage for Viagra versus birth control</td>
<td>Companies more likely to cover Viagra</td>
<td>June 12-18, 1998</td>
</tr>
<tr>
<td>Congressional action on patients' rights</td>
<td>Congress has yet to take any action</td>
<td>August 6-20, 1998</td>
</tr>
<tr>
<td>How does Preven work</td>
<td>Prevents a pregnancy from occurring</td>
<td>October 10-18, 1998</td>
</tr>
<tr>
<td>Tobacco settlement</td>
<td>Right to sue not part of the settlement</td>
<td>December 8-13,1998</td>
</tr>
<tr>
<td>Clinton proposals on Social Security</td>
<td>Government investment in stocks</td>
<td>February 19-25, 1999</td>
</tr>
<tr>
<td>Report on financial condition of Social Security</td>
<td>Run out of money later than expected</td>
<td>April 10-22, 1999</td>
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<tr>
<td>Pharmaceutical companies and price fixing</td>
<td>Pled guilty to vitamin price fixing</td>
<td>June 11-16, 1999</td>
</tr>
<tr>
<td>Has Patients' Rights been voted on by the Senate</td>
<td>It was passed in the Senate</td>
<td>August 6-10, 1999</td>
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<tr>
<td>Nat'l Academy of Sciences on hospital errors</td>
<td>New gov't agency to protect patients</td>
<td>December 3-13, 1999</td>
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<tr>
<td>Clinton State of the Union Address 2000</td>
<td>Proposed lowering Medicare to age 55</td>
<td>February 4-8, 2000</td>
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<tr>
<td>President Clinton and gun control</td>
<td>Called for background checks at shows</td>
<td>March 31-April 3, 2000</td>
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<td>Democratic proposals for Medicare drug coverage</td>
<td>Proposed to pay for prescription drugs</td>
<td>May 26-June 4, 2000</td>
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<tr>
<td>Supreme Court action on partial-birth abortion</td>
<td>States do not have right to outlaw</td>
<td>August 2-6, 2000</td>
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</tbody>
</table>

(continued on next page)
Table A-1 Continued.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Survey Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer premiums for health insurance</td>
<td>Increased faster than in previous years</td>
<td>Sept. 29-Oct. 2, 2000</td>
</tr>
<tr>
<td>FDA warning about PPA and medications that include it</td>
<td>Cold and cough medicines</td>
<td>Nov. 29-Dec. 3, 2000</td>
</tr>
<tr>
<td>Cabinet nomination of Tommy Thompson</td>
<td>Nominated for Secretary of Dept. of HHS</td>
<td>January 25-28, 2001</td>
</tr>
<tr>
<td>Solvency of Medicare and Social Security</td>
<td>Government reports more longevity</td>
<td>March 28-April 1, 2001</td>
</tr>
<tr>
<td>Senate action on the McCain-Feingold bill</td>
<td>Senate passed the bill</td>
<td>April 18-22, 2001</td>
</tr>
<tr>
<td>Patients' rights legislation</td>
<td>Patients can sue health plans</td>
<td>May 31-June 3, 2001</td>
</tr>
<tr>
<td>Why controversy on funding stem cell research</td>
<td>Human embryos are destroyed</td>
<td>August 2-5, 2001</td>
</tr>
<tr>
<td>Action on prescription drug discount cards</td>
<td>Private company creates card program</td>
<td>Jan. 31-Feb. 3, 2002</td>
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<tr>
<td>Action to provide elderly relief on prescription drugs</td>
<td>Pharmacies establish drug card program</td>
<td>March 28-31, 2002</td>
</tr>
<tr>
<td>International AIDS conference statements</td>
<td>Prevention programs are effective</td>
<td>July 18-21, 2002</td>
</tr>
<tr>
<td>How West Nile Virus is spread</td>
<td>Carried by mosquitoes</td>
<td>Oct. 10-13, 2002</td>
</tr>
<tr>
<td>Risk factors associated with cervical cancer</td>
<td>HPV is associated with cervical cancer</td>
<td>December 6-10, 2002</td>
</tr>
<tr>
<td>President Bush's proposal for fighting AIDS</td>
<td>Increase U.S. funding for AIDS in Africa</td>
<td>February 6-10, 2003</td>
</tr>
<tr>
<td>Senate action on partial-birth abortion ban</td>
<td>Voted to pass the bill</td>
<td>April 3-6, 2003</td>
</tr>
</tbody>
</table>

Note: Complete question wording, including response options, can be obtained from the Roper Center Archive. All surveys are separate cross-sections even though dates may overlap.
## Table B-1. Probit Estimates for Study 1

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1998 Tobacco Settlement with States</th>
<th>1997 Congressional Proposals on Medicare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Means Test Benefits</td>
<td>Patient Choice</td>
</tr>
<tr>
<td>Education</td>
<td>0.003</td>
<td>0.041</td>
</tr>
<tr>
<td>(0.027)</td>
<td>(0.028)</td>
<td>(0.029)</td>
</tr>
<tr>
<td>Income</td>
<td>-0.066 +</td>
<td>0.013</td>
</tr>
<tr>
<td>(0.036)</td>
<td>(0.036)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.002</td>
<td>0.005 +</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Female</td>
<td>-0.079</td>
<td>-0.083</td>
</tr>
<tr>
<td>(0.085)</td>
<td>(0.086)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>Black</td>
<td>-0.057</td>
<td>-0.097</td>
</tr>
<tr>
<td>(0.146)</td>
<td>(0.144)</td>
<td>(0.150)</td>
</tr>
<tr>
<td>Follows issue</td>
<td>0.131 **</td>
<td>0.301 **</td>
</tr>
<tr>
<td>(0.045)</td>
<td>(0.044)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.679 **</td>
<td>-0.511 *</td>
</tr>
<tr>
<td>(0.233)</td>
<td>(0.231)</td>
<td>(0.236)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-668.3</td>
<td>-648.4</td>
</tr>
<tr>
<td>N</td>
<td>1201</td>
<td>1201</td>
</tr>
</tbody>
</table>

### Note:
Table entries are maximum likelihood estimates with robust standard errors in parentheses. The data have been weighted to reflect the U.S. population. + = p < .10, * = p < .05, ** = p < .01
Figure 1. The Varying Relationship Between Education and Knowledge

Panel A. The 1998 Tobacco Settlement

Panel B. Congressional Proposals on Medicare

Note: Squares denote coefficient value. Lines represent 95% Confidence Interval.
Figure 2. The Distribution of Knowledge: Surveillance Issues 1992-2003
Figure 3. Knowledge across Education Groups on Issues with Low and High Coverage

Panel A. Issues with Low Coverage

Panel B. Issues with High Coverage

% Correct

Low Education □ High Education □

0% | 20% | 40% | 60% | 80% | 100%
---|---|---|---|---|---
Bush's drug plan | Price fixing | Viagra | SS Solvency | Medical errors | Morning After Pill | Medicare for 55-65
Rwanda | Invest SS | Stem cells | Means test Medicare | Phen-fen | Gays in the military | West Nile Virus
Figure 4. The Effects of the Information Environment on the Relationship between Education and Knowledge

Panel A. Interaction between Education and Newspaper Coverage

- Gap: 10 pts.
- Gap: 33 pts.

Panel B. Interaction between Education and Television Coverage

- Gap: 14 pts.
- Gap: 20 pts.

Legend:
- Low Education
- High Education